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Edited by
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FOREWORD

The Economic Research Institute for ASEAN and East Asia (ERIA) is an International Organisation which pursues economic research and makes policy recommendations relevant to the East Asia Summit member countries.

The Australian Government was one of the earliest donors among the member countries which pledged financial contribution to ERIA to conduct its research in such manner that the findings are of value to the member countries.

ERIA would like to take this opportunity to thank the Australian Government and AusAID, without whose generous contribution this research would not have been possible. ERIA also looks forward to continued association with AusAID in the future and hopes that the member countries find this research useful.

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§ The views expressed in the publication are those of the author(s) and not necessarily those of the Commonwealth of Australia.

EXECUTIVE SUMMARY

The studies in this volume address the major causes of the build-up of current account surpluses in the East Asian region, commonly referred to as the problem of "global imbalances". We note that the external surpluses are matched by domestic imbalances of savings and investment. There are broadly two types of policies available to the countries on the surplus side of the global imbalances – changes to the domestic economy to give different savings-investment outcomes and changes to relative prices between home-produced and foreign-produced good. Adjustment cannot and should not, however, come only from one side of the imbalance equation. We do not explicitly address the policies that might help the deficit side but look at the policies that would benefit both the Asian surplus economies themselves and help address global imbalances.

The studies in the volume look carefully at the behaviour of savings and investment during recent episodes of crisis and at the behaviour of China. Drawing on both macroeconomic and microeconomic data they make clear that the investment side of the equation is where the greatest attention is needed. Listed companies do not behave in ways that are very different from other international firms but some are finance constrained. Policy settings are not excessively favourable towards foreign or trade-engaged firms but they do currently seem to favour "outward orientation" (e.g. giving greater support to firms that have external activities as well as domestic).

There is evidence that governments resist exchange rate change for a number of reasons, not only to promote exports and these underlying motivations will need to be addressed before policies will change. There is much evidence that opening financial markets and more closely cooperating in financial activities in the region can bring benefits but the fears about increased instability have some basis and need to be addressed. Specifically the study recommends:

- Investment is the key: We recommend the main policy focus should be on improving the investment climate. Reducing savings could be counter-productive as it could bring rising interest rates globally. More investment,

directed to the right industries and activities, will be growth enhancing as well as helping imbalances. Savings adjustment will come with higher household income growth, improved social safety nets and better access to more developed financial markets (including consumer financial markets) but specific policy actions are less valuable here than in investment.

- Further research on specific policies and legal environments that support investment will be valuable and ERIA could play a role in collecting better survey data on the business environment and investment climate to extend the World Bank Doing Business data.
- Exchange rate realignments play only a supporting, not the main, role. Even in China the effect of revaluation is tempered by the possible cost-reducing impact on imported components if revaluation changes relative exchange rates in the region. The exchange rate effect therefore needs to be coordinated with others in the region. They, in turn, will resist relative revaluations of their own currencies against China, so a coordinated approach is the only option. This is unlikely unless the other reasons that governments manage exchange rates and accumulate reserves are addressed.
- Improving access to the potential risk-reducing functions of the international financial system will enhance welfare and remove impediments to adopting better policies. Greater integration with external financial markets can improve welfare by reducing consumption volatility and by reducing the need to accumulate foreign exchange reserves. Working with well-chosen partners to develop safe and well-sequenced financial opening measures will achieve the largest gains. These arrangements could subsequently be extended to other partners in the region. There is less to be gained by trying to forge region-wide financial agreements from the outset if these are politically and administratively difficult.
- The region is vulnerable to external shocks but the sources are specific and can be managed if well understood. The main source of business cycle fluctuations is still the US; despite the growth of China its business cycles play a much smaller role.

- Global financial shocks are transmitted to the region by cross-border banking flows but foreign-owned banks operating on the ground within the region, and particularly other Asian-owned ones, have been a stabilising influence. Thus, opening banking markets and removing behind-the-border barriers to market entry can be helpful. These measures should be accompanied by the implementation of international standard bank regulations, which can in fact improve bank performance, and by careful management of the use of external, wholesale funding by banks. Establishing cross-border collateral arrangements and imposing a systemic-risk charge on 'systematically important' cross-border institutions would also help reduce volatility.
- Policies that attempt to limit or promote particular types of cross-border capital flows need to take account of the possible knock-on effects on other types of flows. These flows are not independent of each other.

CHAPTER 1

Macroeconomic Rebalancing and Financial Integration in East Asia: Overview

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1. Introduction

Since the Asian Financial Crisis (AFC) of 1997–98 large current account surpluses have accumulated in the countries of Asia and the Pacific with corresponding deficits elsewhere. These surpluses are a result of a complex mix of factors that result from rapid economic growth with an increasing dependence on export-oriented industries in the countries of the region. Past experience of global external imbalances teaches that they may be sustainable for extended periods as long as the matching financial flows do not strain the international financial system but, eventually, the pattern is unsustainable. Deficit countries have to adjust macroeconomic policies and reduce consumption while surplus countries must also adjust policies or allow inflation to erode the competitive advantage that underpins export performance. They will also face changes to the structure of their economies as resources are shifted from externally-oriented sectors (traded) to domestically-oriented ones (including non-traded). The present imbalances must eventually be corrected but the timing is uncertain. Both sides of the imbalance

will not be well-served by an adjustment problem arising at short notice. Thus some "rebalancing" now can reduce the vulnerability to the high cost of sudden reversals.

The studies in this volume consider the East Asian side of the equation. We look at the economic structures and policies that give rise to current account surpluses and consider what policy adjustments could change them. This is not because the problem lies only in Asia. History makes abundantly clear that behaviour, policy and economic structure on both sides of global imbalances need to adjust. The great disruptions to the global economic system, such as the collapse of the Bretton Woods system of managed exchange rates in the 1970s, occur when adjustment is asymmetric and postponed to the point of explosion. The focus on Asia also derives from the recognition that the surplus countries have important interests in reducing the imbalances just as much as the deficit countries. From the perspective of the East Asian countries, the interest in growth rebalancing is motivated by several concerns. First, there is the possibility that current account surpluses (positive flows) will have to turn into deficits (negative flows) at short notice, leading to social disruption and other adjustment costs. Second, there is the fear that the stock of debt owed to them, which represents the accumulated surpluses and is largely held in dollar denominated government bonds, might become so high that repayment becomes impossible. Third is the possibility that, in the absence of a managed process, uncontainable pressure builds in either the foreign exchange markets or the domestic money markets. In the former case, sudden changes to currency values could result in capital losses on the foreign assets held, while in the latter, domestic inflation could become difficult to control.

The studies draw a more nuanced picture than is usually available in discussing imbalances. We begin from the premise that the imbalances are a macroeconomic problem that reflects a mismatch between savings and investment in the surplus countries. Causality is difficult to establish but it is clear that either or both of high savings and low investment will give rise to a savings gap that must be matched either by domestic government consumption (fiscal deficits) or by external surpluses. To understand the origins of the mismatch we consider what policies impact on the incentives to save and invest. We consider whether the macroeconomic and microeconomic evidence supports the idea that corporate savings in particular, are the source of the imbalance in China (which is such a large part of the story) or in the other

countries of the region and draw attention to reasons to doubt one current conventional view.

Since causation can also run from the large export surplus back to domestic excess savings we also look for evidence of policies that distort resource allocation towards "excessive" focus on export sectors or outward orientation of the economies. Much policy debate (too much in our view) focuses on the role of prices (i.e. exchange rate misalignment) in encouraging exports and implies that changing relative prices, by revaluing Asian currencies, will be the key to correcting imbalances. We consider whether this is likely to be effective in the case of China and whether, and why, other Asia economies might resist foreign pressure for revaluation as the Chinese have. Part of the explanation for their currency strategy lies in their perceived need to build war chests of foreign exchange reserves to provide a buffer in case of instabilities similar to those of the Asian and recent Global Financial Crises. The excessive reliance on exports is as much a consequence of these other reasons for keeping exchange rates low and accumulating reserves, as it is a cause. We therefore consider whether countries are able to take advantage of other possibilities for insuring against economic volatility by more actively and openly engaging with international capital markets and show that closer financial integration, involving more open financial markets, with well-chosen partners, would be welfare-improving and should reduce the need for the counter-productive self-insurance policies that result in managed exchange rates and foreign exchange accumulation.

Much of this analysis leads to the conclusion that financial market liberalisation and reform, greater openness and more flexible exchange rates will be important policy tools to enable the structural changes that will support a gradual reduction of surpluses and a redirection of resources to the non-traded sector that will absorb employment and allow an orderly rebalancing. What are the risks? It seems clear that governments in the region still worry that moving in this direction will bring greater, rather than less, economic volatility. We therefore examine how financial integration is linked to the transmission of economic shocks to the real economy and between economies.

The measurement of integration, in both financial and trade spheres, is not easy, so it is useful to set out some stylized facts about which countries are most closely integrated with which others in the region. A new method for measuring integration

reveals some surprises about which partners are currently most closely linked. We then ask which partners would be the best combinations based on economic welfare considerations rather than historical and political ones that give rise to the current arrangements. Again there are patterns that challenge understanding of the status quo. The policy message is not, however, to unpick existing arrangements but that there are still further gains to be derived from more integration and openness, often with specifically selected partners, and that these gains come because openness reduces, rather than increases, volatility. At the same time, policy to open financial markets can have unintended consequences and we examine whether different types of capital flows into the region are complements or substitutes so that the impact on each type of flow from opening markets to other types of flow can be understood.

To support our emerging view that financial openness has significant benefits that are not yet fully captured in the region, and that could enhance welfare as well as aid in the rebalancing process, we look at the transmission mechanisms of real sector volatility and whether the countries in the region have become decoupled from global business cycles. We examine the main sources of transmission of recent shocks during the global financial crisis to discover the role of financial and real (trade) shocks and look also at whether business cycle volatility is transmitted within the region or comes mainly from outside. We then look more closely at the role of banks in transmitting financial shocks and compare the role of cross-border bank flows with the activities of multinational banks within countries. The behaviour of regionally-owned banks is seen to differ from multinationals. Certain types of bank regulation are seen to improve the efficiency and performance of banks during crisis periods.

2. Economics of Savings, Investment and Global Imbalances

While almost all countries in the region are running large current account surpluses (except Australia and NZ), Warr (Chapter 2) notes that China accounts for over half the total. The countries that were most affected by the Asian crisis account for a much smaller part of the region's surplus. Unpacking the matching savings-investment

imbalance, Warr notes that in the crisis-affected countries (Indonesia, Korea, Malaysia, the Philippines, Thailand, Vietnam) there has been a large, but not overwhelming increase in private savings while in the group of countries not affected by the Asian crisis (Australia, NZ, China and Japan), the total current account surplus was due primarily to a massive increase in private saving. Chinese private savings were the largest but were almost matched by Japanese private saving. When public sector savings are taken into account, Japan's aggregate savings were even larger than China's. Overall there is a significant increase in savings for all countries but large declines in investments in the Asia-crisis-affected countries and smaller investment declines in the other countries. While the decline in investment may be a response to the overinvestment boom before the crisis, there is some evidence that the imbalances are as much driven by investment behavior as by savings. Both the savings increase and the investment declines appear to have been driven by rising uncertainty in Asia. Warr's policy conclusion is that improvements to the investment climate and the provision of social safety nets will go some way to solving these problems. Restoring confidence in household income growth would reduce the need for households' precautionary savings (the low share of household income in China has been noted as a cause of relatively high savings there by IMF (2010)). On balance, it is more important to focus on policies that increase investment than on those that reduce savings since the former will promote growth which will, in turn, allow consumption growth. Warr points out that if the bulk of adjustment comes from reduction in Asian savings, global interest rates will rise. This is an important reason why an increase in savings in the deficit countries will be an important element of the global solution.

An important question is whether policy distortions contribute to an excessive focus on exports or on the traded goods sector (as suggested by IMF (2010)). Chapter 3 uses evidence from the World Business Environment Survey to show that, while East Asian governments provided a generally good business environment, they did not emphasise trade or inward foreign investment any more than governments in other regions. Aisbett finds no evidence of trade-related distortions to policy (i.e. policies that favoured exporting firms over others or foreign over domestic firms and which could contribute to an excessive build-up of current accounts), though there is some evidence of favourable treatment of outward-investing firms. This may suggest a policy orientation

that encourages the accumulation of foreign assets rather than a focus on domestic investment, but otherwise does not provide strong evidence of a need for policy change in this area (though it does not rule out the need for policies that encourage the development of new, domestically-focussed business). The study does draw attention to the lack of good survey data in the region and recommends that data be collected that would match that available in other developing regions of the world such as Latin America so that a more nuanced view of the effect of specific policy effects can be developed. Given the growing expertise of ERIA in building survey-based datasets, this would be a useful contribution for a future project.

The macroeconomic analysis of Chapter 2 already raises questions about a conventional view that excess savings in Asia is the major source of the imbalances. Chapters 4 and 5 develop this argument further. Corbett and Twite (Chapter 4) argue that the microeconomic evidence from listed-company accounting data do not indicate a problem with excessively high company savings. Companies in the region do not have excessively high retentions nor are their dividend payouts unusually low. Where they do build up accumulations of liquid assets (i.e. holding their accumulated profits as cash or in financial assets) these are quickly applied to capital expenditure so that the share of fixed assets (plant and equipment) in total assets is high. While the data do not cover the entire corporate sector, leaving out small and medium firms that are not listed, the listed company sector is now quite large in most of the region's economies. As several of China's state-owned enterprises are now partially privatized and have some shares listed, they are also included. The authors conclude that the imbalance between savings and investment seems to be the result of constraints on the investment side, rather than incentives to build up excessive savings. A policy focus on the drivers, determinants and impediments to investment will be a more productive way to respond to global imbalances than a narrow focus on corporate savings. Preliminary results suggest that financial constraints are an impediment to investment for many firms, providing further support for the need for financial sector reform. Further research on elements of the broad, country-level policy variables used in this study (legal systems, corporate and shareholders rights, indicators on corruption and financial market openness) would help to identify particular policy actions.

Chapter 5 presents two important arguments about global rebalancing and the case of China. First, Wei doubts there is strong link between exchange rate regimes and current account imbalance. He reiterates the results of his other empirical studies showing that shifting to flexible change rates in China might not lead to a fast adjustment of current account. Second, compared to the exchange rate regime, Wei argues that China's unusually high national saving rates is a more fundamental factor that explains China's current account surplus. He emphasizes that Chinese national savings are driven by household savings, not by corporate behavior. The best explanation for high household savings is demographic. As a result of the one-child policy and the gender imbalance that arose, there is a competition for marriage partners that lead to savings for wealth accumulation. The policy responses that are normally proposed to change savings behavior will not redress this balance and there is no benefit to the commonly proposed policies to change exchange regimes or to focus on corporate savings behavior.

Chapter 6 reinforces Chapter 5's challenge to the conventional prescriptions for China's currency appreciation, by noting that the effect may be quite different from the conventional one as a result of the production network structure of trade. A revaluation of the Chinese currency that was not followed by other Asian economies could increase the competitiveness of Chinese exports by reducing the cost of imported components. Yamashita is able to show the effects using new data on the detailed composition of regional trade and a carefully constructed, trade-weighted exchange rate that demonstrates the offset to the expected decline in export in the face of revaluation.

The argument of Chapter 6 draws attention to the importance of the response by Asian countries to yuan revaluation, which is the subject of Chapter 7. Pontines and Siregar show evidence of a general fear of appreciation over long periods not associated with crisis, and additionally a fear of floating during crisis periods for major Asian countries including, but not only, China. Their smooth transition, auto-regressive model finds that five countries (Indonesia, Korea, Philippines, Thailand, and Singapore) show clear aversion to currency appreciations during the pre-GFC period and a stronger aversion to appreciation against the Chinese renminbi than against the US dollar. Under crisis conditions, there is a general tendency to manage exchange rates and avoid currency movements in either direction.

Chapter 8 extends the understanding of the region's currency management by showing that there are multiple reasons why countries manage exchange rates so as to accumulate foreign exchange reserves from current account surpluses. In addition to any "mercantilist" desire to preserve exchange rates for competitiveness, a dominating motivation is self-insurance: countries are accumulating reserves beyond what would be needed just to meet private sector demands and keep the exchange rate stable. Governments are doing more than just "leaning against the wind" to stabilize currencies and are helping to keep them undervalued to build war chests of reserves. Understanding this motivation gives rise to policy recommendations. Since the concern is about instability, rather than competitiveness, policies (including explicit international and regional cooperation) to improve the access to international financial support in times of crisis would reduce this pressure.

3. Transmission of Shocks and the Role of Financial Integration

While opening financial markets may help in growth rebalancing, an important policy concern is whether they bring greater vulnerability to shocks. This is the question addressed by the remaining papers which focus on the major transmission mechanisms of shocks, the role of integration in transmission, the extent of synchronization of business cycles within the region and the degree of external decoupling and the role of banks, against the background of an increasingly liberalized but still incompletely integrated Asian financial system.

3.1. Integration, Openness and Stability

Economic integration in Asia is an ongoing, dynamic and multifaceted process. Compared to North America and Western Europe, it is commonly understood that economic integration in Asia is in its early stage and confined to a few sectors of a few countries in the region. However, since the aftermath of the Asian Financial Crisis, economic liberalization and integration in Asia have gained momentum. Integration has become more far-reaching and interactions among Asian economies in trade and

financial sectors have become more complex than a decade ago. The first three studies provide fresh perspectives to understand the increasingly complex, dynamic nature of the integration process in Asia and shed light on a number of important policy agendas by examining measures and characteristics of the economic integration in both trade and financial aspects (Chapter 9), consumption correlations among country pairs in the region (Chapter 10) and the dynamics of the interactions between components of financial integration (Chapter 11).

There is no single measure that sufficiently captures all salient characteristics of integration between economies. Cavoli employs various measures of the extent of economic integration in East and Southeast Asia on real and financial dimensions, including measures of business-cycle correlation, deviation from relative PPP (RPPD), trade openness, deviation from uncovered interest parity (UID), equity market correlations, and Foreign Direct Investment openness. Using a new principal components analysis to create a measure of 'overall' integration, Cavoli finds that the original ASEAN nations (Indonesia, Malaysia, the Philippines, Singapore and Thailand) seem to be more integrated with the rest of Asia than other groups (new ASEAN, Plus 3, ASEAN+3) in terms of both real and financial integration. They also tend to be well integrated with each other and price measures that pick up co-movement in financial markets indicate this group is the most internally financially integrated of all groups. The newer ASEAN members are the least integrated across all measures. The quantity measures show that Japan, Korea and China are highly integrated when measuring both trade intensity and FDI and portfolio intensity, but less so in finance. The measures indicate that there are quite well-defined clusters, or sub-regions, in terms of integration. While the larger economies are quite well integrated with the smaller ones, they are not as well integrated with each other. The policy implications for the design of trade or investment accords need to be further examined, but the results suggest that the region as a whole does not yet meet the criteria for close integration that would be considered a pre-requisite for a regional bloc moving towards a monetary union involving the three major countries.

If the current extent of integration varies across countries the question is whether this matters and why. Chapter 10 considers the benefits of integration and examines welfare gains in the East Asian region from greater use of the risk-sharing opportunities

provided by integration with countries that have different patterns of income variation. This allows a consideration of whether there are welfare gains from more integration and also identifies which partnerships provide the biggest gains. Corbett and Maulana confirm significant welfare gains of up to 5 per cent of annual consumption for some countries. They also find that pair-wise integrations achieve the bulk of the gains and that larger group integrations adding decreasing value. Under certain circumstances the best pair for most of the 10 Asian countries studied is a developed country with a different business-cycle pattern, such as Australia. There is no evidence that the current Association of South-East Asian Nations Five (ASEAN 5) grouping is optimal in terms of risk reduction, or that there are gains from a grouping of China–Japan–Korea. For policy makers the welfare benefits of risk-sharing are large enough that they should form an additional part of the policy dialogue on regional integration. The results of such discussions might change the perspective on which partners should begin the process of closer financial cooperation. Since that process can be difficult it may be easier to begin with particular partners where integration will provide the largest benefits and move, subsequently, to add extra partners.

An important dimension of international financial integration is international capital flows. Chapter 11 studies the dynamics of the interactions between components of capital flows and explores whether the respective components—foreign direct investment, portfolio equity, portfolio debt, and bank flows—are substitutes or complements. Cavoli examines both the mean and the volatility of capital flows. The research framework, using a vector-autoregression approach (VAR) in a system of equations as well as analyzing a series of single-equation models, shows whether one type of capital flow enhances or inhibits the others and also whether these notions of substitution and complementarity apply to the volatility of the components of flows as well as to the level of each flow. Considering Hong Kong, Indonesia, Japan, Korea, Malaysia, the Philippines and Thailand for the period 2000-09 it appears that an increase in bank inflows crowds out FDI flows with a lag. Thus if policy makers employ liberalization policies relating specifically to bank inflows, this might have the effect of inhibiting FDI flows, which could be an unintended consequence of the policy. There is also some evidence of substitution between debt inflows and equity inflows. Higher volatility of debt inflows potentially results in an increase in FDI inflows so

policies designed to reduce the variability of debt flows might have the unintended consequence of reducing FDI inflows. On the other hand, any policy designed to make FDI inflows more stable might result in enhancing bank inflows. A key policy message from this study is that policy makers need to be mindful of the possibility of any crowding out in designing financial liberalization policy. Also, by utilizing the complementarity embedded in various components of flows, policy makers might be able to achieve policy targets in a cost-effective and efficient manner.

Given the potential benefits from greater financial market openness identified in the first section of this study, it is important to consider whether financial openness entails an increased potential for volatility. The severe damage imposed by the recent Global Financial Crisis on the global economy makes it imperative to understand the transmission of shocks to the region. The next two chapters focus on crisis transmission mechanism and the contribution of international and domestic shocks to macroeconomic outcomes in selected Asian countries.

Miankhel, Meehan and Kalirajan's study (Chapter 12) pays particular attention to the external shock transmission mechanisms to ASEAN+3 through trade and financial channels. The study tests whether trade or financial channels are the more important mechanisms for the transmission of external shocks. Using both an Error Correction Model (ECM) and a panel Vector ECM (VECM) model, the authors find that during the GFC, the real shock was transmitted through trade variables to Singapore and Malaysia, but the region as a whole demonstrates no short-term relationship between GDP and exports, i.e. there was little transmission of the shock via real channels. On the other hand, the ASEAN+3 region shows significant vulnerability to short-term capital movement and this suggests the financial channel transmitted the shock of the GFC into the region. Further work is needed to clarify the specific channels of transmission but the results add weight to earlier studies (e.g. Corbett, Onji and Gai (2009)) suggesting that banking systems in the region played some role in shock transmission. These issues are further examined in Chapters 14 to 17.

An implication of Miankhel, Meehan and Kalirajan's study is that external or foreign shocks might be an increasingly important part of regional business cycle dynamics in Asia. Dungey and Vehbi's study (Chapter 13) further explores this dimension. They model five East Asian economies respectively—Singapore, Thailand,

the Philippines, Malaysia, and Indonesia—in a small, open economy Vector Error Correction Model (VECM) and investigate the historical evolution of domestic responses to domestic and external output shocks. The external output shocks mainly originate in the United States and China during the period 1986-2009. Despite the rapid growth of China's importance in the region, their study suggests that the United States remains much more important than China as source of external influences. The result delivers an important policy message that the economic situation in the United States is *the* key factor to be considered for understanding external sources of business cycle shocks and that, despite rapid growth and increasing regional integration, the region has not yet decoupled from the US. The world economy is an increasingly interconnected and integrated entity with one constantly influencing another. In Christine Lagarde's words, the new managing director of the IMF, "Decoupling is a myth"[1]. Asia, once a passive outsider, is now an active component of the entity. On one hand, through its massive and rapidly growing activities in international trade and financial markets, Asia is open to and integrated with the global economy on an unprecedented scale. On the other hand, these Asian economies unavoidably expose themselves, of various degrees though, to more trade and financial turmoil from the outside world than ever before. The evidence from this study seems to suggest that, on a macro level, the financial markets compared to trade are a main channel of external shock transmission in Asia.

3.2. Role of Banks in Shock Transmission

It is commonly agreed that Asian financial markets are still dominated by banks. A critical question that follows is what role banks played in transmission of financial shocks to the region. The next set of studies focus on the role of banks in shock transmission. They find that although cross-border bank lending has been an important element of importing instability from external sources, foreign banks' local lending plays a positive role of stabilizing local financial markets facing stress. Reliance on funds from the global wholesale market influenced how much bank responded to international volatility and the extent to which they passed this on to local economies. Banks that were more reliant on external wholesale funding did cut back lending more

[1] The Economist (online version), http://www.economist.com/blogs/freeexchange/2011/08/world-economy (28/08/2011)

than other banks. As a result, these studies shed new light on key regulatory strategies for the Asian banking industry to prevent and counter harmful impact from future external crises.

Pontines and Siregar (Chapter 14) examine cross-border bank loans from the United Kingdom, the United States and Japan to five major Southeast Asian economies and Korea. They examine evidence on the push and pull factors and show that global banks indeed act as a channel of financial shock transmission from the global financial markets to the local economy. Policy reaction will require cross-border banking supervision and they argue for enhancing the central banks' main responsibility as the monetary authority supervising financial institutions, increasing cross-country supervisory cooperation, coordination to overcome information asymmetry on cross-country risk exposure and establishing a college of supervisors to facilitate cross-border policy cooperation. In addition, policies to reduce the complexity of large cross-border banks through 'subsidiarization', increasing capital levels and buffers and deposit insurance coverage, establishing cross-border collateral arrangements and imposing a systemic-risk charge on 'systematically important' cross-border institutions would help reduce volatility.

In contrast to cross-border lending, foreign banks' local lending has positive implications for financial stability. Extending the conventional view that local lending can be stabilising, Xu (Chapter 15) provides fresh evidence that country-of-origin of foreign banks explains variations in lending behavior and has distinctive effects on credit stability in Asia. Asian-owned foreign banks behaved quite differently from non-Asian during the Global Financial Crisis. The former showed the mildest change in credit growth in times of stress, contributing to credit stabilization, whereas the latter cut off credits sharply from the Asian periphery, undermining credit stability in the region. An important reason for the sudden withdrawal of credit from by non-Asian banks lies in the breakdown in the global wholesale funding market where these banks locate their funding source. The Asian-owned banks rely more for their funding on the more stable deposit base that developed out of increasing savings in the region and which were mainly intermediated through banks.

Policies to encourage Asian banks' entry to the local financial markets may be useful to enhance stability. While the Pontines and Siregar's study indicates that cross-

border lending is a potential source of financial instability they also recommend policies to welcome foreign banks' subsidiaries to reduce the volatility of foreign lending. Xu's study supports this finding by clarifying the unstable nature of local lending of large global banks from North America and Europe during the crisis and by showing that regional banks were stabilizers. This provides support for policies encouraging regional financial integration with Asian-owned foreign banks. The diversification of ownership of foreign banking will help to build a robust and stable Asian banking system.

Xu's finding on wholesale funding market is consistent with Onji, Vera and Gai's (Chapter 16) observation on the role of the money market in the transmission mechanism in the region. They examine disruptions in the money market during the Asian Financial Crisis and the Global Financial Crisis and find that 'money market dependent banks' had greater reduction in loans in Asia banks during the crises and that the financial sector's dependence on wholesale funds is a more important source of vulnerability in Asian economies than in other developed economies.

In addition to the cross-border lending channel revealed by Chapter 14, Onji, Vera and Gai's study highlights another channel of transmission of shocks: the wholesale channel via banks. This sends an important message to supervisors and policymakers in Asia that particular attention should be paid to wholesale-dependent banks when financial shocks occur outside the region and that new rules should be adopted to encourage banks to maintain liquidity in forms other than wholesale funding. The ongoing global financial crisis poses new challenges on banking regulation and supervision in the region. How have conventional bank regulation and supervision measures influenced banking efficiency and performance? Thangevalu and Findlay (Chapter 17) develop a database of 600 banks in the region to empirically test the effects of three main regulatory measures: restrictions on banking activities, capital requirements and private sector monitoring. Interestingly, higher capital requirements (higher total equity to total asset ratios) seem to have improved bank performance in Asia, with the deadweight losses from regulation being offset by the higher returns from decreased risk. This result is somewhat unexpected (since capital requirements are normally considered a deadweight cost on banks and lower risk portfolios would normally bring lower returns) though it has been verified in other studies. These results provide strong support for the implementation of the new requirements of Basel Accord

within the region. Additional policy messages relating to bank regulation point to the importance of utilizing private sector monitoring to aid public supervisors' scrutiny since private monitoring helps to reduce the risk taken on by banks at a lower cost than formal supervision. Off-balance sheet activities increase bank profitability but some risky activities endanger stability and should be restricted, which requires an efficient monitoring and supervisory system with sufficient capacity in identifying these risk sensitive activities. They also find that there are positive impacts on bank performance from foreign ownership and participation, again reinforcing the message that financial openness will be important for development and efficiency of the banking systems.

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CHAPTER 2

Growth Rebalancing and Investment in Asia and the Pacific

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Especially since the Asian Financial Crisis (AFC) of 1997–98, the countries of Asia and the Pacific have, to varying extents, focused their production structures increasingly towards exports, meaning that resources have moved away from production for the domestic market and towards production of traded goods and services destined for external markets. Large current account surpluses have accumulated in these countries and corresponding deficits elsewhere. This trend is unsustainable. It is certain that it must end but the timing is uncertain. Asia is vulnerable to an adjustment problem arising at short notice. The suggestion is that some "rebalancing" now—away from reliance on external demand and towards domestic demand—can reduce this vulnerability by reducing Asia's export dependence. Increasing investment is one way of doing this. Policy initiatives that could achieve increased investment levels in Asia include: increased public sector infrastructure investment; improvement in the investment climate, including more consistent application of the rule of law; and better access to finance. This can include development of a domestic corporate bond market and reform of collateral laws to enable a wider range of securitization beyond real estate and other fixed assets and reduced credit risk by facilitating corporate restructuring.

Keywords: global imbalances, growth restructuring, investment, economic reform

JEL Classifications: F40, O11, E22

1. Introduction

Since the Asian Financial Crisis (AFC) of 1997–98, the countries of Asia and the Pacific have, in aggregate, run huge annual current account surpluses. Much the same has been true of the oil-exporting countries of the Middle East. The counterpart of these surpluses has been correspondingly huge current account deficits in the rest of the world, including Europe and, most especially, the United States. Over the decade and a half that this process has continued, huge stocks of debt have accumulated. Much of this is US Government debt owed to the central banks of the East Asian countries. About half of it is held by China. It is of course expected that the debt will eventually be repaid and this implies that the surpluses must eventually turn into deficits, and vice versa. Indefinite accumulation of debt is unsustainable.

For a variety of reasons, many observers regard the process described above as unsustainable, even in the short run. First, East Asian countries might be unwilling to continue to accumulate US debt and might even wish to reduce the stock they hold. Second, the United States might be unwilling to allow this accumulation of indebtedness to continue and might indeed wish to reduce the stock of debt it currently owes. The two are not mutually exclusive and could happen at the same time. They both rest on the fear that the burden of debt servicing might suddenly become intolerable for the debtors—notably, the United States. The emphasis is on "suddenly", meaning that an unexpectedly rapid adjustment becomes necessary.

There is some possibility that East Asia's current account surpluses might have to decline, and even turn into deficits, very quickly. Eventually, this must happen. The question is *when*. If the answer is "gradually and predictably", there is not necessarily any problem. But if it is "soon", at an unexpectedly rapid rate, there could be a serious adjustment problem involved. By anticipating this potential problem, it might be possible to avoid the large-scale unemployment and other social costs that would otherwise result from an unanticipated economic crisis. To put it mildly, these events are uncertain. "Growth rebalancing" is essentially a problem of risk management.

From the perspective of the Asian-Pacific countries, the interest in growth rebalancing is motivated by two concerns. First, there is the possibility that current

account surpluses (positive flows) will have to turn into deficits (negative flows) at short notice, leading to social disruption and other adjustment costs. Second, there is the fear that the stock of debt owed to them might become so high that repayment becomes impossible. The first concern is more immediate.

Especially since the AFC, the countries of Asia and the Pacific have, to varying extents, focused their production structures increasingly towards exports, meaning that resources have moved away from production for the domestic market and towards production of traded goods and services destined for external markets. If the current account surpluses are to be reduced significantly, or even reversed, and if massive unemployment is to be avoided, resources must be reallocated in the reverse direction—away from production for the export market and towards production for the domestic market. For the deficit countries the problem is exactly the reverse. The policy imperative is similar in both cases: to avoid the disruption, especially the large-scale unemployment, that could result from a required rate of adjustment that is too rapid.

Growth rebalancing is the term that has been applied to describe this process. The issue is not really whether growth rebalancing will occur, but when, at what rate and by what means. For countries seeking to reduce their current account surpluses, "growth rebalancing" means reallocation of resources away from production for external markets (export) and towards production for domestic markets. For deficit countries such as the United States, growth rebalancing means exactly the opposite.

In the current global environment, Asia is vulnerable to such an adjustment problem arising at short notice. The suggestion is that some "rebalancing" now—away from reliance on external demand and towards domestic demand—can reduce this vulnerability by reducing Asia's export dependence.

2. Global Imbalances

Current account imbalances are not necessarily a problem. They reflect what Obstfeld and Rogoff (1997) and Corden (2007, 2011) call international inter-temporal trade. One country (the surplus country) is exchanging current goods and services for financial assets that are claims on goods and services in the future. The other country (the deficit country) is doing the reverse. Mutual gains from trade can arise from these transactions because the initial circumstances of the countries involved are not the same. For some countries, it makes sense to save more now in order to consume and invest more later. For others, the reverse applies. In this respect, inter-temporal trade is not fundamentally different from contemporaneous trade in goods and services. But basic differences do exist. The time dimension can mean that the individuals obliged to repay a debt might not be the same as those who incurred it. The outcomes chosen by this generation of Americans, for example, can create an unwelcome problem for the next generation.[1]

Since the 1997 AFC, Asia has run large current account surpluses and the rest of the world (especially the United States) has run correspondingly large deficits. Figure 1 summarizes the annual magnitude of these deficits added over the 12 countries:

Group I: Crisis affected

- Indonesia
- Korea
- Malaysia
- the Philippines
- Thailand
- Vietnam.

Group II: Not crisis affected

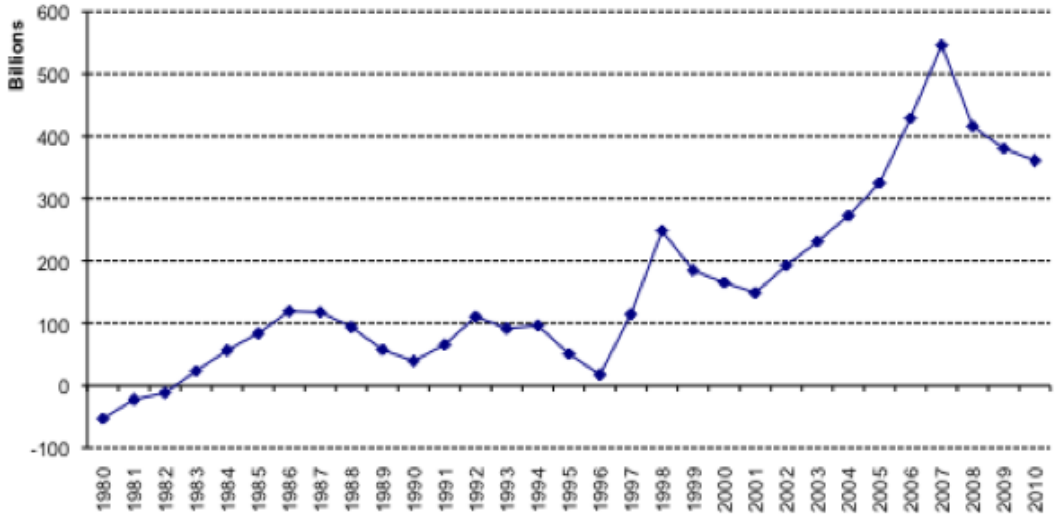
- Australia
- China

[1] This phenomenon is already being recognized politically in the United States under the label "intergenerational theft".

- India
- Japan
- New Zealand
- Singapore.

For reasons that will become clear from the subsequent discussion, the 12 countries are grouped above according to those significantly affected by the 1997–98 AFC (Group I) and those not significantly affected (Group II).

Figure 1. Annual Current Account Balance: 12 Asian-Pacific countries (Constant 2000 US$)



Source: IMF, CEIC.

3. Saving and Investment Balances in Asia

Table 1 summarizes, in the first column, the cumulative current account surpluses of the 12 Asian-Pacific countries listed above, added across the years 1996–2009, inclusive. Here we use cumulative surpluses because this is the counterpart of the stock of outstanding debt. The calculations are performed in US dollars, expressed in constant 2009 prices. China accounts for just more than half of the total accumulated current account surpluses of all 12 countries. The Group I (AFC-affected) countries

represent about one-quarter of the total. The remaining four columns draw upon the familiar macroeconomic identity that the current account balance is equal to the difference between aggregate saving and aggregate investment. Aggregate saving can be further divided into public saving (the government's budgetary balance) and private saving (household plus corporate), and aggregate investment can be similarly subdivided into public and private, giving:

$$CAB = S - I = S_{PUB} + S_{PRIV} - I_{PUB} - I_{PRIV} \quad (1)$$

In the Group I countries there was a large increase in private savings accompanied by a somewhat smaller increase in private investment. Public investment increased by slightly more than public saving, offsetting the difference between private saving and investment. In the Group II countries the total current account surplus was due primarily to a massive increase in private saving. Chinese private savings were the largest but were almost matched by Japanese private saving. When public sector savings are taken into account, Japan's aggregate savings were larger than China's. In addition, there was a very large increase in both private and public investment in the Group II countries. Table 2 presents these data as shares of the total current account surplus of all 12 countries. Figure 2 shows this graphically.

Table 1. Cumulative Current Account Balance and Components, 1996–2009 (Constant 2009 US$ millions)

	Cumulative current account balance	Cumulative public saving	Cumulative private saving	Cumulative public investment	Cumulative private investment
Australia	–127,094	180,211	2,307,637	303,765	2,311,177
China	1,917,468	–576,539	17,858,557	9,973,138	5,391,411
India	–328,925	–484,810	3,657,512	927,000	2,574,628
Indonesia	275,526	–46,787	1,751,369	225,660	1,203,397
Japan	837,139	1,027,368	16,740,204	4,079,948	12,850,485
Korea	230,140	230,589	2,791,411	492,722	2,299,137
Malaysia	395,659	62,272	846,944	236,611	276,946
New Zealand	1,060	67,583	263,332	69,911	259,945
The Philippines	–46,364	–45,096	301,299	63,290	239,278
Singapore	412,850	128,917	802,324	89,233	429,158
Thailand	170,338	–36,944	1,014,089	235,017	571,791
Vietnam	–73,287	–44,174	260,012	140,079	149,045
Total	**3,664,511**	**462,592**	**48,594,690**	**16,836,374**	**28,556,397**
Group I	**952,013**	**119,861**	**6,965,124**	**1,393,379**	**4,739,593**
Group II	**2,712,498**	**342,730**	**41,629,566**	**15,442,994**	**23,816,804**

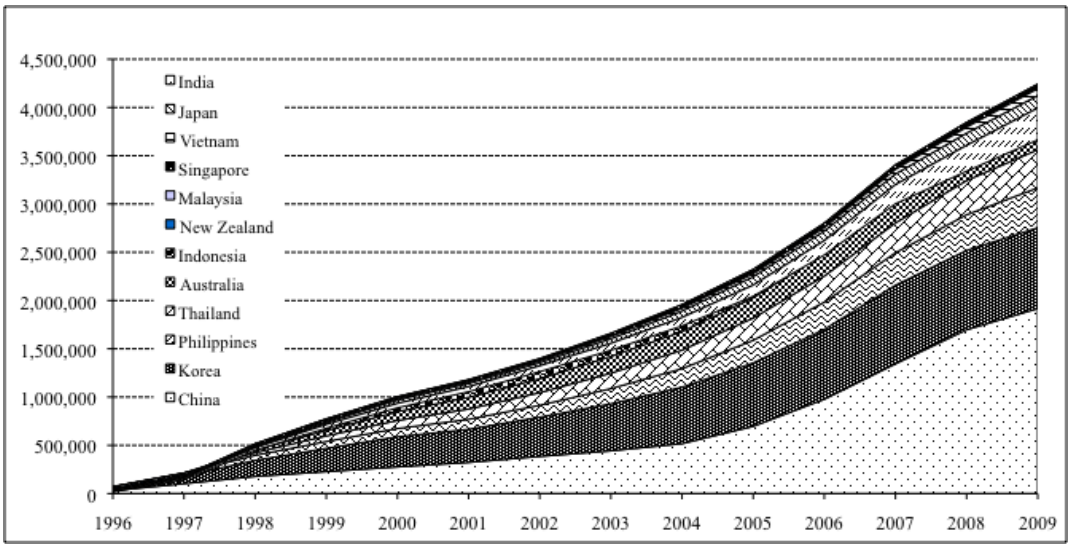
Note: Group I = Indonesia, Korea, Malaysia, the Philippines, Thailand, Vietnam; Group II = Australia, China, India, Japan, New Zealand, Singapore.

Table 2. Cumulative Current Account Balance and Components, 1996–2009 (Constant 2009 US$, percentage of total)

	Cumulative current account balance	Cumulative public saving	Cumulative private saving	Cumulative public investment	Cumulative private investment
Australia	–3.47	38.96	4.75	1.80	8.09
China	52.33	–124.63	36.75	59.24	18.88
India	–8.98	–104.80	7.53	5.51	9.02
Indonesia	7.52	–10.11	3.60	1.34	4.21
Japan	22.84	222.09	34.45	24.23	45.00
Korea	6.28	49.85	5.74	2.93	8.05
Malaysia	10.80	13.46	1.74	1.41	0.97
New Zealand	0.03	14.61	0.54	0.42	0.91
The Philippines	–1.27	–9.75	0.62	0.38	0.84
Singapore	11.27	27.87	1.65	0.53	1.50
Thailand	4.65	–7.99	2.09	1.40	2.00
Vietnam	–2.00	–9.55	0.54	0.83	0.52
Total	**100**	**100**	**100**	**100**	**100**
Group I	**25.98**	**25.91**	**14.33**	**8.28**	**16.60**
Group II	**74.02**	**74.09**	**85.67**	**91.72**	**83.40**

Note: Group I = Indonesia, Korea, Malaysia, the Philippines, Thailand, Vietnam; Group II = Australia, China, India, Japan, New Zealand, Singapore.

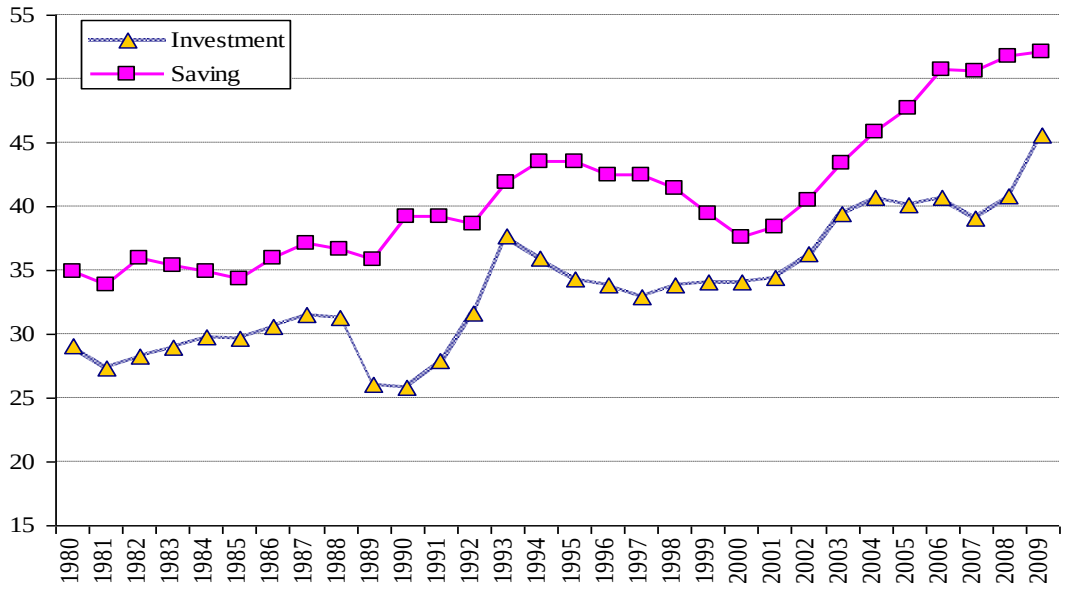
Figure 2. Cumulative Current Account Balances: 12 Asian-Pacific Countries



Source: IMF, CEIC.

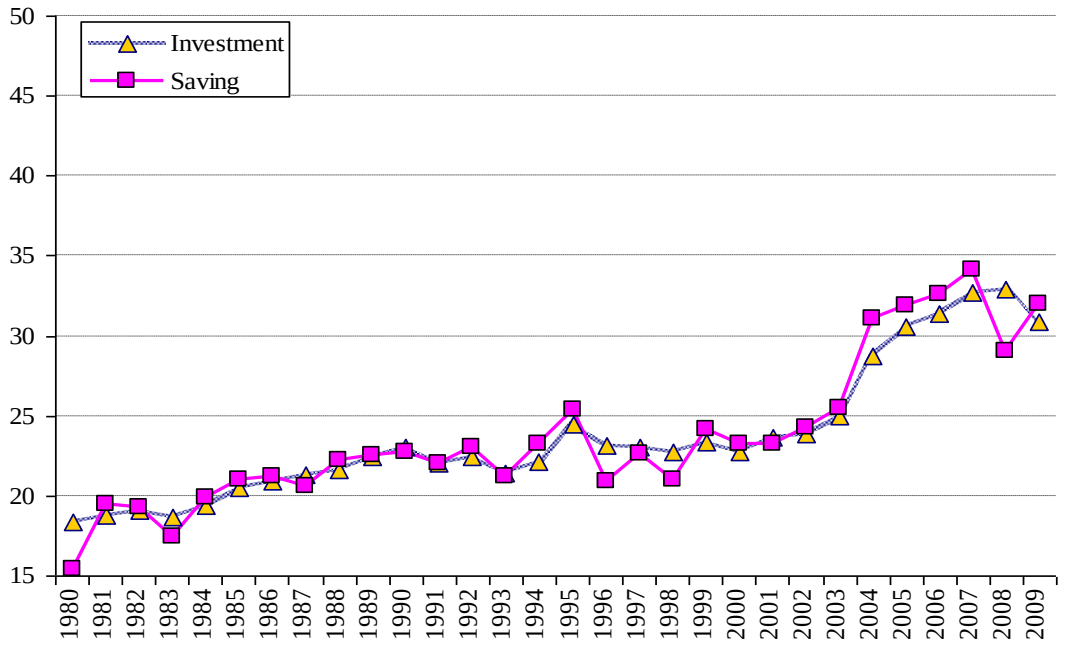
Figures 3–7 examine these data by looking at aggregate savings and investment over time, expressed as shares of GDP. In China (Figure 3) the aggregate savings share increased dramatically after 2000. The investment share also increased, but not as much, hence the huge surplus. In India (Figure 4), both saving and investment shares increased significantly but by similar amounts. In the group of countries seriously affected by the AFC (Indonesia, Korea, Malaysia, the Philippines and Thailand) shown in Figure 5, both saving and investment shares declined following the AFC, but the decline in investment shares was larger, leading to a substantial current account surplus. Table 1 makes it clear that private investment is the principal source of this decline. Even though the absolute level of private investment increased, it declined significantly as a share of GDP. Figure 6 shows similar information for Australia and New Zealand, confirming small current account deficits. Finally, from Figure 7 it is clear that when the data for all 12 countries are added, the share of savings in aggregate GDP increased from about 2002 but the share of investment increased even further.

Figure 3. Saving and Investment Shares of GDP: China (percent)



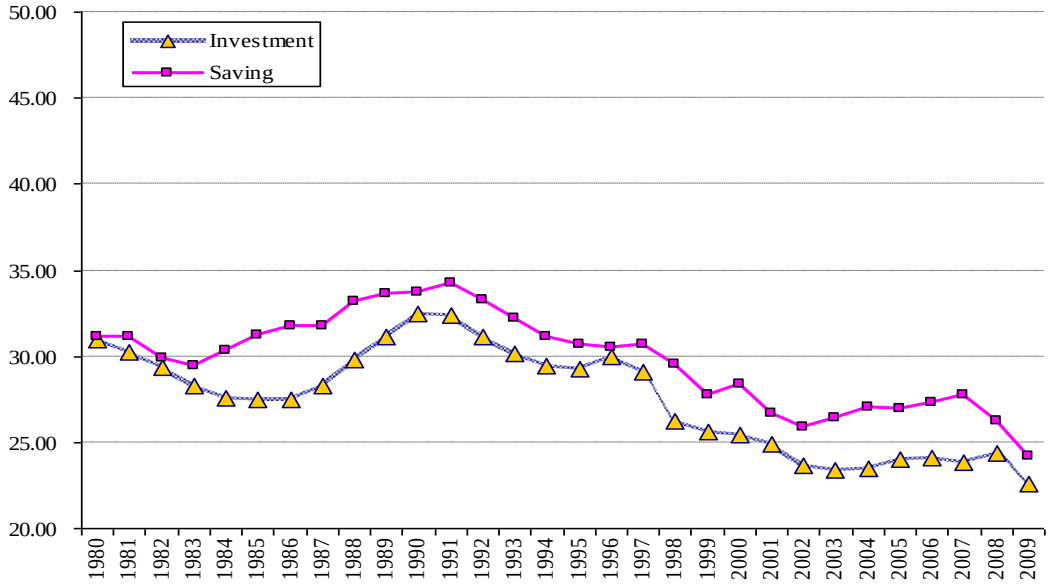
Source: IMF, CEIC.
Note: Investment = gross fixed capital formation; saving = gross domestic savings.

Figure 4. Saving and Investment Shares of GDP: India (percent)



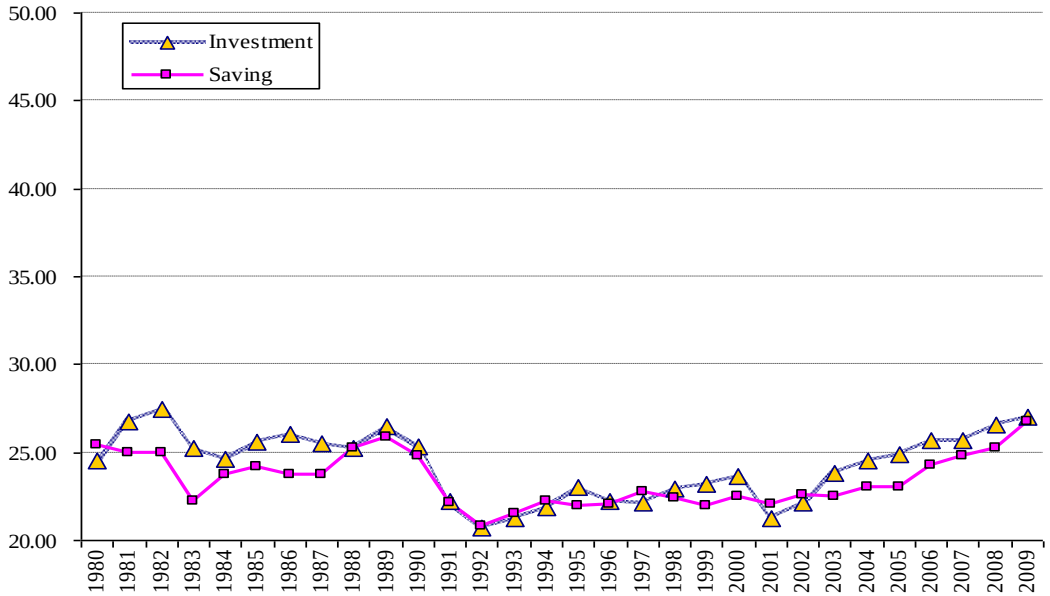
Source and note: See Figure 3.

Figure 5. Saving and Investment Shares of GDP: Indonesia, Korea, Malaysia, the Philippines and Thailand (percent)



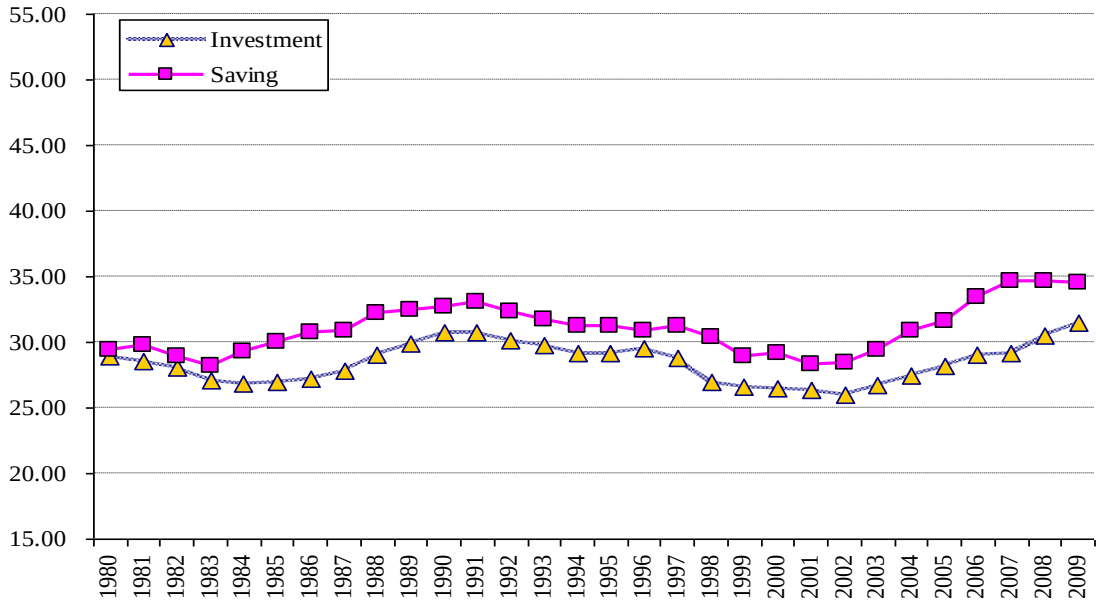
Source and note: See Figure 3.

Figure 6. Saving and Investment Shares of GDP: Australia and New Zealand (percent)



Source and note: See Figure 3.

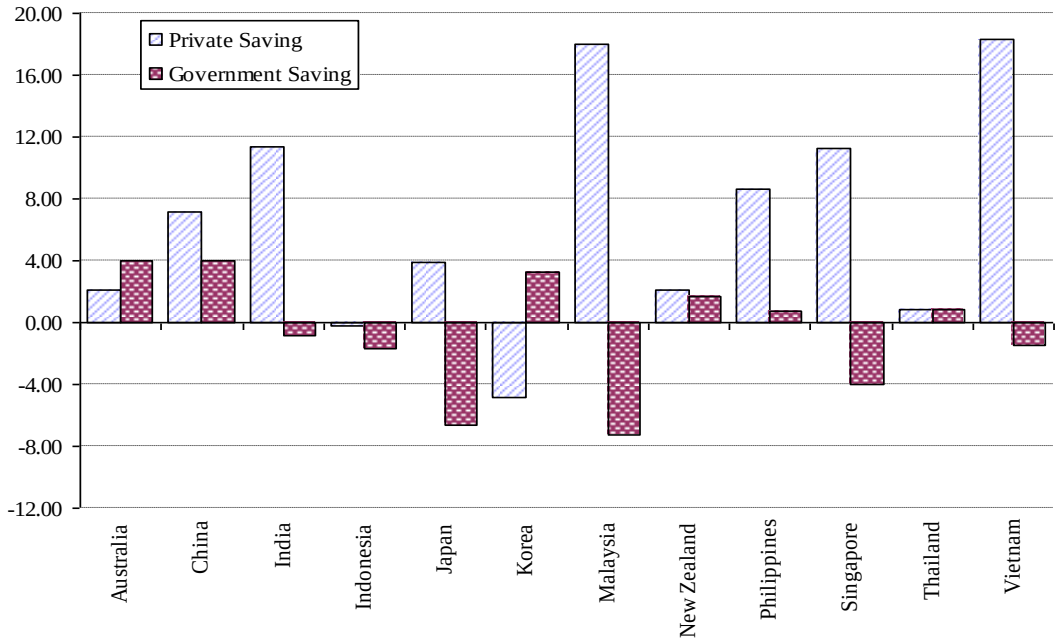
Figure 7. Saving and Investment Shares of GDP: All 12 countries (percent)



Source and note: See Figure 3.

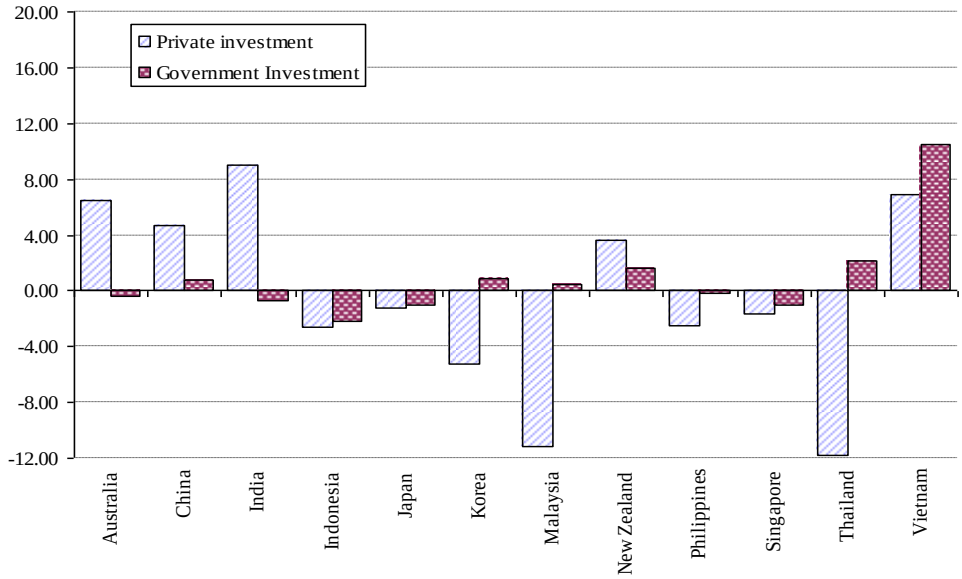
Figures 8 and 9 compare the average GDP shares of saving and investment, respectively, between two periods: the pre-AFC period of 1990–96 and the post-crisis decade of 1999–2009. This comparison is made for all 12 countries. China's increase in saving was huge in total but as a share of GDP it was by no means the largest. India, Malaysia, the Philippines, Singapore and Vietnam all increased their savings shares by larger proportions. Figure 9 shows that the increase in China's investment share, post-crisis, was smaller than India's. The figure also shows the dramatic difference between the Group I and Group II countries with respect to investment. Investment shares contracted in all of the countries affected by the AFC except Vietnam and increased in all other countries except Japan. The contractions in Malaysia and Thailand were especially large. Indonesia is an interesting outlier. Although Indonesia was severely affected by the AFC, its private investment share contracted post-crisis much more moderately than, for example, Malaysia, Thailand and Korea.

Figure 8. Change in Saving Share of GDP, 1990–96 to 1999–09 (percent)



Source: World Bank, IMF, CEIC.
Note: Pre-crisis average calculated over 1990–96, and post-crisis average calculated over 1999–2009; change in saving share of GDP = post-crisis share – pre-crisis share.

Figure 9. Change in Investment Share of GDP, 1990–96 to 1999–09 (percent)

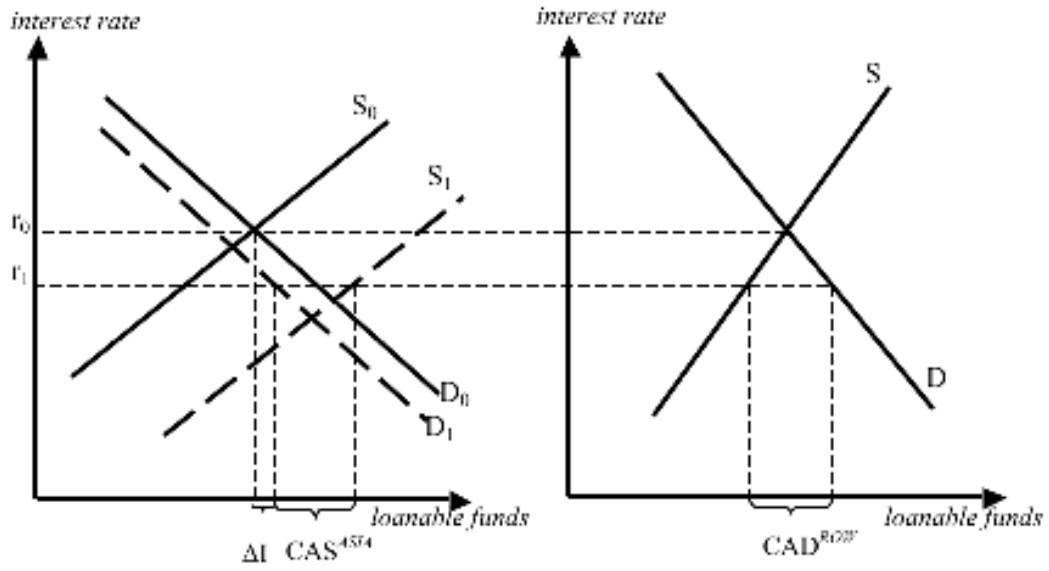


Source: World Bank, IMF, CEIC.
Note: Pre-crisis average calculated over 1990–96, and post-crisis average calculated over 1999–2009; change in saving share of GDP = post-crisis share – pre-crisis share.

4. A Simple Loanable Funds Model of Global Imbalances

Figure 10 presents a simple loanable funds model to describe these events. Investment is represented by the demand for loanable funds and saving is represented by their supply. Consider panels A and B first, representing "Asia" (panel A) and the "rest of the world" (panel B), respectively. These two panels represent the global market for loanable funds. They determine the equilibrium world interest rate at the level where Asia's current account surplus (or deficit) is equal to the rest of the world's deficit (or surplus). For convenience, it is assumed that both Asia and the rest of the world are in current account balance in the initial period (period 0), roughly representing the late 1990s. The world interest rate is r_0.

Figure 10. A Loanable Funds Model of Global Imbalances



Panel A: Asia Panel B: Rest of the World

The second period (period 1) represents roughly 2009. For simplicity, the supply and demand for loanable funds in the rest of the world are each assumed to remain stationary, as assumed in the well-known Bernanke "savings-glut" interpretation of global imbalances (Bernanke, 2005). The action takes place initially in Asia. There is a huge shift to the right in Asia's supply of loanable funds (saving), from S_0 to S_1, and a smaller shift to the left in the demand (investment), from I_0 to I_1. The world interest

rate declines from r_0 to r_1. In the rest of the world the fall in interest rates induces a movement along both the supply and the demand schedules for loanable funds, inducing a contraction of saving and an expansion of investment, producing a large current account deficit, CAD^{ROW}. In Asia there was both the shift in the supply and demand schedules described above and a movement along the new schedules as interest rates fell. The result was a huge increase in aggregate saving and a small increase in aggregate investment. Asia's current account moved to a large surplus—the difference between Asia's saving and investment at the lower interest rate, where $CAS^{ASIA} = CAD^{ROW}$.

What caused the shift in Asia's saving and investment schedules? In the Group I countries, confidence was negatively affected by the devastation of the AFC of 1997–98. The demand for loanable funds (investment) shifted to the left as firms became much more pessimistic about future prospects. Growth rates declined significantly compared with the pre-crisis decade of 1986–96. In the Group II (not crisis-affected) countries there was an export-led economic boom. Savings increased as a share of GDP in response to the income growth.

Figure 10 can be used to make one further point. If the "rest of the world"—principally the United States—wishes to reduce its current account deficit, is it better to make the adjustment itself or to attempt to induce Asia to adjust? If the United States adjusts, either by shifting its demand for loanable funds to the left or by shifting its supply to the right, its excess demand for loanable funds contracts, the equilibrium level of its current account deficit declines and world interest rates fall. If Asia contracts its excess supply of loanable funds, the same combination of current account balances might result, but with an *increase* in world interest rates. Given the huge level of its stock of debt, the United States has a strong interest in low world interest rates. It should do the adjusting itself and should not be berating Asia to reduce its current account surpluses.

Asia's current account surpluses can be lowered either by reducing saving (by increasing consumption) or by increasing investment. In the Group I (crisis-affected) countries, both are possible strategies. Fiscal expansion can reduce public sector saving by increasing social expenditures on education, health and other public services. The

same can be done in the Group II countries—notably in China. But in the Group I countries, policies that raise investment will have the dual benefit of reducing current account surpluses and raising growth rates. We shall therefore focus on this option.

5. Determinants of Asian Investment

Is export-dependent Asia investing too little? One way of approaching this question is to compare actual investment shares in GDP with steady-state shares calculated from a neo-classical growth model (Islam, 1995). Abstracting from population growth for simplicity, the required steady-state level of investment i^* is given by:

$$i^* = k^*(g + d)/(1 + g), \tag{2}$$

where k^* denotes the steady-state capital–output ratio, d denotes the rate of depreciation and g denotes the potential rate of growth of output. For a given value of d, k^* is found as the mean value of the capital–output ratio over a long period (1950–2008). An International Monetary Fund study (IMF, 2005) derived the potential rate of output growth from medium-term projections from the IMF *World Economic Outlook*. It found that application of this simple neo-classical framework leads to three conclusions concerning the emerging countries of Asia other than China:

i. In the years preceding the 1997 AFC, actual investment shares exceeded steady-state shares, suggesting overinvestment.

ii. In the years immediately following the crisis, actual investment shares exceeded steady-state shares, as firms moved to eliminate excess capacity.

iii. Actual shares still remain below the steady-state shares required to sustain real GDP growth rates above 5 per cent (IMF, 2010). That is, emerging Asia (except China) is underinvesting. If growth rates of 5 per cent are to be maintained, actual investment shares need to increase (for example, by 5 per cent of GDP in Thailand and by 3 per cent in Malaysia and the Philippines).

This analysis suggests investment to output ratios for most Association of South-East Asian Nations (ASEAN) economies at between 93 and 97 per cent of their required levels. That is, for most ASEAN countries, achievement of the IMF growth projections requires investment as a share of GDP to increase by an average of about 5 percentage points.

An econometric study of the determinants of investment (IMF, 2009) suggests three conclusions. First, slowed GDP growth since the AFC reduced the rate of return to investment and this reduced investment spending relative to GDP by an average of 2.5 percentage points. Second, macroeconomic uncertainty caused firms to hold back on investment plans and this greater uncertainty since the AFC reduced the investment share of GDP by about 1 percentage point. Third, a deterioration in investors' perceptions of the investment climate—including application of the rule of law, creditor rights and transparency of government operations—has reduced the investment to GDP share by just less than 1 percentage point. Some progress has occurred in most of these areas since the AFC, but investors' perceptions have been slow to catch up.

6. Policy Conclusions

Increasing investment in Asian countries other than China should not be seen as an objective in itself. It is desirable in part as an instrument of growth rebalancing, but only if it is productive. The above discussion leads to four conclusions on means to increase levels of private and public investment.

1. *Increased public sector infrastructure investment*. A higher level of private investment requires infrastructure improvements. Greater use of public–private partnership models can assist in financing this investment.
2. *Further improvement in the investment climate*. This includes the governance issues mentioned above (more consistent application of the rule of law, creditor rights and transparency of government operations, including procurement) and also further reform to enhance the competitiveness of output and labor markets.
3. *Better access to finance*. This can include development of a domestic corporate bond market and reform of collateral laws to enable a wider rage of securitization beyond real estate and other fixed assets.
4. *Reduced credit risk by facilitating corporate restructuring*. Creating a market for distressed corporate debt by purchase of non-performing loans (NPLs) from banks and repackaging them for subsequent sale to the private sector.

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CHAPTER 3

Were East Asian Policies Particularly Outward Biased? Evidence from the World Business Environment Survey

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East Asia is often held up as the prime example of export-led growth, and it has become a truism to say that East Asian policies over the past few decades have been "export promoting" and "outward oriented". A pertinent, but neglected, question in the enormous literature on the East Asian miracle is whether their policies were any more outward oriented than those of other countries. Evidence from the World Business Environment Survey suggests that while East Asian governments provided a generally good business environment, they did not emphasise trade or inward foreign investment any more than governments in other regions. Thus, we find no evidence of trade-related distortions that contribute to an excessive build-up of current accounts, though there is some evidence of favorable treatment of outward-investing firms. This finding is of particular interest given the ongoing academic and public debate over the causes and consequences of global investment imbalances and the need for more "balanced growth" in East Asia.

Keywords: East Asia, balanced growth, export promotion, policy

JEL Classifications: O53, F4, F13

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1. Introduction

The East Asian growth miracle and the role of exports in that miracle have been the subject of an enormous literature over the past three decades. It is standard in this literature to claim that East Asian governments were "export promoting" and "outward oriented". Remarkably though, the literature appears to lack objective, quantitative evidence that East Asian governments were any *more* outward oriented than governments in other parts of the world. This omission might be attributable to the well-documented difficulty of comparing policies across countries (see, for example, Harrison, 1996; Pritchett, 1996; Rodriguez and Rodrik, 2001). His current paper attempts to fill this gap by utilizing a major World Bank survey of firm perceptions of their business environment.

The World Business Environment Survey (WBES) was conducted for the World Bank across 80 countries in 1999 and 2000. Firm managers were asked an extensive set of questions about their operating environment, especially those aspects influenced or directly determined by government. The questions of relevance to the current paper included firms' perceptions of the degree of corruption, influence over government policies, and regulatory obstacles. Regulatory obstacles were assessed for eight different areas, including foreign exchange and the country's customs and trade regulations. The survey also collected information about the firm, including exporting behavior, foreign ownership, and operations or holdings in another country.

There is a range of ways in which governments may seek to achieve "outward orientation". This paper thus uses the WBES to shed light on a number of related sub-questions and helps build a picture of the nature and extent of outward orientation of East Asian policy at the turn of the century. The first question is whether East Asian government performance was particularly strong in outward-oriented policy areas. To answer this, we compare the relative performance of East Asian governments (as measured by firm managers' perceptions) in areas related to trade with that in other policy areas, ranging from control of corruption to inflation.

A second possibility is that East Asian governments sought to achieve outward orientation through industrial policy that favoured the tradable sector. To answer this,

we test whether perceptions of East Asian government performance across a broad range of important indicators were relatively high in manufacturing and agriculture compared with the less-traded sectors (services, construction and 'other').

Finally, it is possible that East Asian governments used microeconomic policy to systematically support outward-oriented firms. We use exporting, foreign ownership, and multinational operations as indicators of firms' outward orientation, and ask whether these firm characteristics are associated with higher perceptions of East Asian government performance (relative to governments in other regions).

2. Data

The World Business Environment Survey (WBES) is a survey of more than 10,000 firms in 80 countries and one territory conducted in 1999–2000. The survey was conducted through face-to-face interviews with firm managers and owners and covers a large range of questions concerning the firms' relationship with the government, including perceptions of regulations, corruption, influence, macroeconomic policies, competition, and infrastructure.[2] Although the surveys were very similar in all countries, there were some regional variations in wording and choice of questions. We use data for all regions except "Middle-East and North Africa" and "Africa" as there were data compatibility issues for these two regions. The remaining sample has more than 7,100 firms.

2.1. Dependent Variables

We make use of the richness of the WBES data by utilizing 15 different indicators of the government–firm relationship as dependent variables in separate regressions. Each of these variables is described below.

[2] Permanent url: http://go.worldbank.org/RV060VBJU0

2.1.1. Government is Helpful

The WBES asked managers to respond for both local and national governments, now and three years ago:

> Please rate your overall perception of the relation between government and/or bureaucracy and private firms on the following scale. All in all, for doing business I perceive the state as: Very helpful, mildly helpful, neutral, mildly unhelpful, very unhelpful.

We use the responses for the current national government. For the full sample there were 7,894 responses, distributed as: very helpful (9 percent), mildly helpful (22 percent), neutral (27 percent), mildy unhelpful (19 percent), very unhelpful (23 percent). For our regressions, we use a dependent variable, "Helpful Government", which is coded 1 if the government scored "Neutral" or better.[3]

2.1.2. Influence Over Government

The WBES asked managers for each of the executive, legislature, ministry and regulatory agencies of the national government of the country in which they were operating:

> When a new law, rule, regulation, or decree is being discussed that could have a substantial impact on your business, how much influence does your firm typically have at the national level of government on the content of that law, rule, regulation or decree? Would you say "very influential", "frequently influential", "influential", "seldom influential" or "never influential"?

Summary statistics reported in Table 1 show that for all four branches of government most firms feel that they are "never" influential. The four branches of government appear to have very similar levels of susceptibility to influence.

[3] Missing values in the original data remain missing.

Table 1. Influence Data Summary: Percentage of firms in each category and total observations

	Never %	Seldom %	Sometimes %	Often %	Always %	Obs
Influence executive	61	21	10	4	3	6,095
Influence legislature	63	21	9	4	3	6,104
Influence ministry	62	21	10	5	3	6,094
Influence regulator	60	21	12	5	3	5,971

A high degree of colinearity between the four measures of influence in Table 1[4] suggests that treating them as four separate dependent variables would amount to duplication and limit the space available for other analysis and robustness checks. The ordinal nature of the variables, however, means that creating a composite variable by averaging or adding them is not appropriate. Additionally, we have no means by which to judge which of the four measures of influence is the most important for any given firm, since the most important branch of government over which to exert influence is likely to vary by firm and country of operation. Thus, we create and use a "maximum-influence" variable that is equal to the maximum reported influence over any branch of government for each firm.[5]

2.1.3. Receipt of Subsidies

Managers were asked:

> Does your enterprise receive subsidies (including tolerance of tax arrears) from local or national government?

Responses were coded 1 (Yes), 2 (No), 3 (Don't know), 4 (Refused). We created a binary variable by recoding 1 (Yes), 0 (No) and treating all other responses as missing. Of the 7,014 non-missing responses, 11 percent were 'Yes' and 89 percent 'No'.

2.1.4. General Constraints

Many of our measures of government–firm relationships were all sub-questions to the one main question about "general constraints", which was worded:

[4] Pair-wise correlations for the four influence variables range from 0.77 to 0.83.

[5] For example, if a firm reports influence scores of 1, 1, 2 and 3 for the executive, regulator, legislature and ministry respectively, the maximum-influence variable takes a value of 3 for that firm.

> Please judge on a four-point scale how problematic are the following factors for the operation and growth of your business: No Obstacle, Minor Obstacle, Moderate Obstacle, Major Obstacle.

The factors the managers had to score were labeled: financing; infrastructure (e.g., telephone, electricity, water, roads, land); taxes and regulations; policy instability/uncertainty; inflation; exchange rate;[6] functioning of the judiciary; corruption; street crime/theft/disorder; organized crime/mafia; anti-competitive practices by government or private enterprises; other (specify constraint). Summary statistics for the factors used in this analysis are presented in Table 2.

Table 2. Constraint Data Summary: Percentage of firms reporting each level of obstacle and total observations (median response in bold and modal response in italics)

	No %	Minor %	Moderate %	Major %	Obs
Exchange rate	26	20	**23**	*32*	7,544
Taxes & regulations	11	18	**32**	*39*	7,875
Financing	20	17	**26**	*37*	7,795
Infrastructure	*34*	**28**	33	15	7,704
Inflation	16	21	**26**	*36*	7,692
Policy instability/uncertainty	16	20	**27**	*37*	7,671
Corruption	29	23	**21**	*28*	6,940
Anti-competitive practices	*31*	**24**	24	22	7,027
Functioning of judiciary	*35*	**30**	21	14	7,108

2.1.5. Trade-Related Regulatory Constraints

Two of our trade-related measures of government performance were sub-questions to a bigger question about "regulatory constraints", which was worded:

> Please judge on a four-point scale how problematic are these different regulatory areas for the operation and growth of your business… Environmental Regulations, Business Licensing, Customs/Foreign Trade Regulations in your country, Labour Regulations, Foreign Currency/Exchange Regulations, Fire & Safety Regulations, Tax Regulations/Administration, High Taxes.

[6] Unfortunately, the wording of this question in the survey (reproduced exactly above) was not specific about whether the firms perceived the exchange rate to be too high or too low.

Possible responses for each regulatory area were: 1 (no obstacle); 2 (minor obstacle); 3 (moderate obstacle); or 4 (major obstacle). Table 3 shows that most firms considered the trade-related constraints to be at most minor constraints.

Table 3. Trade-Related Regulatory Constraint Data Summary: Percentage of firms in each category, mean and total observations (median response for each variable shown in bold)

	No %	Minor %	Moderate %	Major %	Mean	Obs
Foreign exchange regulations	48	**23**	17	11	1.91	7,237
Customs, trade regulations	37	**23**	26	14	2.18	6,882

2.1.6. Import Days

Our final measure of trade-related government performance is import days—reported in answering the question:

> If you import, how long does it typically take from the time your goods arrive in their point of entry (e.g., port, airport) until the time you can claim them from customs?

The mean response in the sample of 5,102 respondent (i.e., importing) firms was 11.4 days. The standard deviation of 24 days suggests substantial variation in government performance on this measure.

2.2. Explanatory Variables and Empirical Approach

The WBES data contain a number of firm characteristics that we might expect to be associated with a firm's perception of its operating environment. Given that the distribution of firm types might vary systematically across countries, it is important to control for firm characteristics in order to correctly identify the regional variables. Thus, the variables on the right-hand side in our base regressions are:

- exporter: coded 1 if firms export some product, 0 otherwise;
- foreign: coded 1 if firms report at least 10 percent foreign ownership, 0 otherwise;

- multi-country: coded 1 if firms report having operations or holdings in other countries, 0 otherwise;
- size: coded 1 for small (5–50 employees), 2 for medium (51–500 employees) and 3 for large (> 500 employees);
- government: coded 1 if firms reported having any share of government ownership, 0 otherwise;
- age: coded 1 for 0–5 years, 2 for 6–20 years, and 3 for more than 20 years firm age;
- sector: manufacturing, services, agriculture, construction, and other; and
- region of operation of respondent firm.

Since the variables are categorical they are summarized as their component binary variables in Table 4, where the mean value is the fraction of reporting firms that are in that category. Countries included in the analysis are listed in Table A1 (in the Appendix). Table 4 shows that sample size and proportion in each category are sufficient for identification of regression coefficients. In some cases—for example, foreign firms—this is the result of intentional over-sampling in the survey design.

Table 4. Summary of Binary Explanatory Variables: Mean value is the fraction of reporting firms that are in that category; N represents the number of non-missing values for each variable

	Mean	N
Exporter	0.327	7,996
Foreign	0.148	8,081
Multi-country	0.158	8,072
Small	0.414	8,132
Medium	0.420	8,132
Large	0.166	8,132
Government	0.125	8,057
Young	0.311	7,956
Middle-aged	0.332	7,956
Old	0.357	7,956
Manufacturing	0.380	7,611
Services	0.462	7,611
Other sectors	0.158	7,611

Obviously, our list of explanatory variables does not include every variable from the WBES that might possibly affect firms' perceptions of their business environment. Concentration of ownership of the firm and legal organization of the firm, for example, have been used by other papers using the same or similar data for examiner questions about firm influence (Campos and Giovannoni, 2007; Chong and Gradstein, 2007; Desai and Olofsgard, 2008). These and other robustness checks are considered in a related paper by Aisbett and McAusland (2011). Since none of the specification changes was found to qualitatively affect the results, they are not discussed here.

The results presented in the body of this paper are discrete effects from binary probit models. Aisbett and McAusland (2011) also considered a range of alternative models, including ordered probit, logit, partial proportional odds, heterogeneous logit, and probit with a Heckman correction for selection bias. They found that all of the alternative estimators had substantively the same qualitative results, and chose the binary probit model used here as it allowed the most straightforward calculation and interpretation of effects.

For the purposes of presentation and discussion in the remainder of the paper, the regression results for the different dependent variables were grouped as trade-related, general, economic, or political and legal indicators, as per Table 5.

Table 5. Dependent Variables by Group

General indicators	Trade-related constraints	Economic constraints	Political & legal constraints
Helpful government	Exchange rate	Financing	Policy uncertainty
Influence over government	Trade regulations	Infrastructure	Corruption
Constraint from taxes and regulations	Currency regulations	Inflation	Anti-competitive practices Judiciary

3. Did East Asian Governments Focus on Outward-Oriented Policy Areas?

We address this first question by regressing all our 15 dependent policy-perception variables on firm characteristics and region dummies. Our results suggest that although East Asian governments generally perform well across a broad range of policy areas, they actually performed relatively less well in trade-related areas.[7] Table A2 shows that East Asia was the third-best performing region on all of our four trade-related measures. The top two performing regions were the Organization for Economic Cooperation and Development (OECD) and Central and Eastern Europe (CEE), except for "exchange rate constraint", where South Asia performed better than both East Asia and CEE.

In contrast, Table A3 shows that East Asia was the single top-performing region in the three "general" measures (influence over government; helpfulness of government; general tax and regulatory constraints). Meanwhile, Tables A4 and A5 show that East Asia was the second-best performing region—after the OECD—on all but two of the "economic" and "political and legal" measures. The exceptions were infrastructure and anti-competitive practices, for which East Asia ranked third behind the OECD and CEE. Thus, our results suggest that, rather than placing particular emphasis on policies to facilitate trade, East Asian governments aimed for a broadly conducive business environment. We thus turn to our next question.

4. Did East Asian Governments Focus on Tradable Sectors?

It is often claimed that industrial policy played an important role in the development of export industries in many East Asian economies. To see whether we find evidence of this in the WBES data, we add region-by-sector interactions to the regressions used in Section 3. If East Asian governments especially favoured the key export sectors (manufacturing and agriculture) over less export-intensive sectors (services,

[7] In all cases "performance" is from the perspective of the individual firms, not necessarily society as a whole.

construction, and other), we might see evidence of this in the marginal effects for the region–sector interaction terms. The marginal effects are reported in Tables A6–A8. We see no systematic evidence that East Asian governments treated manufacturing or agricultural firms relatively better compared with other sectors and regions.

It is possible that the reason we do not find evidence of East Asian special treatment of manufacturing or agricultural firms is that the data are insufficient for such purposes. We do note, however, that there are some systematic patterns evident in the data, which—while not obvious *ex ante*—do seem to make sense. For example, column 2 of Table A7 shows that the relative lack of infrastructure in other regions compared with the OECD is most keenly felt in the agricultural sector. Similarly, column 3 of Table A8 shows that the negative impacts of the more extensive anti-competitive practices in other regions compared with the OECD are felt least in manufacturing. Since manufacturing is the most heavily traded sector, this result is entirely consistent with the broadly held belief that one of the key benefits of trade is to increase competition. Another interesting pattern—worthy of further investigation—is apparent in column 3 of Table A7. There we see that the negative impacts of higher inflation outside the OECD are also felt least keenly in the manufacturing sector.

5. Did East Asian Governments Focus on Outward-Oriented Firms?

To examine whether East Asian governments systematically favoured outward-oriented firms, we added interactions between the region dummies and firm outward orientation (i.e., export status, foreign ownership and ownership of foreign assets or holdings) to the regression used in Section 4. The marginal effects for the interaction terms are reported in Tables A9–A11. Since there are a large number of regressions and interaction terms, the results are summarized in Table 6. While it is difficult to make any absolute claims on the basis of the results in Table 6, it is clear that outward-investing firms (i.e., those with foreign assets or holdings, labeled "Owns-foreign" in Table 6) are relatively better treated in East Asia. For example, the top row of Table 6 shows that outward-investing firms reported better treatment in East Asia than in the

OECD for three of our measures, while the corresponding numbers for exporters and foreign-owned firms were 1 and zero respectively. Similarly, the bottom row of Table 6 shows that outward-investing firms did not prefer a different non-OECD region to East Asia on any measure, whereas exporters and foreign-owned firms both preferred other regions on five different measures.

Table 6. Summary of Results for Interactions Between Outward Orientation and Region ("Better than OECD" indicates statistically significant marginal effect on East Asia interaction term in a direction favouring firms; "Worse than OECD" indicates statistically significant marginal effect of opposite sign; similarly for comparisons with non-OECD regions)

	Exporter	Foreign-owned	Owns-foreign
Better than OECD	1	0	3
Same as OECD	10	10	8
Worse than OECD	0	1	0
Single best non-OECD	0	0	2
Equal best non-OECD	6	6	9
Not best non-OECD	5	5	0

6. Conclusion

This paper has considered the question of whether East Asian government policies are particularly outward biased compared with those of governments in other regions. We considered three different possible dimensions of outward policy orientation: emphasis on trade-related policies, emphasis on tradable sectors, and favourable treatment of outward-oriented firms. Contrary to our expectations, we did not find evidence of particular emphasis on trade-related policies, tradable sectors, or exporting firms. Instead, the survey evidence suggests that the overall business environment in East Asia was very good—second only to the OECD. This is good news for East Asia's long-term growth prospects as it suggests that the growth over the past decades has been largely based on good fundamentals and not on an export bias in policy.

There was, however, one dimension in which East Asian policy appeared to be systematically outward biased: our results suggest that East Asian governments do give more preferential treatment to outward-investing firms than do governments in other regions. This finding is of particular interest given the ongoing academic and public debate over the causes and consequences of global investment imbalances and the need for more "balanced growth" in East Asia.

The results in this paper—interesting as they are—need to be considered in light of the limitations of the WBES data. In particular, the lack of evidence of export bias might be due to small sample size at the country level and incomplete country coverage, combined with substantial country-level heterogeneity. Panel data with larger samples and better country coverage would significantly enhance our ability to ask questions such as ours for East Asia. Such data are already available from the World Bank for Central and Eastern Europe. It could be worthwhile to encourage a similar regional survey in East Asia, in conjunction with the World Bank, to allow a more detailed understanding of the current policy emphasis and areas for improvements.

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Appendix

Table A1. Countries with Data Included in the Base Regression (by World Bank Region)

Region	Country
Transition Europe	Albania, Armenia, Azerbaijan, Belarus, Bosnia, Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Kyrgizstan, Lithuania, Moldova, Poland, Romania, Russia, Slovakia, Slovenia, Turkey, Ukraine, Uzbekistan
East Asia	China, Malaysia, Indonesia, Singapore
South Asia	India
Latin America	Argentina, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Peru, Trinidad & Tobago, Uruguay, Venezuela
OECD	Canada, France, Germany, Italy, Portugal, Spain, Sweden, United Kingdom, United States

Table A2. Impediments to Trade: Column 1 OLS regression coefficients; columns 2 and 3 probit regressions to predict probability regulatory obstacle greater than minor; average discrete effects for change in dummy variables from 0 to 1 reported; dummies for size, sector, age category and government ownership included but results not reported; excluded region is OECD

	Import days	For. ex. regs constraint	Trade regs constraint	Exchange rate constraint
EAsia	–2.545	0.129**	0.0658**	0.304**
	(1.396)	(0.0225)	(0.0247)	(0.0242)
CEE	–7.202**	0.0732**	0.0950**	0.318**
	(1.182)	(0.0213)	(0.0231)	(0.0210)
LatAm	0.710	0.131**	0.265**	0.354**
	(1.264)	(0.0212)	(0.0224)	(0.0212)
SAsia	4.492*	0.221**	0.302**	0.300**
	(1.877)	(0.0309)	(0.0339)	(0.0347)
Exporter	1.734	0.0366**	0.0838**	0.00306
	(0.889)	(0.0133)	(0.0143)	(0.0145)
Foreign	–0.223	0.00916	0.00536	0.0149
	(1.027)	(0.0168)	(0.0184)	(0.0188)
Multi-country	1.783	–0.000658	0.0300	–0.0238
	(1.025)	(0.0168)	(0.0183)	(0.0189)
Observations	4,330	6,323	6,006	6,611

Note: Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$.

Table A3. General Indicators of Firm–Government Relationship: Probit regressions with average discrete effects for change in dummy variables from 0 to 1 reported; dummies for size, sector, age category and government ownership included but results not reported; excluded region is OECD; column 1 reports probability influence greater than "none"; column 2 probability national government is not unhelpful; column 3 probability tax and regulatory obstacle is greater than minor

	Influence gov.	Gov. helpful	Tax & reg. constraint
EAsia	0.218**	0.315**	–0.104**
	(0.0286)	(0.0234)	(0.0193)
CEE	–0.0904**	–0.129**	0.198**
	(0.0208)	(0.0196)	(0.0176)
LatAm	–0.0284	–0.0307	0.0939**
	(0.0205)	(0.0201)	(0.0178)
SAsia	0.142*	0.0898**	–0.0566*
	(0.0563)	(0.0323)	(0.0285)
Exporter	0.0709**	–0.00268	–0.0253*
	(0.0153)	(0.0137)	(0.0127)
Foreign	0.00299	0.0177	–0.0235
	(0.0205)	(0.0182)	(0.0162)
Multi-country	0.0689**	0.0537**	–0.0393*
	(0.0198)	(0.0180)	(0.0158)
Observations	5,456	6,940	6,906

Note: Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$.

Table A4. Government-Influenced Economic Constraints and Receipt of Subsidies: Columns 1–3 are probit regressions to predict probability general constraint greater than "minor"; average discrete effects for change in dummy variables from 0 to 1 reported; dummies for size, sector, age category and government ownership included but results not reported; excluded region is OECD

	Finance Constraint	Infrastructure Constraint	Inflation Constraint	Rec. subsidy Y/N
EAsia	0.102**	0.179**	0.175**	–0.0461**
	(0.0218)	(0.0241)	(0.0227)	(0.0164)
CEE	0.238**	0.102**	0.311**	–0.0871**
	(0.0187)	(0.0214)	(0.0186)	(0.0122)
LatAm	0.223**	0.244**	0.232**	–0.0889**
	(0.0191)	(0.0208)	(0.0193)	(0.0125)
SAsia	0.177**	0.423**	0.308**	–0.0104
	(0.0315)	(0.0344)	(0.0316)	(0.0313)
Exporter	0.0126	–0.0278*	–0.0934**	0.0251**
	(0.0136)	(0.0141)	(0.0135)	(0.00883)
Foreign	–0.114**	0.0323	–0.0248	–0.0130
	(0.0173)	(0.0183)	(0.0178)	(0.0123)
Multi-country	–0.0693**	–0.0202	–0.0496**	–0.00690
	(0.0170)	(0.0182)	(0.0176)	(0.0118)
Observations	6,835	6,747	6,735	6,161

Note: Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$.

Table A5. Political and Legal Constraints: Probit regressions to predict probability general constraint greater than "minor"; average discrete effects for change in dummy variables from 0 to 1 reported; dummies for size, sector, age category and government ownership included but results not reported; excluded region is OECD

	Polit. instab. constraint	Corruption constraint	Anti-compet. constraint	Judiciary constraint
EAsia	0.197**	0.279**	0.186**	0.0592*
	(0.0223)	(0.0276)	(0.0254)	(0.0260)
CEE	0.304**	0.303**	0.145**	0.156**
	(0.0188)	(0.0220)	(0.0219)	(0.0214)
LatAm	0.306**	0.403**	0.178**	0.245**
	(0.0191)	(0.0214)	(0.0221)	(0.0209)
SAsia	0.343**	0.556**	0.271**	0.198**
	(0.0324)	(0.0337)	(0.0482)	(0.0332)
Exporter	–0.0421**	–0.0572**	–0.0351*	–0.00577
	(0.0138)	(0.0150)	(0.0154)	(0.0145)
Foreign	–0.0212	–0.0246	–0.0232	0.0188
	(0.0179)	(0.0198)	(0.0205)	(0.0187)
Multi-country	–0.0136	–0.00143	–0.0302	0.0104
	(0.0177)	(0.0194)	(0.0200)	(0.0184)
Observations	6,710	6,069	6,148	6,205

Note: Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$.

Table A6. General Indicators of Government–Firm Relationship: Sector–region interaction effects; dummies for region, size, sector, age category, export status, ownership of foreign assets, foreign ownership and government ownership included but results not reported; excluded region is OECD and excluded sector is manufacturing; probit regressions with average discrete effects for change in dummy variables from 0 to 1 reported; column 1 reports probability influence greater than "none"; column 2 probability national government is not unhelpful; column 3 probability tax and regulatory obstacle is greater than "minor"

	Influence gov.	Gov. helpful	Tax & reg. constraint
Manu_EAsia	–0.0350	0.0511	–0.0764
	(0.0602)	(0.0501)	(0.0410)
Manu_CEE	0.0600	0.0186	–0.0273
	(0.0416)	(0.0404)	(0.0367)
Manu_LatAm	–0.0133	–0.0266	–0.00817
	(0.0436)	(0.0433)	(0.0387)
Manu_SAsia	–0.202	–0.0228	–0.195**
	(0.115)	(0.0694)	(0.0612)
Agri_EAsia	0.264	0.207	–0.348*
	(0.285)	(0.181)	(0.175)
Agri_CEE	0.0932	0.189	–0.191
	(0.163)	(0.148)	(0.153)
Agri_LatAm	0.119	0.125	–0.191
	(0.180)	(0.166)	(0.167)
Agri_SAsia	.	0.151	–0.313
	.	(0.221)	(0.246)
Observations	5,455	6,940	6,906

Note: Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$.

Table A7. Economic Indicators: Sector–region interaction effects; dummies for region, size, sector, age category, export status, ownership of foreign assets, foreign ownership and government ownership included but results not reported; excluded region is OECD and excluded sector is manufacturing; columns 1–3 are probit regressions to predict probability general constraint greater than "minor"; average discrete effects for change in dummy variables from 0 to 1 reported

	Finance Constraint	Infrastructure Constraint	Inflation Constraint	Rec. Subsidy Y/N
Manu_EAsia	–0.0200	–0.108*	–0.0888	0.00528
	(0.0461)	(0.0503)	(0.0479)	(0.0338)
Manu_CEE	0.0521	–0.0765	–0.0996*	–0.0273
	(0.0399)	(0.0432)	(0.0401)	(0.0237)
Manu_LatAm	0.0177	–0.0166	–0.114**	–0.00822
	(0.0423)	(0.0455)	(0.0426)	(0.0259)
Manu_SAsia	–0.143*	–0.121	–0.152*	0.0668
	(0.0684)	(0.0761)	(0.0696)	(0.0663)
Agri_EAsia	–0.0138	1.335**	0.116	0.0137
	(0.175)	(0.106)	(0.186)	(0.113)
Agri_CEE	0.0384	1.585**	0.106	0.0259
	(0.148)	(0.0458)	(0.159)	(0.0773)
Agri_LatAm	–0.0213	1.550**	–0.142	–0.0541
	(0.167)	(0.0881)	(0.174)	(0.0878)
Agri_SAsia	–0.113	1.216**	0.0565	.
	(0.238)	(0.321)	(0.270)	.
Observations	6,835	6,747	6,735	6,160

Note: Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$.

Table A8. Political and Legal Constraints: Sector–region interaction effects; dummies for region, size, sector, age category, export status, ownership of foreign assets, foreign ownership and government ownership included but results not reported; excluded region is OECD and excluded sector is manufacturing; probit regressions to predict probability general constraint greater than "minor"; average discrete effects for change in dummy variables from 0 to 1 reported

	Polit. instab. constraint	Corruption constraint	Anti-compet. constraint	Judiciary constraint
Manu_EAsia	–0.0703	0.00989	–0.143**	–0.119*
	(0.0473)	(0.0606)	(0.0532)	(0.0543)
Manu_CEE	0.00759	0.0342	–0.134**	–0.0226
	(0.0402)	(0.0484)	(0.0448)	(0.0439)
Manu_LatAm	–0.0466	0.0265	–0.115*	–0.0620
	(0.0432)	(0.0508)	(0.0477)	(0.0460)
Manu_SAsia	–0.181*	-0.0974	–0.147	–0.0408
	(0.0736)	(0.0787)	(0.0997)	(0.0710)
Agri_EAsia	–0.194	–0.337	–0.151	–0.0463
	(0.180)	(0.247)	(0.203)	(0.203)
Agri_CEE	–0.199	–0.287	–0.0678	–0.0198
	(0.153)	(0.169)	(0.171)	(0.170)
Agri_LatAm	–0.508**	–0.415*	–0.127	–0.0696
	(0.169)	(0.186)	(0.189)	(0.185)
Agri_SAsia	–0.471	.	–0.0318	0.0820
	(0.249)	.	(0.340)	(0.287)
Observations	6,710	6,061	6,148	6,205

Note: Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$.

Table A9. General Indicators: "Firm outward orientation"–region interaction effects; dummies for region, size, sector, age category, export status, ownership of foreign assets, foreign ownership and government ownership included but results not reported; excluded region is OECD and excluded sector is manufacturing; probit regressions with average discrete effects for change in dummy variables from 0 to 1 reported; column 1 reports probability influence greater than "none"; column 2 probability national government is not unhelpful; column 3 probability tax and regulatory obstacle is greater than "minor"

	Influence gov.	Gov. helpful	Tax & reg. constraint
Export_EAsia	–0.00402	0.120*	0.0576
	(0.0700)	(0.0575)	(0.0453)
Export_CEE	0.0991*	0.119**	–0.0772*
	(0.0443)	(0.0425)	(0.0378)
Export_LatAm	0.0516	0.00232	–0.0649
	(0.0472)	(0.0464)	(0.0407)
Export_SAsia	0.224	0.131	–0.0991
	(0.149)	(0.0717)	(0.0627)
Foreign_EAsia	0.00141	–0.0603	0.0963
	(0.0774)	(0.0647)	(0.0521)
Foreign_CEE	0.0913	0.100	–0.104*
	(0.0595)	(0.0565)	(0.0493)
Foreign_LatAm	0.122*	–0.0101	–0.0566
	(0.0564)	(0.0557)	(0.0483)
Foreign_SAsia	–0.0419	0.270**	–0.0698
	(0.152)	(0.0944)	(0.0730)
MultNat_EAsia	–0.0128	–0.0390	–0.108*
	(0.0799)	(0.0657)	(0.0520)
MultNat_CEE	–0.0455	–0.0198	0.0159
	(0.0579)	(0.0542)	(0.0477)
MultNat_LatAm	–0.0820	–0.0529	0.0682
	(0.0528)	(0.0519)	(0.0455)
MultNat_SAsia	–0.0699	0.00551	0.0485
	(0.132)	(0.0889)	(0.0704)
Observations	5,455	6,940	6,906

Note: Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$.

Table A10. Economic Constraints: "Firm outward orientation"–region interaction effects; dummies for region, size, sector, age category, export status, ownership of foreign assets, foreign ownership and government ownership included but results not reported; excluded region is OECD and excluded sector is manufacturing; columns 1–3 are probit regressions to predict probability general constraint greater than "minor"; average discrete effects for change in dummy variables from 0 to 1 reported

	Finance Constraint	Infrastructure Constraint	Inflation Cconstraint	Rec. subsidy Y/N
Export_EAsia	–0.0753	–0.00296	0.0359	–0.00454
	(0.0514)	(0.0589)	(0.0547)	(0.0371)
Export_CEE	–0.160**	–0.0814	–0.0843*	–0.0190
	(0.0417)	(0.0481)	(0.0425)	(0.0240)
Export_LatAm	–0.121**	0.0354	–0.0524	0.0126
	(0.0451)	(0.0509)	(0.0458)	(0.0265)
Export_SAsia	–0.123	0.159*	0.0619	–0.125
	(0.0700)	(0.0791)	(0.0704)	(0.0790)
Foreign_EAsia	0.0981	0.0335	0.0726	–0.0449
	(0.0609)	(0.0666)	(0.0629)	(0.0437)
Foreign_CEE	–0.0869	0.0420	0.0252	–0.0262
	(0.0554)	(0.0614)	(0.0562)	(0.0361)
Foreign_LatAm	–0.0356	–0.0418	–0.0251	0.0250
	(0.0544)	(0.0600)	(0.0549)	(0.0328)
Foreign_SAsia	–0.0192	–0.0673	0.123	–0.0509
	(0.0821)	(0.0891)	(0.0846)	(0.0868)
MultNat_EAsia	–0.0473	0.0241	–0.176**	0.0477
	(0.0604)	(0.0677)	(0.0612)	(0.0411)
MultNat_CEE	0.127*	0.133*	–0.0975	–0.0601
	(0.0535)	(0.0608)	(0.0531)	(0.0346)
MultNat_LatAm	0.0690	0.126*	–0.0471	–0.00457
	(0.0508)	(0.0578)	(0.0510)	(0.0309)
MultNat_SAsia	0.152	0.303**	–0.154	0.0480
	(0.0811)	(0.0954)	(0.0800)	(0.0709)
Observations	6,835	6,747	6,735	6,160

Note: Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$.

Table A11. Political and Legal Constraints: "Firm outward orientation"–region interaction effects; dummies for region, size, sector, age category, export status, ownership of foreign assets, foreign ownership and government ownership included but results not reported; excluded region is OECD and excluded sector is manufacturing; probit regressions to predict probability general constraint greater than "minor"; average discrete effects for change in dummy variables from 0 to 1 reported

	Polit. instab. constraint	Corruption Constraint	Anti-compet. Constraint	Judiciary Constraint
Export_EAsia	0.0315	–0.0517	–0.00900	–0.103
	(0.0535)	(0.0675)	(0.0612)	(0.0652)
Export_CEE	–0.0678	–0.133**	–0.0380	0.0317
	(0.0425)	(0.0506)	(0.0481)	(0.0475)
Export_LatAm	–0.0120	–0.122*	–0.0786	–0.0147
	(0.0463)	(0.0539)	(0.0520)	(0.0504)
Export_SAsia	0.00149	–0.0873	–0.226	–0.106
	(0.0747)	(0.0814)	(0.115)	(0.0737)
Foreign_EAsia	0.142*	0.0236	–0.0955	0.115
	(0.0616)	(0.0767)	(0.0707)	(0.0739)
Foreign_CEE	–0.00942	–0.0453	–0.129*	0.110
	(0.0565)	(0.0667)	(0.0633)	(0.0635)
Foreign_LatAm	0.00417	–0.0276	–0.152*	0.135*
	(0.0557)	(0.0654)	(0.0616)	(0.0618)
Foreign_SAsia	0.0454	–0.215*	–0.212	0.113
	(0.0843)	(0.0933)	(0.152)	(0.0882)
MultNat_EAsia	–0.168**	–0.0529	0.0354	0.0572
	(0.0593)	(0.0747)	(0.0710)	(0.0708)
MultNat_CEE	–0.0190	0.0756	0.0915	0.01000
	(0.0536)	(0.0633)	(0.0617)	(0.0590)
MultNat_LatAm	–0.0517	0.0167	0.0764	–0.00334
	(0.0516)	(0.0607)	(0.0590)	(0.0561)
MultNat_SAsia	–0.192*	0.0876	0.239	–0.0407
	(0.0818)	(0.0947)	(0.127)	(0.0840)
Observations	6,710	6,061	6,148	6,205

Note: Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$.

Chapter 4

Corporate Savings, Investment and Financial Structure in East Asia: Micro-evidence

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This chapter uses micro-data on financial structure from a large sample of firms to show that Asian firms are unusual in raising a large part of their funds externally (not from retained earnings). Although there has been a steady increase in retained earnings for some firms, there are others with negative earnings that have no retentions and are entirely dependent on external finance for survival. Amongst the sources of external finance there has been an increasing role for equity financing. This is unusual in an international context and challenges the conventional view that companies in East Asia are excessively dependent on debt. We show that dividends and cash holdings are not lower and higher, respectively, than what are generally observed internationally. We find that accumulated retained earnings are used for the creation of fixed assets and are not held as inefficiently large cash balances. We conclude there is little evidence that listed firms in the region are hoarding savings. The imbalance between savings and investment seems to be the result of constraints on the investment side, rather than incentives to build up excessive savings. A policy focus on the drivers, determinants and impediments to investment will be a more productive way to respond to global imbalances than a narrow focus on corporate savings.

Keywords: company finance, corporate finance, corporate governance, corporate investment, corporate savings, financial statistics, firm, firm level, East Asia, financial systems

JEL Classifications: G320, G380, G390, O330, O160, K000

1. Introduction

Global current account imbalances are widely acknowledged to reflect internal savings–investment imbalances. Yet it is not always clear which side of the savings–investment ledger is out of line, and a failure to analyse this clearly can lead to mistaken policy advice. Even if correctly identified, it can be quite difficult to explain why those savings imbalances arise. Indeed it is not even straightforward to measure the domestic components of the imbalances and to allocate them accurately between household and corporate sectors though the effort is important for policy analysis, as demonstrated by Bayoumi and Wei (2010).

This chapter draws attention to the role of finance for the corporate sector as a key part of the economic structure that underlies global macroeconomic imbalances. If companies are amassing large savings balances there will be some economic reason for that behaviour. Either firms are building savings in order to invest or they are accumulating excess savings because they are unable (or unwilling) to invest. The first pattern of behavior suggests that firms might be unable to raise funds for investment when needed from the financial system and are forced to rely on their own savings. The second would arise when firms earn profits that they cannot then apply to investment projects and which accumulate inside the firm or are used for the acquisition of financial assets rather than physical capital expenditure. Each of these stories would give rise to distinctive patterns in corporate financial structure.

Our purpose in this chapter is to examine and clarify claims that the current imbalances are largely caused by excessive corporate savings and that these are driven by inadequacies in financial systems. This claim has been made in many quarters, including by the International Monetary Fund (IMF, 2009), and is primarily based on macroeconomic data from national income accounts. We use micro-data from company accounts of listed firms to shed light on these problems. If the claims from the macro-data are correct, they should also be reflected in companies' financial accounts. We examine the evidence of the patterns of retained earnings, dividend payouts and the accumulation of assets and find little support for the idea that there is a build-up of excessive finance in the listed company sector. Not only do firms not retain earnings to

an unusual degree or build up war chests of cash and liquid assets, the internal and external finance available is being used primarily to finance real asset creation. The micro-evidence does not support the macro-claims but does support the alternative hypothesis that more investment could be undertaken with different policy settings and possibly greater development of financial systems.

The structure of the chapter is as follows. First, we consider how firms raise their finance (that is, in what form) and what they do with the funds raised. We then use the micro-data to see whether they support claims that corporate savings are a large part of the "excess savings" story. Both sides of this coin are important for policy responses to understanding financial needs and to addressing imbalances. Our data bring a micro-perspective to the question of whether the financial system is contributing to a build-up of corporate savings or to low levels of investment, or both. We examine whether firms are financially constrained in investment and what characteristics explain different patterns of retention or accumulation of liquid assets.

Section 2 describes the sources of finance, to show where firms get their funds when raising finance. This section demonstrates that Asian firms are somewhat unusual in raising a large part of their funds externally (not from retained earnings). We also show that although there has been a steady increase in retained earnings for some firms, there are others with negative earnings that have no retention and are entirely dependent on external finance for survival. Amongst the sources of external finance there has been an increasing role for equity financing. This is unusual in an international context and challenges the conventional view that companies in East Asia are excessively dependent on debt. Furthermore, there have been significant changes around crisis events.

We then turn the data around to ask how firms use their finance as between investing in real physical assets and accumulating cash or other financial assets. Since the previous data show only where funds come from and not what they are used for, this section gives an important perspective on whether finance is used to create the real assets that are the source of countries' productive capacity and growth.

From the data in Section 2, we can clarify the role of firms' own funds (retentions from profit) in the creation of real assets and increase the understanding of whether the pattern and scale of corporate savings are unusual in Asia and whether there is a problem of corporations withholding their savings from productive investment. This

leads, in Section 3, to a discussion of whether the micro-data are consistent with the macro-evidence on corporate savings reported in other studies.

Section 4 presents regression results to explain the link between savings and investment and to examine the extent of financial constraints on investment. We link these results to the earlier discussion of whether accumulated assets are being hoarded by firms. Section 5 draws conclusions and policy implications.

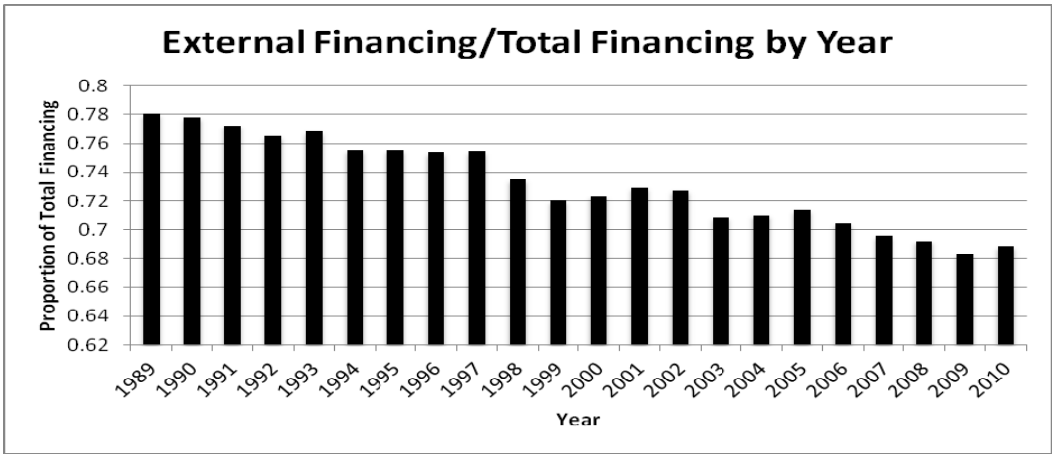
2. Sources of Finance: Where do firms get their funds?

Corbett and Twite (2010) noted several unusual features of corporate finance in the Asian region—in particular, the relatively high dependence on external finance and, within that, a rather large role for common stock as a source. Figures 1 to 6 show that these features have now become even more pronounced in the recent period of global financial turmoil.

While the share of external sources in total finance fell after the Asian Financial Crisis (AFC) of 1997–98, and has continued to fall, it is still about 70 percent for the nine countries considered (Figures 1 and 2). As Figure 3 shows, debt began to decrease significantly as a share of financing after the AFC, while issues of both common stock and the use of retained earnings rose. Countries vary significantly in their use of debt versus equity (Figure 4), with China, India and Korea the high debt users (at 40 percent to 50 percent of total financing sources), followed by Indonesia and Thailand (at more than 30 percent). Japan also uses considerable debt but differs from the other high-debt countries in using more retained earnings than either separate source of external finance.[1]

[1] This replicates the finding in Corbett and Jenkinson (1985) that Japan used a "balance" of sources of financing across retentions, equity and debt.

Figure 1. External Financing/Total Financing by Year



Note: We use book values and drop firms with negative earnings for which the concept of internal finance is not meaningful. This applies to Figures 1–6.

Figure 2. External Financing/ Total Financing by Country (1989-2010)

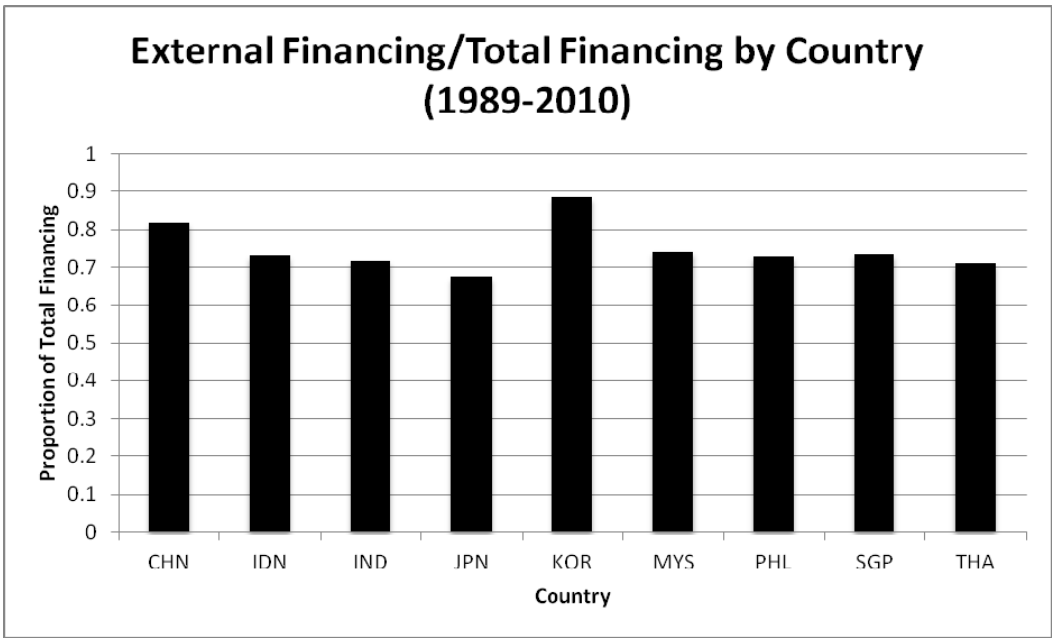


Figure 3. Sources of Financing by Year

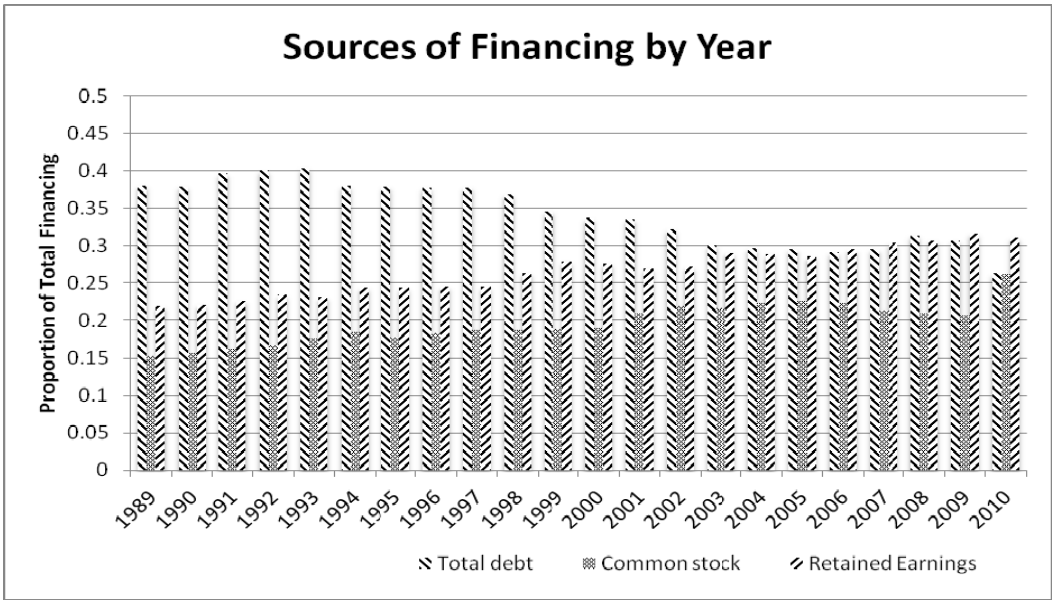
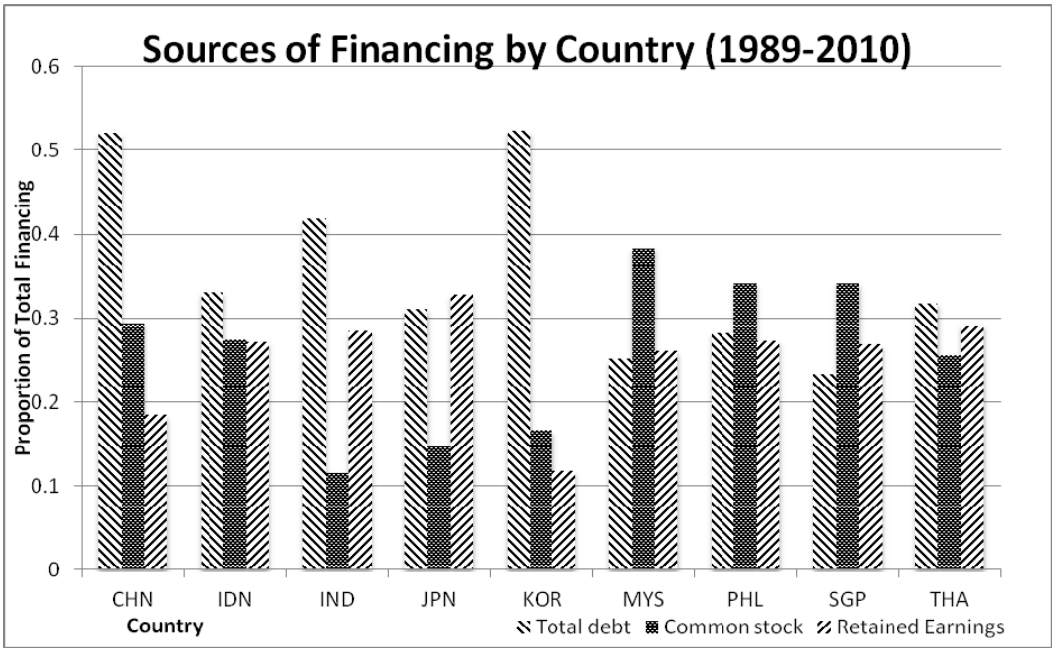


Figure 4. Sources of Financing by Country



Another striking feature is the substantial use of common stock by several countries. For Malaysia, the Philippines and Singapore, common stock issues have been the largest source of finance, accounting for more than either debt or retained earnings.[2] In

[2] Contrary to one frequently repeated view of financing in developed markets (cf. Mishkin, 2009), that view is hard to reconcile with the well-accepted data on debt/equity ratios.

Thailand, Indonesia and China, they have accounted for more than 25 percent. This might seem surprising given the conventional view that corporate sectors in Asia are heavily bank dependent,[3] but it is consistent with data showing that the listed firms in the region are not dramatically different from global averages in the debt/equity structure of their finance. The average leverage ratio (debt/book value equity) for all countries covered by Compustat data is 31 percent; the United Kingdom is 28 percent and Australia 21 percent. Table 1 shows the average for our sample against relevant comparators.

Table 1

	Mean Book Leverage
Our sample	0.4555
Total other countries in Computstat	0.3028
Developed countries	0.3247
Developing countries	0.3092

Breaking down external sources into more detailed components, Figures 5 and 6 also show the growing sharing of equity and the decline in both long and short-term debt after the AFC. Amongst debt instruments, the most important is now trade credit between companies. Data for individual countries show the consistently important role of trade credit and short-term debt (presumed to be bank debt), but again the striking role of equity issues. Long-term debt has been a generally smaller share and no doubt reflects the underdeveloped corporate bond markets.

[3] It might be partly explained by the fact that we are considering the listed company sector and do not have data for the small and medium firms that are not listed, and which might be more debt financed. As we have argued in the discussion of our data, the listed firm sector is now a significant part of the region's economies and cannot be dismissed as unrepresentative or unimportant, though it is likely true that its financial structure is different from family owned and small and medium firms.

Figure 5. External Sources of Finance by Year

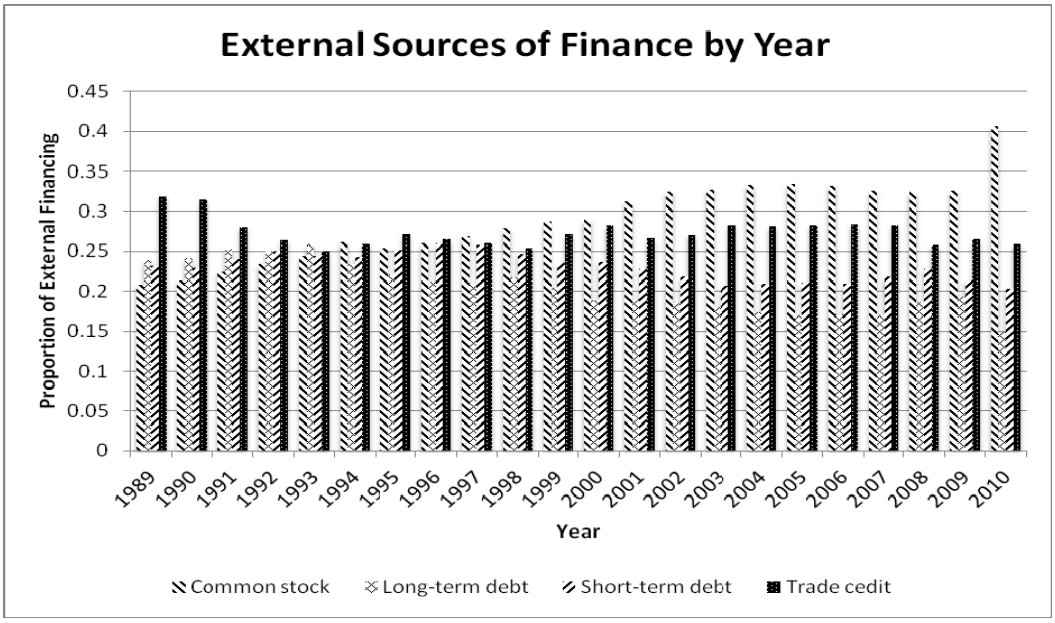
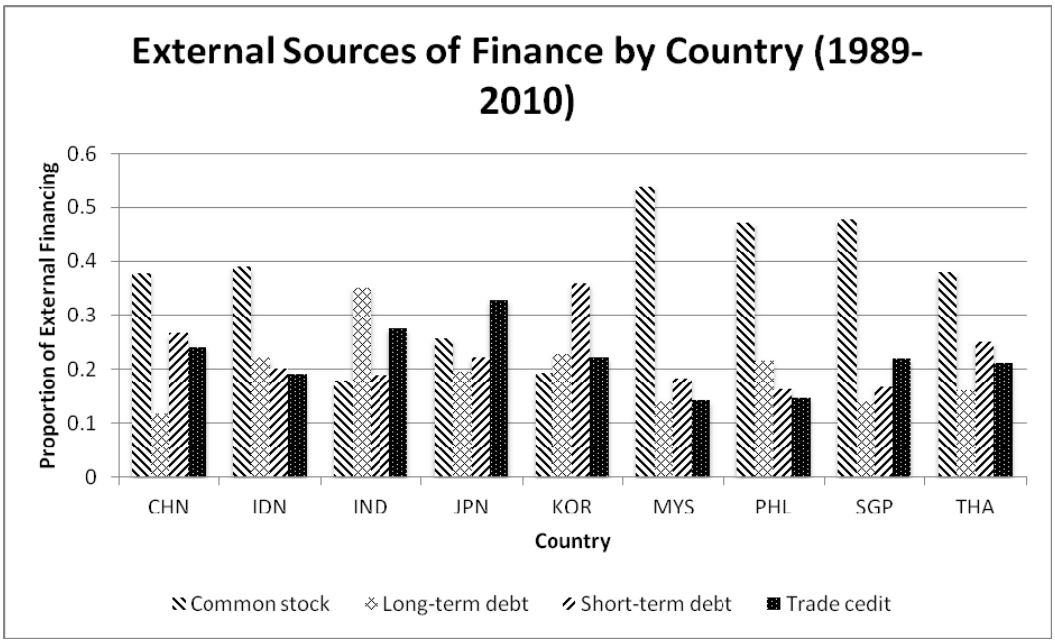


Figure 6. External Sources of Finance by Country (1989-2010)



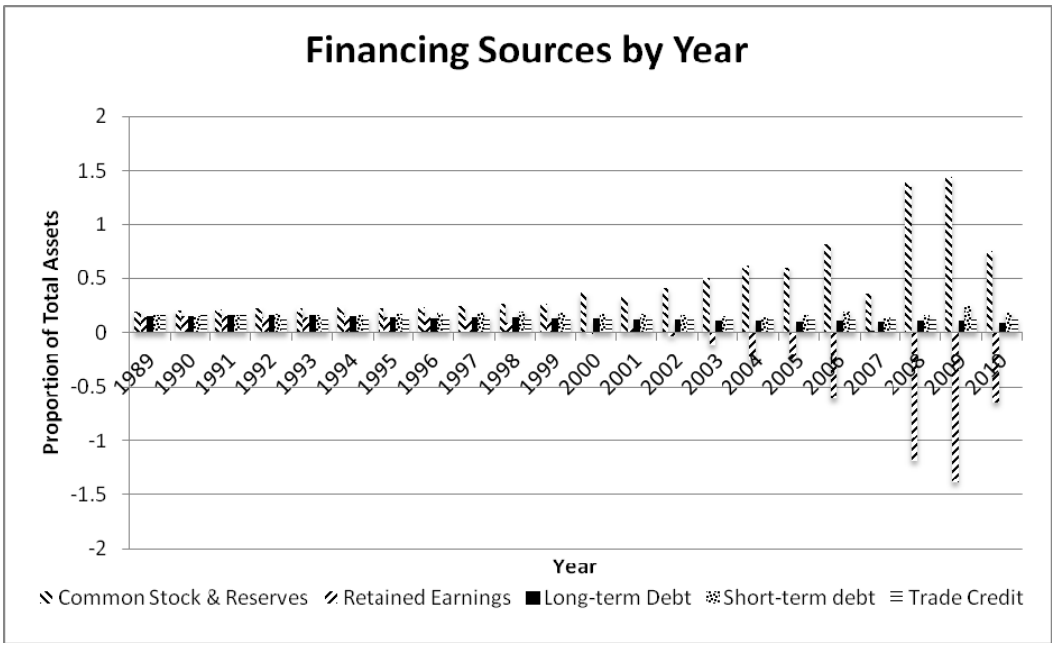
Figures 3 and 4 also indicate the steady increase over time in the role of retained earnings in financing, albeit at fairly low levels. Across countries, retentions generally vary between 20 percent and 30 percent as a share, with the remainder of financing coming from external sources. This contrasts with one widely held view in corporate finance that retained earnings are generally a larger source of finance than external

sources. Even in Japan—the country in our sample with the largest share for retentions—external sources combined are a larger share of total financing. China—contrary to the view that companies are building up large savings (further discussed below)—is much more dependent on external sources than on internal ones.

For the sample of companies with positive earnings, we conclude that at the time of the AFC, as external finance began to drop, retentions were used to keep the total amount of financing from dropping significantly. This trend has continued, bringing these firms closer to international norms in their reduced dependence on external finance. In some countries, they have increasingly used equity as the larger source of external financing.

Once we include the firms with negative earnings, however, the role of retentions is quite different, with large negatives recorded since 2000 and an increasing share of equity finance offsetting falling internal sources (with particularly large declines in retentions in 2002 and 2005) (Figure 7). For the corporate sector as a whole, therefore, external finance has remained very important.

Figure 7. Financing Sources by Year



While this implies that, on the positive side, some external finance is available to act as a buffer when corporate profits plunge, it also means that as a result of crisis periods the

corporate sector becomes more dependent on external finance at the margin. If these changes in the finance mix could be achieved rapidly at times of crisis, without a large drop in the overall quantity of finance, the impact of crisis on capital expenditure (investment) would be less than if finance were not available, and this is an important function of the financial sector.

The puzzle identified by Corbett and Twite (2010)—that there is no impact from the mix of financial sources on investment—might be partly tempered by the emerging picture. Given the patterns described, we might not expect to observe a close contemporaneous correlation between the mix of finance and the creation of real assets. Yet, at times of crisis, the ability to source new finance does matter and it might result in significant changes in the mix, as firms replace difficult sources with more readily available ones. An inability to replace declining sources of finance with alternative sources would have an impact on the amount of investment carried out. The question to ask is not whether having more debt or more equity allows firms to invest more but whether the ability to change the funding mix reduces constraints on investment.

Another perspective on the role of different types of finance and their ability to acquire assets comes from focussing on the uses of firms' finance rather than the sources.

2.1. The Uses of Funds

If firms are uncertain about the reliability of external financing sources, we might observe a build-up of cash and other liquid assets either because firms want a war chest from which to fund planned investment in future or because they become more conservative generally and want to hoard cash against future financing shortages, even if they have no plans for investment. In the former case, we should observe that, even if cash holdings are large, or rise at times of crisis, they will be used for capital expenditure. In the latter case, we might see large cash build-ups that do not result in the formation of assets. To understand this behaviour, we look at the share of different types of asset acquisition in the total assets of firms.

A pattern of acquisition of accumulated cash and liquid asset sources could help to explain earlier results (Corbett and Twite, 2010) showing the irrelevance of financial structure to investment (with only country characteristics mattering for investment

performance). While consistent with other studies, it seemed a surprising result for Asia since it seemed to imply that improving access to particular types of finance (for example, strengthening the corporate bond market or the stock market) would have little effect on companies' investment behaviour. This seemed to mean that increasing the breadth and depth of financial markets would not increase investment, though macroeconomic studies typically show that financial depth improves investment and growth. It seems more likely that the financial mix does affect the investment behaviour of firms but that econometric exercises might not detect the effect because of the ability to disconnect current investment from current financing by using accumulations of liquid assets.[4] If markets worked perfectly, this behaviour would not be necessary since, if some types of finance were not available, firms would be able to substitute with others and would not have to cut investment, but in the presence of financial friction firms might build up cash reserves to protect investment plans.

We find, in fact, that cash holdings (and cash plus equivalent liquid assets) at less than 20 percent as a share of assets are not particularly large in any of the countries (Figures 8 and 9), though there is cross-sectional variation. There had been a steady decline in the lead-up to the AFC, and liquid holdings stayed low after the crisis until countries began to build them up again about 2002–03. It appears that during and immediately after the AFC, even though profits fell, firms raised more finance despite the poor economic situation and they ran down their own liquid assets, with the result that fixed assets stayed at a fairly stable share of total assets (Figures 10 and 11).

[4] Note: If liquid assets are parked somewhere (for example, bank deposits) then running these down becomes a source of finance but shows up as a change in assets (reduction), not a change in liabilities. The "net sources" approach of Mayer et al. might miss this effect by deducting the change in assets holdings from the change in similar liabilities but would pick it up if there is no change in the matching liability (or if the change in assets is larger than the change in liability so adding to the total source from, for example, banks). The only way to fully capture this is to show the assets side, which is what we do in the next section.

Figure 8. Cash Holdings by Year

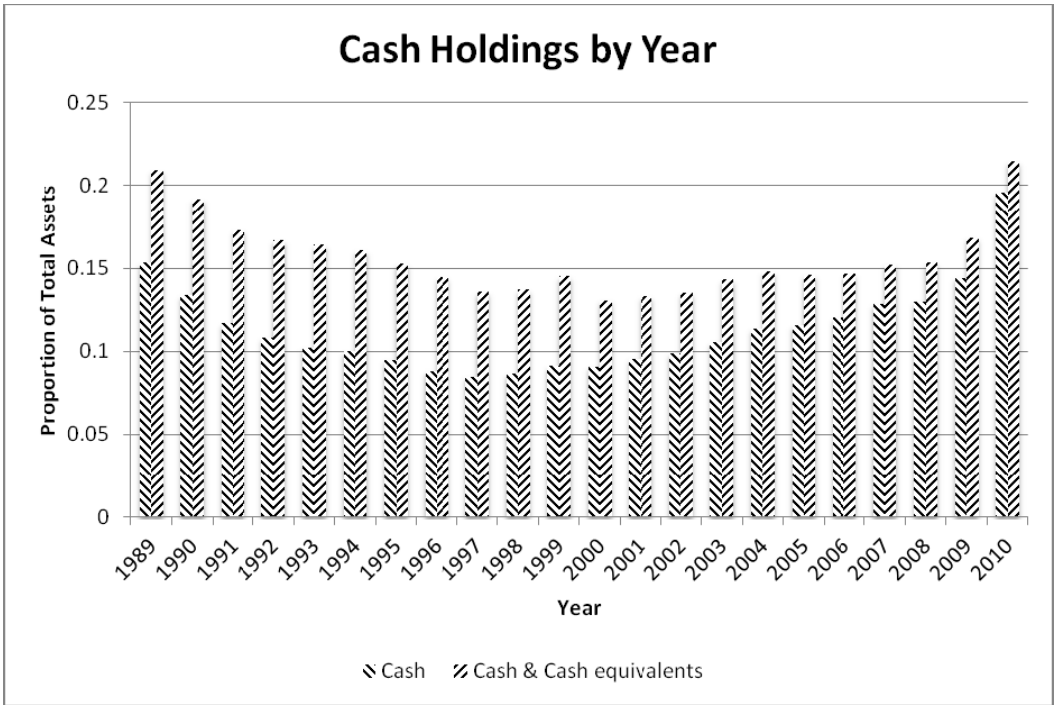


Figure 9. Cash Holdings by Country (1989-2010)

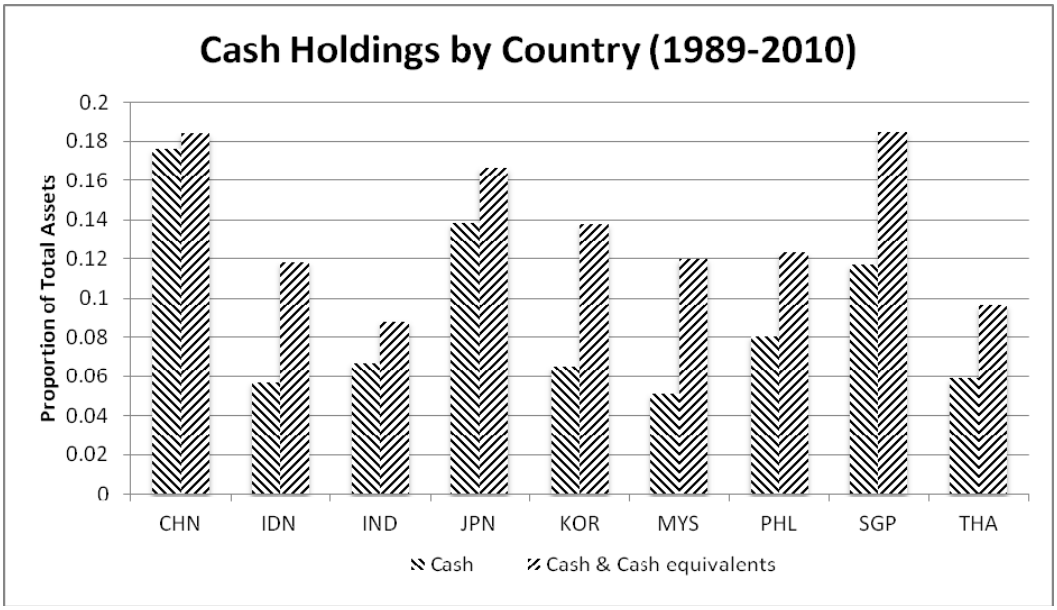


Figure 10. Fixed Assets

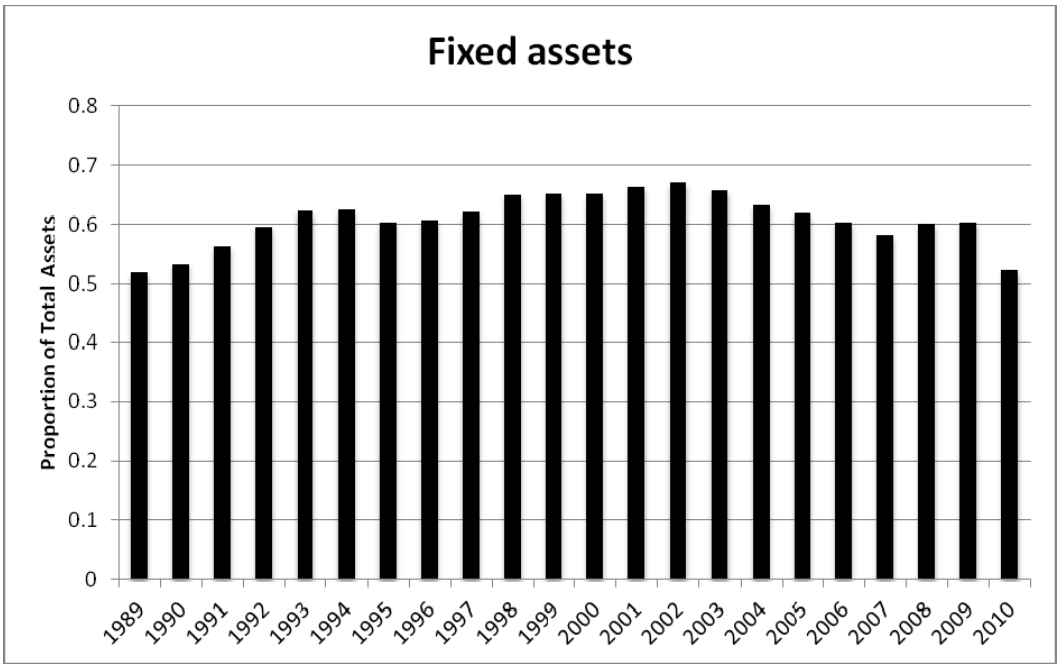
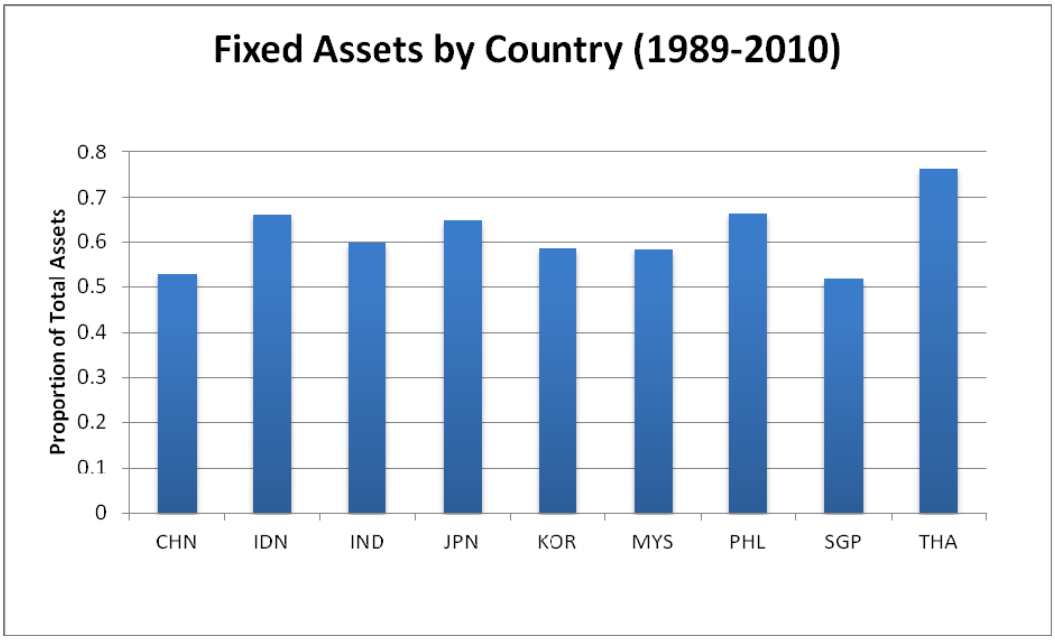


Figure 11

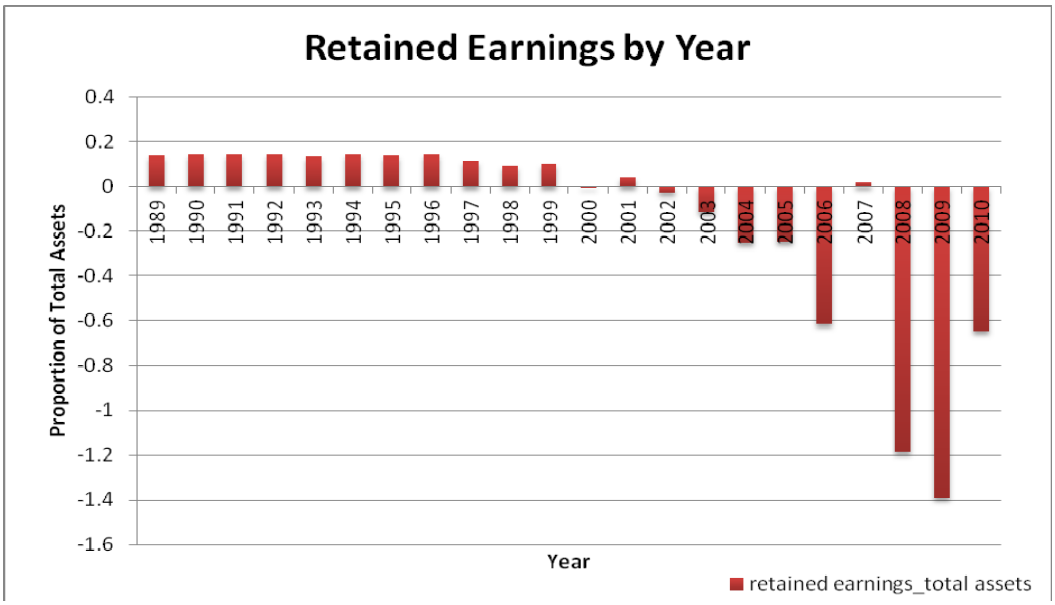


An alternative to managing liquid assets for firms facing financial constraints is to manage retentions. Firms with poor access to external financial markets, but with productive investment opportunities, could cut dividends to provide more retained earnings. Shareholders might be willing to accept this in the short term if longer-term

investment returns are positive. The effect in company accounts would be a rise in the share of retentions relative to assets (given that dispersing retentions into fixed assets cannot take place immediately) and this would, in effect, be a temporary deferral of acquisition of current real assets for future ones.

Figures 12 and 13 show no evidence of large accumulations of retained earnings. In fact, as noted above, despite the increase in retentions for some firms, when all firms are included (even those with negative earnings), retentions have declined since the AFC, in some years have become heavily negative. This is not the result of large dividend payouts. Figures 14 and 15 show payout ratios across countries and over time that are not significantly different from international standards (at about 0.6).[5] Rates have fallen since 2000 but this is also true across the world.

Figure 12. Retained Earnings by Year



[5] The Mean Dividend Payout Ratio for all countries in the Compustat data is 0.600011; all countries excluding the United States have 0.608032; the United States has 0.23906; all countries with payout < 1 have 0.414713; developing countries have 0.405512; developed countries have 0.794509.

Figure 13. Retained Earnings by Country (1989-2010)

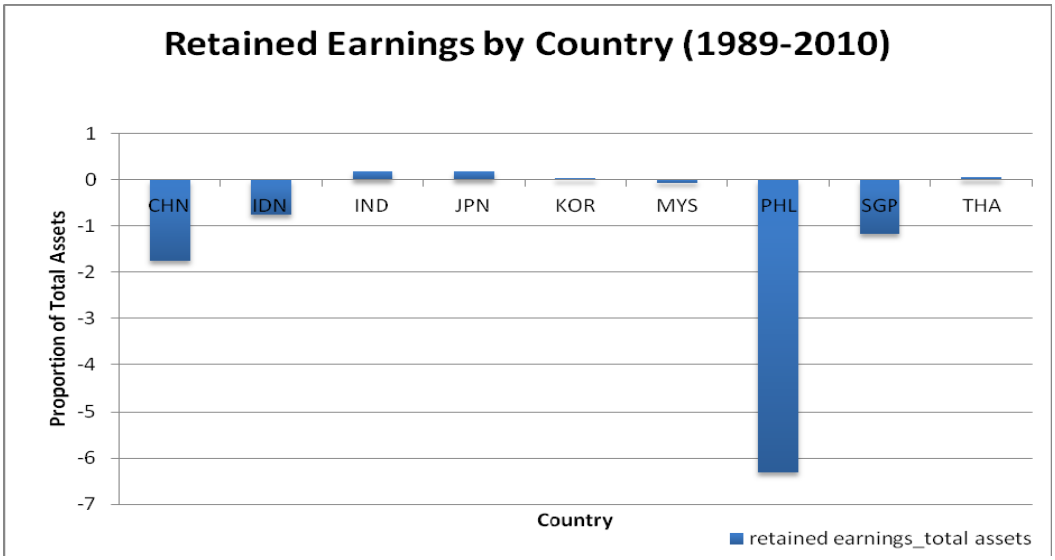


Figure 14. Dividend Payout by Country (1989-2010)

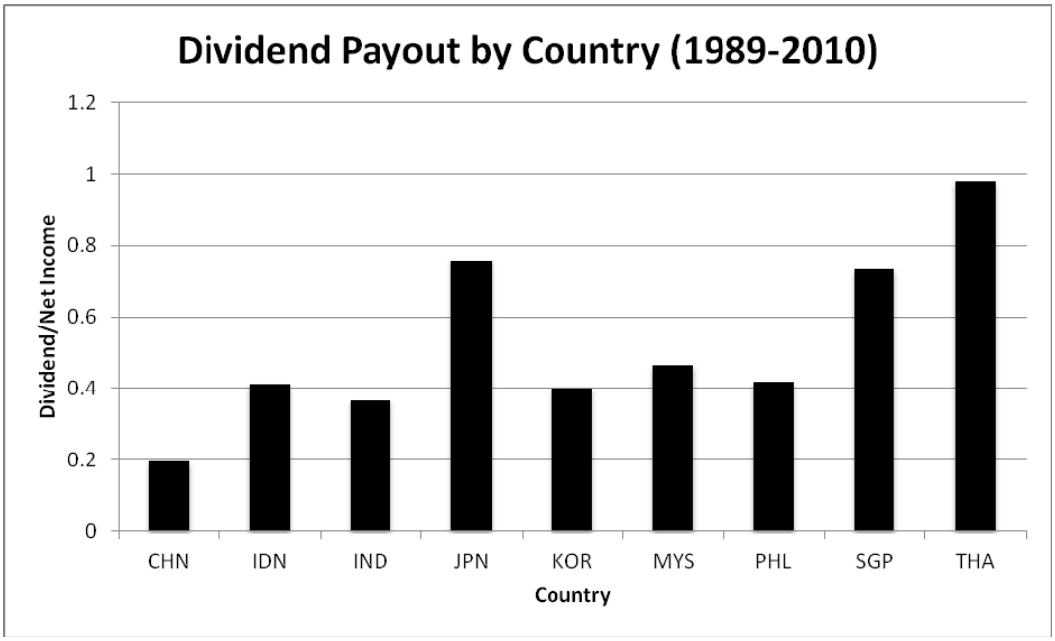
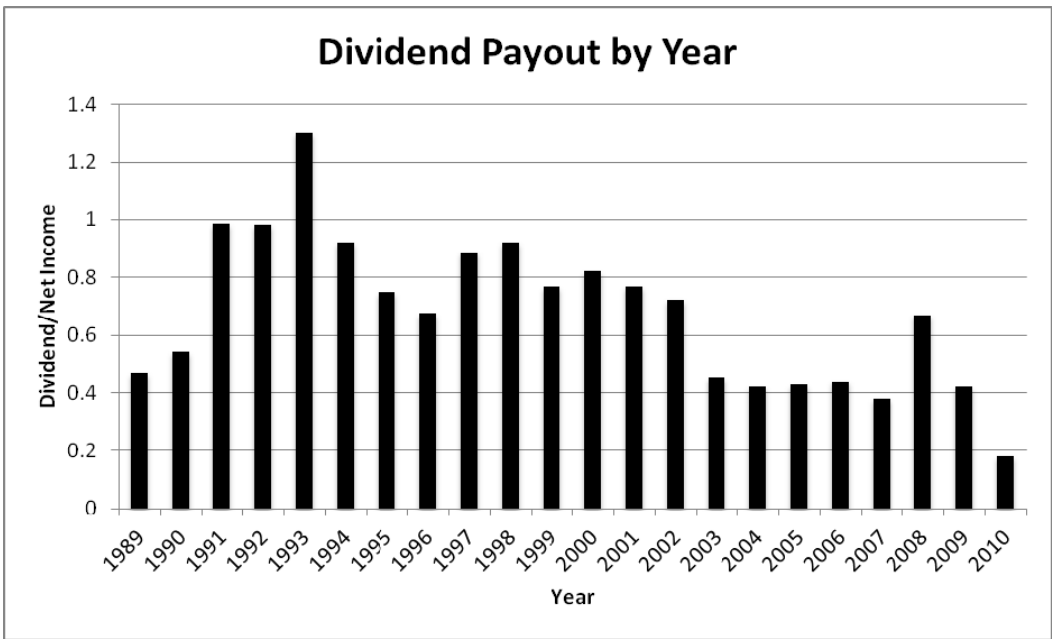


Figure 15. Dividend Payout by Year



There is little evidence, therefore, that cash accumulations or retained earnings were hoarded rather than used for real asset creation. Figures 10 and 11 show that even the lowest countries have a high proportion of fixed assets in total assets, at 50 percent to 70 percent. Even during the crisis years, the proportion of fixed assets remained high. From 2003 onwards, these shares have fallen—consistent with other evidence that investment has slowed in most of these countries (possibly in response to "excess" investment in the pre-AFC years), but even at their lowest level in 2010, fixed assets represented 50 percent of total assets.

We can exploit the variation in the pattern of retentions and accumulation of liquid assets to look more closely at the main drivers of the asset-accumulation behaviour. Table 2 shows a set of regression results that shows the significant effects of country-level policy and institutional factors on firms' allocation of funds between different uses (retained earnings, liquid assets and fixed assets). These are the results of two-stage regressions that give the country-specific factors affecting the acquisition of different types of assets, after accounting for firm effects. The two-stage procedure regresses the dependent variable on firm characteristics, then uses the error terms from those regressions as dependent variables in the second stage. The first-stage dependent

variables are: i) cash and cash equivalents over total assets; ii) retained earnings over total assets; and iii) fixed assets over total assets.

Table 2. Asset Accumulation

Dependent variables:	Cash & cash equivalents/total assets	Retained earnings/total assets	Fixed assets/total assets
Independent variables:			
Country factors:			
Common law	–0.0795	–2.6953	–0.3694
	(–12.81)***	(–3.05)***	(–7.93)***
Corruption	–0.0060	0.5289	0.0547
	(–2.04)**	(2.60)***	(2.44)***
Creditor rights	0.0138	–0.8143	–0.0971
	(3.31)***	(–2.49)***	(–2.74)***
Shareholder rights	–0.0001	0.6541	0.1401
	(–0.02)	(2.39)***	(10.58)***
Bank state owned	0.0489	1.6164	0.3065
	(4.15)***	(1.92)*	(3.97)***
Tax evasion	0.0105	1.8507	0.2056
	(1.38)	(2.97)***	(3.47)***
Openness	0.0038	–0.6970	–0.0010
	(1.21)	(–2.61)***	(–0.08)
AFC	–0.0224	0.4202	–0.0243
	(–4.25)***	(1.04)	(–1.10)
Industry:			
Non-durables	0.0033	0.0609	0.0643
	(0.58)	(0.37)	(1.96)*
Durables	0.0300	0.1678	0.0593
	(4.11)***	(1.33)	(0.97)
Manufacturing	0.0011	–0.7551	0.0686
	(0.30)	(–0.71)	(2.49)**
Energy	0.0198	–0.2167	0.1901
	(1.84)*	(–0.76)	(3.60)***
High-tech	0.0918	0.3931	–0.3659
	(7.88)***	(2.11)***	(–9.48)***
Telecomm.	0.0616	0.4748	0.0506
	(5.60)***	(3.27)***	(0.64)
Shops	–0.001	0.1629	–0.1930
	(–0.30)	(1.24)	(–9.55)***
Health services	0.0179	0.2689	0.1266
	(1.47)	(1.16)	(0.78)
Number of observations	75,883	76,790	76,216
R-squared	0.1357	0.0002	0.1901

Note: Two-stage regression of dependent variable on country-level variables, controlling for firm and industry. Standard errors are robust to clustering within country over time. T-statistics are given in parentheses. Significance levels: * 10 %; ** 5 %; *** 1 %.

The picture that emerges is that firms in common-law systems retain less and also accumulate lower proportions of cash. This result is consistent with common-law systems providing better investor protection, and enabling investors to "demand" higher dividend payments and more frequent monitoring via external financing. The observation that common-law systems are associated with lower levels of fixed assets is consistent with better property rights protection facilitating the investment in intangible assets. Interestingly, firms in countries with high corruption levels have lower cash and higher retentions. As expected, the higher retentions result in an increase in fixed assets rather than an accumulation of cash. This is consistent with higher corruption levels implying less ability to protect property and to enforce non-defined contracts, giving a disadvantage to holding cash and an advantage to investing in fixed (non-discretionary) assets. This might result in overinvestment in inefficient physical projects. Stronger creditor rights are normally associated with the use of more debt, allowing lower retained earnings, as we find. In our results, the puzzle is that this leads to higher accumulation of cash rather than the investment in fixed assets. As expected, stronger shareholder rights are associated with higher levels of retained earnings and fixed assets because shareholders' confidence in their ability to exercise their property rights gives them the confidence to allow firms to retain earnings. Recent criticism of the indexes that we and many others use to capture investors' rights raises issues about the interpretations to be put on the results and are discussed in more detail in the conclusion. An important finding for the region is that the more open the economy, the stronger is the reliance on external financing and the lower is the level of retained earnings, though openness has no effect on the allocation between cash and fixed assets. Finally, the AFC seems to have had little impact on either the level of retention or the accumulation of fixed assets, but certainly did result in a decline in cash holdings, suggesting that at least part of the firms' investment during that period was financed by a depletion of cash holdings rather than the use of external financing.

This closer consideration of the accumulation of retentions also helps to make the link we seek between corporate savings behavior and investment. What can we conclude about the hypothesis that the region suffers from excess corporate savings given the evidence of the declining role for retentions and a growing need for external sources of finance?

3. Do East Asian Firms Save A Lot or A Little?

As noted in the introduction, we are interested in the sources and uses of financing not only for what they tell us about the way in which access to finance might impact on the formation of productive assets and as a means to understand the transmission of financial shocks to real investment, but also because they provide another lens through which to understand the development of corporate savings. Our evidence on retained earnings so far does not suggest that these are unusually high, or that dividend payouts are out of line with international norms. Furthermore, it appears that retentions have been managed along with total financing and the acquisition of assets so as to keep the share of fixed assets quite high. There is little support for the idea of unproductive hoarding of corporate earnings. Yet the idea that an important source of global imbalances is excess corporate savings has been prevalent.

Two recent IMF studies give rather different pictures of the contribution of corporate savings to global imbalances. The IMF (2009) claims that corporate savings have increased in Asia since the turn of the century, that they have driven up national savings rates because households have not reduced their savings to compensate and that they now account for a rising share of global savings. The data to support these claims are not easy to verify as many countries in the region do not report corporate savings in their national income accounts and the source of the IMF study data is not given. The study argues that a combination of stagnant investment and household consumption plus rising corporate savings create the global imbalances. They attribute rising corporate savings to governance structures and financial institutions that give rise to high retained earnings (IMF, 2009:57). In an argument paralleling ours above, they note that limited market financing options and low shareholder pressure to pay dividends *could* give rise to an "excessive" build-up of retentions. They claim their micro-data-based study, using 20,000 firms from 60 countries, shows that a lack of financial development leads to an external finance premium forcing Asian firms to save (defining savings as after-tax earnings net of dividends divided by sales). Full details of the study are not available but those that are reported in fact show that an interaction term between financial liberalization and an Asian region dummy has a significant, and large, negative

coefficient, implying that financial liberalization in Asia has reduced corporate savings by even more than in other regions (see pp. 69–70). This can be interpreted as showing that financial liberalization has an even greater effect in Asia than elsewhere but it does not, directly, allow the interpretation that there is an external finance premium. Furthermore, the results as reported do not provide evidence of whether Asian firms' savings differ from the average, much less whether they are unusually high, so the interpretation that financial liberalization would "improve" the results depends on other evidence that Asian corporate savings are above average. That evidence comes from a regression on aggregate corporate savings in national income accounts data in which Asia post 2000 does seem to be larger than the mean of other countries. It is not clear, however, which Asian countries have been included or whether the definitions of corporate savings are comparable (see our discussion below about the problem of depreciation in the data).

The authors conclude that though improvements in both governance and financial markets have occurred in Asia, reducing the need for corporations to "amass a large war chest of savings" (IMF 2009:57), these effects have been "offset" by rising corporate savings. They draw the policy conclusion that more of the same governance and finance reforms are needed to further reduce savings.

An alternative interpretation is proposed in IMF (2010) and in Bayoumi et al. (2010) (see also the chapter by Wei in this volume). Both papers argue that corporate savings are not a particular problem in Asia generally, or even in the most likely case of China, and that the problem is high, though stable, household savings, low household incomes and low corporate investment. The important difference of emphasis has policy significance. If corporate savings are not the main problem then policy attention should be focussed on the investment side of the corporate equation. It might still be that improving financial markets plays a role here but, as we show below, and as is borne out in many other studies, a focus on the general investment and legal climate is likely to be a key. If these policies have an effect, it will come about by increasing investment, not by reducing savings.

We have already shown that retention ratios are not particularly high relative to assets, nor are dividends unusually low. Furthermore, even companies with positive

earnings are accessing external finance, implying that they are creating fixed assets beyond their own resources (that is, that their investment exceeds their savings).

To consider what factors influence the accumulation of corporate savings, Table 3 reports regressions of gross savings (over total assets) and gross savings adjusted for dividends (over total assets) on firm and country-level variables, controlling for industry. The firm-level characteristics are firm size (natural logarithm of sales), leverage (book value of total debt over book value of total debt plus book value of common stock plus book value of preferred stock), asset tangibility (fixed assets over total assets) and profitability (net income over total assets) lagged one period to allow for contemporaneous correlation between profitability and gross savings. As expected, we find that gross savings are higher, and the larger the firm, the higher is the investment in fixed assets and the lower is the leverage (that is, the less use is made of external finance). These results are consistent with other literature and indicate that firms with higher investment needs will accumulate high savings. As we have shown from the descriptive data, there is evidence that these savings are used for investment rather than being hoarded.

The country variables, which are of particular interest, show (somewhat puzzlingly) that the level of gross savings is higher under strong legal environments—namely, where there is a common-law system, lower corruption and less tax evasion. This result could be consistent with better legal systems allowing for the enforcement of non-defined contracts and permitting the retention of funds within the firm. The observation that stronger shareholder rights are associated with lower levels of gross savings would imply that, with better shareholder protection, shareholders "demand" the distribution of earnings and more frequent monitoring via external financing, but this is not consistent with the result on the legal system. Curiously, the results suggest that firms in countries characterized by state ownership of banks have lower levels of gross savings, suggesting that bank financing might in fact substitute for corporate savings in these countries.

Table 3. Explaining Total Savings

Dependent variables:	Gross savings/total assets	Gross savings dividend adjusted/total assets
Independent variables:		
Firm factors:		
Size	0.0140	0.0071
	(6.22)***	(3.20)***
Leverage	–0.0096	–0.0184
	(–3.13)***	(–2.32)**
Asset tangibility	0.0118	0.0279
	(0.72)	(3.72)***
Profitability(t-1)	0.0409	0.0462
	(1.26)	(1.90)*
Country factors:		
Common law	0.1450	0.0795
	(6.44)***	(3.21)***
Corruption	–0.0070	–0.0093
	(–2.44)***	(–1.76)*
Creditor rights	–0.0036	0.0064
	(–1.20)	(1.44)
Shareholder rights	–0.0366	–0.0191
	(–5.38)***	(–2.76)***
Bank state owned	–0.0751	–0.0388
	(–3.87)***	(–2.47)***
Tax evasion	–0.0402	–0.0396
	(–3.99)***	(–3.68)***
Openness	0.0037	0.00630
	(1.67)*	(1.94)*
AFC	–0.0105	–0.0079
	(–0.95)	(–1.21)
Industry:		
Non-durables	0.0090	–0.0083
	(1.86)*	(–0.59)
Durables	0.0097	0.0104
	(1.53)	(1.99)**
Manufacturing	0.0110	0.0068
	(2.47)***	(2.56)***
Energy	0.0125	0.0133
	(1.03)	(1.02)
High-tech	0.0027	0.0100
	(0.28)	(1.61)
Telecomm.	0.0185	0.0337
	(2.00)**	(6.08)***
Shops	–0.0058	–0.0027
	(–0.59)	(–0.51)
Health services	0.0096	0.0080
	(1.52)	(0.79)
Number of observations	81,546	57,807
R-squared	0.0711	0.0103

Note: Regression of gross savings (over total assets) and gross savings adjusted for dividends (over total assets) on firm and country-level variables controlling for industry. Standard errors are robust to clustering within firm and country over time. T-statistics are given in parentheses. Significance levels: * 10 %; ** 5 %; *** 1 %.

While we do not include a variable for financial reform (as in IMF, 2009), our variable for financial openness is only marginally significant, so there is no strong evidence that companies hoard savings as economies liberalize. The AFC dummy is insignificant so the apparent crisis-induced increase in savings in the raw data does not survive, once controls for other effects are included. We have some doubts about the reliability of regressions such as these for reasons noted in the conclusions below and put more weight on the results reported in Table 2, which cast a different light on savings behaviour. Since the savings variable used in Table 3 is the same as that in IMF (2009), their results might also require care in interpretation.

4. Savings and Investment

We have previously described how firms allocate their financial resources to different types of assets (liquid versus fixed) and found little evidence that they hoard cash and liquid assets but do appear to use them for fixed asset formation. We can consider more directly the hypothesis that firms' investment activity is dependent on their accumulated cash balances or their contemporaneous cash flow (for example, when they cannot access external finance) to see whether there is evidence of an incentive to build war chests. To examine this, we can exploit the variation in the sensitivity of firms' investment to cash flow. High cash flow sensitivity would suggest that firms use cash flow and cash holding as sources of funding for investments. We can, furthermore, look for direct evidence of whether this sensitivity is stronger for financially constrained firms that face limits to the use of external financing.

We present results in Table 4 showing a regression of capital expenditure (normalized by total assets) on cash and cash equivalent (over total assets) lagged one period to allow for contemporaneous correlation between cash holdings and capital expenditure, and cash flow (over total assets). We also include market-to-book ratios (Tobin's Q) and control for country-level factors and industry effects. The three firm-level variables are interacted with a financial constraint dummy (FC). The financial constraint dummy takes a value of 1 if the firm has above median dividend payout and

leverage (total debt/[total debt + book value of common stock + book value of preferred stock]) and 0 otherwise.

While we find no general relationship between cash flow and investment, we find a positive and significant relationship between cash flow and capital expenditure for financially constrained firms, suggesting that investment by firms faced with constrained access to external financing is sensitive to the availability of the firms' own cash and cash flows. This has fairly immediate and obvious policy implications—developed below.

In addition, we find that capital expenditure is higher under a strong legal environment—namely, a common-law system—with better shareholder and creditor protection, lower corruption and less tax evasion. Interestingly, the results suggest that firms in countries characterized by state ownership of banks invest more in fixed assets. These results provide more unambiguous evidence that improving the legal environment increases firms' willingness to invest compared with the more tentative results on the effect on fixed assets as a share of total assets.

Table 4. Explaining Capital Expenditure

Dependent Variables:	Capital Expenditure/ Total Assets
Independent variables:	
Firm factors:	
Cash & cash equivalents(t-1)/total assets	0.0023
	(0.14)
Cash flow/total assets	0.0002
	(1.60)
Market-to-book	0.0001
	(1.88)*
FC*Cash & cash equivalents(t-1)/total assets	–0.0096
	(–0.89)
FC*Cash flow/total assets	0.1677
	(11.19)***
FC*Market-to-book	0.0001
	(0.06)
Country factors:	
Common law	0.0055
	(2.81)***
Corruption	–0.0032
	(–6.66)***
Creditor rights	0.0044
	(2.06)**
Shareholder rights	0.0024
	(2.74)***
Bank state owned	0.0212
	(9.23)***
Tax evasion	–0.0123
	(–8.79)***

Openness	0.0011
	(0.84)
AFC	0.0110
	(3.58)***
Industry:	
Non-durables	–0.0025
	(–0.74)
Durables	0.0094
	(1.17)
Manufacturing	0.0002
	(0.09)
Energy	0.0111
	(1.13)
High-tech	–0.0109
	(–3.00)
Telecomm.	0.0160
	(1.83)*
Shops	–0.0078
	(–1.81)*
Health services	0.0147
	(2.01)**
Number of observations	60,632
R-squared	0.0815

Note: Regression of investment (capital expenditure) sensitivity to cash and cash equivalent (over total assets) lagged one period, cash flow (over total assets) and market-to-book (Q) controlling for country-level factors and industry. In addition, these three variables are interacted with a financial constraint dummy (FC). The financial constraint dummy takes a value of 1 if the firm has above median dividend payout and leverage (total debt/[total debt + book value of common stock + book value of preferred stock]) and 0 otherwise. Standard errors are robust to clustering within firm and country over time. T-statistics are given in parentheses. Significance levels: * 10 %; ** 5 %; *** 1 %.

5. Conclusions

We have shown that the financial patterns that emerged in Corbett and Twite (2010) have continued to be the predominant pattern for Asian firms despite the Global Financial Crisis. Although retained earnings have risen as a source of finance, companies are generally heavily dependent on external sources of funds and are increasingly using common stock issuance as the means of raising finance. This implies that even the strongest firms in these economies—those with positive net earnings and with access to the stock market—are net borrowers rather than net savers. These firms do not have abnormally low dividend payouts and do not accumulate very large cash and liquid asset balances. Their assets are dominated by fixed assets (that is, physical investment in plant and equipment), and the share of fixed assets has been maintained during periods of crisis.

The choice of how to allocate finance to different asset classes—that is, whether to hoard it in liquid assets or to use it for fixed asset formation—is influenced by the presence of common-law systems providing better investor protection, by corruption, by shareholder and debtor rights, and by openness. The AFC also had an effect. Common-law systems that are usually regarded as giving higher protection for property rights have a different effect from the direct effect of stronger shareholder rights. The former results in lower retentions and lower fixed asset shares (and possibly higher intangibles, though we did not explicitly consider that) while the latter are associated with higher retentions and higher fixed assets. Higher corruption increases retentions and fixed assets, perhaps because these are less likely to be expropriated or subject to fraud than cash and liquid assets. This might result in overinvestment in inefficient physical projects. Stronger creditor rights are linked with lower retentions but these do not give rise to higher fixed assets but to higher cash accumulations. Since the basis of legal systems (common versus civil) is hardly likely to be changed, a policy focus on strengthening shareholders' rights and reducing corruption is more likely to be useful in reducing the incentives for firms to hold on to retained earnings. Stronger creditor rights will enable greater access to debt finance and reduce the need for retentions.

An important finding for the region is that the more open the economy, the stronger is the reliance on external financing and the lower is the level of retained earnings, though openness has no direct effect on the allocation between cash and fixed assets.

Our regressions on savings are somewhat different from the findings on retentions. The level of gross savings seems to be higher under strong legal environments—namely, where there is a common-law system, lower corruption and less tax evasion. This result might be interpreted as meaning that better legal systems allow for the enforcement of non-defined contracts and thus allow for the retention of funds within the firm, though that is not what we found when regressing retentions directly on these variables. The savings data, by necessity, include amounts that firms retain for depreciation and we believe that this introduces a bias into the evidence on savings. The result is that when comparing countries we are picking up any variation in the depreciation practices as if they were differences in savings. In a country such as China, where the main growth in fixed assets has been quite recent, the amount of depreciation is likely to be small, while in countries that have had a long history of fixed asset investment, these amounts will be large. In addition, if there are differences, or changes, in accounting practices that lead to different depreciation amounts, these will also confound the results. Since we have confidence in the retention regressions reported earlier (which are not subject to this problem), we prefer those results. This also means that other studies that have drawn conclusions about savings behaviour using similar variables to those in our savings regressions might be unreliable.

Finally, our investment regression shows that financial constraints do hold back investment so that, in addition to improving the general support of investors and creditors rights, policies that remove financial constraints would impact on investment.

Clear policy recommendations require still further research and an extension to other country policy variables that are of specific interest in the region and to a finer grained analysis of the elements of openness, financial sector reform and accounting changes that impact on company strategies and on data. We note also that there has been much careful criticism of the La Porta et al. (1998) indexes on investors' rights and the legal systems. As Spamann (2010) notes, the classification of countries into civil or common law has led to corrections in the classifications that are significant enough to undermine previously accepted research results. Spamann's correlation

between the corrected and original values is only 0.53, and he points out that many empirical results established using the original index might not be replicable with corrected values. This will also apply to the work we have done here, and in future research we should consider whether our countries need to be reclassified. One particularly important aspect is that Spamann's newer results fail to support the notion that shareholder protection is higher in common than in civil-law countries. These have implications for the interpretations we have made in our regression analysis.

We conclude by returning to a point made at the outset. There is little evidence that listed firms in the region are hoarding savings. The savings in the corporate sector are being used for investment purposes. Thus, while it might be true that there is some accumulation of assets in retentions or in liquid form, this seems to be in the group of firms that behave as if financially constrained. A further policy focus on the drivers, determinants and impediments to investment will be a more productive way to respond to global imbalances than a narrow focus on corporate savings.

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Appendix 1. Data

We use firm-level data from the Compustat Global Database from 1989 to 2010. We include data for China, Indonesia, India, Japan, Korea, Malaysia, the Philippines, Singapore and Thailand. Table A1 shows the sample size in total and by country. Because we are using listed company data, we are not able to draw conclusions about the whole corporate sector, and unlisted small and medium enterprises (SMEs) and non-listed firms such as family firms are not covered.

Table A1. Sample Size

Country	Number of firms	Total firm-year observations
China	2,234	13,256
India	2,354	14,420
Indonesia	469	5,060
Japan	4,893	67,045
South Korea	2,336	19,652
Malaysia	1,193	13,339
Philippines	261	2,898
Singapore	835	7,748
Thailand	766	8,278
Total	15,341	151,696

In the regressions reported in the text, the firm-level variables are fixed assets or asset tangibility (fixed assets over total assets), profitability (net income over total assets), firm size (natural logarithm of sales), the market-to-book ratio (market value of equity over book value of equity), dividend payout (total dividend over net income), leverage (total debt/[total debt + book value of common stock + book value of preferred stock]), cash (cash over total assets), cash and cash equivalents (cash and cash equivalents over total assets), cash flow (cash flow over total assets), and a financial constraint dummy that takes a value of 1 if the firm has above median dividend payout and leverage and 0 otherwise.

The country-level variables cover several institutional features: the legal system (common law versus civil law dummy), a corruption index, an indicator of whether the banking system is state owned, a tax-compliance variable, variables for creditors' and shareholders' rights and the degree of openness of the financial system. We also include an indicator for the AFC that takes a value of 1 for 1997 and 1998 and 0

otherwise. The definition and sources for these country-level variables are given in Table A2. Finally, we have adopted a 10-industry classification. The industry classifications are given in Table A3.

Table A2. Definitions and Data Sources of Country-Level Variables

Variable	Description	Source
Common law	A 0 or 1 dummy variable indicating whether a country adopts the common-law system.	Treisman (2000) and La Porta et al. (1998)
Corruption index	An index ranging from 0 to 10, with larger value indicating more severe corruption.	Corruption Perception Index (Transparency International, n.d.)
Creditor rights	An index aggregating creditor rights—restrictions for a debtor to file for reorganization; secured creditors are able to seize their collateral after the reorganization petition is approved; secured creditors are paid first out of the proceeds of liquidating a bankrupt firm; management does not retain administration of its property pending the resolution of the reorganization. The index ranges from 0 (weak creditor rights) to 4 (strong creditor rights).	Djankov et al. (2007)
Tax evasion	Executives' assessment of how important tax evasion is in their country (the lower the measure, the more rampant is tax evasion)	Djankov et al. (2009)
Shareholder rights	Aggregate index of shareholder rights. The index is formed by summing: 1) vote by mail; 2) shares not deposited; 3) cumulative voting; 4) oppressed minority; 5) pre-emptive rights; and 6) capital to call a meeting.	Djankov et al. (2003, 2008b)
State control	An index measuring the proportion of a country's banks that is state controlled, where a bank is defined to be state controlled if the state's voting rights exceed 10 percent.	Caprio et al. (2005)
Openness	An index that measures the extent of openness in capital account transactions. Higher values represent more open economies.	Chinn and Ito (2008)

Table A3. Industry Groups

Industry	Four-digit SIC code
Non-durables: Consumer non-durables—food, tobacco, textiles, apparel, leather, toys	0100–0999, 2000–2399, 2700–2749, 2770–2799, 3100–3199, 3940–3989
Durables Consumer durables—cars, TVs, furniture, household appliances	2590–2599, 3630–3659, 3710–3711, 3714–3714, 3716–3716, 3750–3751, 3792–3792, 3900–3939, 3990–3999
Manufacturing Manufacturing—machinery, trucks, planes, chemicals, office furniture, paper, com. printing	2520–2589, 2600–2699, 2750–2769, 2800–2829, 2840–2899, 3000–3099, 3200–3569, 3580–3629, 3700–3709, 3712–3713, 3715–3715, 3717–3749, 3752–3791, 3793–3799, 3830–3839, 3860–3899
Energy Oil, gas, and coal extraction and products	1200–1399, 2900–2999
High-tech Business equipment—computers, software, and electronic equipment, industrial controls; services—computer programming and data processing; computer-integrated systems design; services—computer processing, data prep.; services—information retrieval services; services—computer facilities management services; services—computer rental and leasing; services—computer maintenance and repair; services—computer-related services; services—research and development labs; services—research, development, testing labs	3570–3579, 3622–3622, 3660–3692, 3694–3699, 3810–3839, 7370–7372, 7373, 7374, 7375, 7376, 7377, 7378, 7379, 7391, 8730–8734
Telecommunications Telephone and television transmission	4800–4899
Shops Wholesale, retail and some services (laundries, repair shops)	5000–5999, 7200–7299, 7600–7699
Health services Health care, medical equipment and drugs	2830–2839, 3693–3693, 3840–3859, 8000–8099
Utilities	4900–4949
Other Other—mines, construction, building materials, transport, hotels, bus services, entertainment, finance	

CHAPTER 5

Is There A Risk in Overvaluing the Role of the Exchange Rate in Global Rebalancing?[1]

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While the inflexible exchange rate regime of China has been said to be a major cause of the global current account imbalances, the intellectual basis for the claim is weak, and the policy attention being given to the issue might pose a risk to the world economy to the extent that it distracts from efforts to find more productive solutions. A systematic examination of the data (Chinn and Wei, forthcoming) finds no strong or robust support for the conventional wisdom that a more flexible exchange regime facilitates a faster current account adjustment. An alternative way to look at China's current account surplus (and the apparent departure of the real exchange rate from purchasing power parity) needs to put more weight on structural factors that underpin China's unusually high national savings rate in recent years. In this regard, one factor that has not been part of the policy discussion, but which could be economically significant in understanding China's savings pattern, is an increasing imbalance in the number of young men relative to the number of young women in the marriage market. As China's sex ratio rises (since the beginning of this century), both corporate and household savings rates rise due to a desire by families with a son and young men to raise their relative wealth so as to improve their chances in the marriage market, in combination with frictions in the financial market (Wei and Zhang, 2011a, 2011b).

[1] This paper was written at the invitation of Professor Jenny Corbett, and draws on various joint research projects with Xiaobo Zhang, Menzie Chinn, Qingyuan Du, Tamim Bayoumi and Hui Tong over the past few years. Part of the underlying research has been supported by a US National Science Foundation grant and general research fund of Columbia Business School, which I gratefully acknowledge. Any errors in the paper are, however, entirely mine, and not those of my collaborators, the funding agencies, or any institutions with which I have affiliation.

This could produce a simultaneous rise in the current account and a decline in the value of the real exchange rate (Du and Wei, 2011). Other factors that contribute to the rising savings rate in China reinforce this basic mechanism. This perspective calls for different policy actions other than the obsession with the form of the nominal exchange rate regime.

Keywords: global rebalancing, exchange rate regimes, savings, sex ratios, China

JEL Classifications: E21, D91, O24

1. Introduction

One of the seemingly intractable problems in the world economy in recent years has been the global current account imbalance. China and a few other countries have been running large current account surpluses since the beginning of this century, which are matched by persistently large current account deficits in a group of other countries—most notably, the United States. The problem has been identified as a root cause of or a contributing factor to the 2007–09 Global Financial Crisis (GFC), and possibly a ticking time bomb that could lead to a future world economic crisis.

Very commonly, the fixed exchange rate regime of certain surplus countries is understood to be a key cause of the current account imbalance problem. Both official statements and opinion pieces in news media have reinforced such a view. For example, a communiqué of G20 finance ministers and central bankers declared that "an orderly unwinding of global imbalances, while sustaining global growth, is a shared responsibility involving…greater exchange rate flexibility".[2]

These statements are not, however, founded on systematic analysis of actual country experiences. Indeed, it is not difficult to find counter-examples. While Egypt has a relatively rigid exchange rate regime, it has a relatively fast current account convergence. On the other hand, while Japan has a flexible exchange rate regime, it does not have a fast convergence speed. Of course, there is a limit to how much we can learn from individual examples.

2. Exchange Rate Regimes and Current Account Adjustment

Chinn and Wei (forthcoming) sought to address this deficiency by systematically investigating the data for all International Monetary Fund (IMF) member countries. After examining the data in many different ways, we find no support for the notion that countries on a more flexible exchange rate regime robustly exhibit a faster convergence of their current account to the long-run equilibrium.

[2] G20 Communiqué, Meeting of Finance Ministers and Central Bank Governors, 17–18 November 2007, Cape Town, South Africa.

We estimated variations of the following specification for 170 countries over the period 1971–2005:

$$ca_{it} = \rho_0 + \rho_1 ca_{it-1} + \theta_{0j} \sum_{j=0}^{k} regime_{jit} + \theta_{1j} (ca_{it-1} \times \sum_{j=0}^{k} regime_{jit}) + v_{it}, \quad (1)$$

where ca_{it} is the current account to GDP ratio for country *i* in year *t*, and the variable *regime* is the *de facto* exchange rate measure, proposed by either Levy-Yeyati and Sturzenegger (2005) or Reinhart and Rogoff (2004).[3] As is standard in the international finance literature, the speed of current account convergence can be inferred from the AR(1) coefficients.[4] (As an extension, we allow for both country fixed effects and year fixed effects; this does not alter the basic conclusion of the paper.)

In Tables 1a and 1b, we separate countries into different groups based on a combination of two criteria: a country's stage of economic development (income) and its nominal exchange rate regime. The nominal exchange rate regime classification is per Levy-Yeyati and Sturzenegger (2005). The most salient feature is the lack of a clear sign that more flexible regimes provide faster current account adjustment. In Table 2, we pool all countries together. The same conclusion emerges.

[3] We have also employed the *de jure* index based upon the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions* instead of the *de facto* measures. The results indicate no systematic relationship.

[4] We check for higher-order auto-regressive terms, and find that an AR(1) is sufficient for the annual data. The sole exception is for the category of non-industrial countries (and non-industrial ex-oil exporters) under a fixed exchange rate regime. In that case, the second lag is typically statistically significant. The pattern of persistence, however—as measured by the sum of the auto-regressive coefficients—is unchanged relative to the baseline specification.

Table 1a. Current Account Persistence by Country Sample, by Regime

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All					Industrial countries		
	Floating	Dirty float	Dirty/crwl	Fixed	Floating	Dirty float	Dirty/crwl	Fixed
CA(-1)	0.630	0.762	0.788	0.735	0.867	1.060	0.893	0.929
	(0.111)***	(0.068)***	(0.065)***	(0.030)***	(0.044)***	(0.066)***	(0.120)***	(0.033)***
Constant	–0.010	0.002	–0.006	–0.012	–0.001	0.003	–0.001	0.000
	(0.004)***	(0.003)	(0.003)**	(0.002)***	(0.001)	(0.003)	(0.004)	(0.001)
Observations	769	278	388	2,125	209	50	35	279
Adjusted R^2	0.38	0.55	0.64	0.58	0.71	0.88	0.8	0.78

Note: Robust standard errors in parentheses. Significance levels: * 10 %; ** 5 %; *** 1 %. Dependent variable = CA; exchange rate regimes are based on Levy-Yeyati and Sturzenegger definitions.

Table 1b. Current Account Persistence by Country Sample, by Regime

	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	Non-industrial countries				Non-industrial countries ex-oil			
	Floating	Dirty float	Dirty/crwl	Fixed	Floating	Dirty float	Dirty/crwl	Fixed
CA(-1)	0.596	0.726	0.781	0.728	0.564	0.717	0.797	0.701
	(0.122)***	(0.078)***	(0.068)***	(0.031)***	(0.133)***	(0.071)***	(0.072)***	(0.039)***
Constant	–0.014	0.000	–0.007	–0.014	–0.016	–0.001	–0.006	–0.020
	(0.005)***	(0.004)	(0.004)*	(0.002)***	(0.006)***	(0.004)	(0.004)	(0.003)***
Observations	560	228	353	1,846	529	209	331	1,579
Adjusted R^2	0.34	0.5	0.62	0.57	0.33	0.49	0.65	0.51

Source: Chinn and Wei (forthcoming), RESTAT.

Note: Robust standard errors in parentheses. Significance levels: * 10 %; ** 5 %; *** 1 %. Dependent variable = CA; exchange rate regimes are based on Levy-Yeyati and Sturzenegger definitions.

Table 2. Current Account Persistence, by Country Sample

	(1)	(2)	(3)	(4)
	All	Industrial countries	Non-industrial countries	Non-industrial countries ex-oil
CA(-1)	0.630	0.867	0.596	0.564
	(0.111)***	(0.044)***	(0.122)***	(0.133)***
CA(-1) x LYS1	0.132	0.193	0.131	0.153
	(0.130)	(0.079)**	(0.145)	(0.151)
CA(-1) x LYS2	0.158	0.026	0.185	0.233
	(0.128)	(0.125)	(0.140)	(0.152)
CA(-1) x LYS3	0.105	0.062	0.132	0.137
	(0.115)	(0.055)	(0.126)	(0.139)
LYS1	0.012	0.003	0.014	0.016
	(0.005)**	(0.003)	(0.007)**	(0.007)**
LYS2	0.004	–0.001	0.007	0.011
	(0.005)	(0.004)	(0.006)	(0.007)
LYS3	–0.002	0.001	0.000	–0.003
	(0.004)	(0.002)	(0.006)	(0.006)
Constant	–0.010	–0.001	–0.014	–0.016
	(0.004)***	(0.001)	(0.005)***	(0.006)***
Observations	3,560	573	2,987	2,648
Adjusted R^2	0.57	0.79	0.56	0.52

Source: Chinn and Wei (forthcoming), RESTAT.

Note: Robust standard errors in parentheses. Significance levels: * 10 %; ** 5 %; *** 1 %. Dependent variable = CA; LYS1 is a dummy variable for a dirty-float regime; LYS2 is a dummy variable for a dirty float/crawling peg; LYS3 is a dummy variable for fixed.

To make sure that our result is not driven by a few outliers, Figure 1 plots the distribution of the AR(1) coefficients by country groups, where a country's group affiliation is defined by its nominal exchange rate regime. It is clear from the graph that there is no strong or systematic association between the nominal exchange rate and the speed of current account adjustment.

Figure 1. Individual Auto-Regressive Coefficients (No Trend) for LYS Categories (Higher Indicates More Fixity)

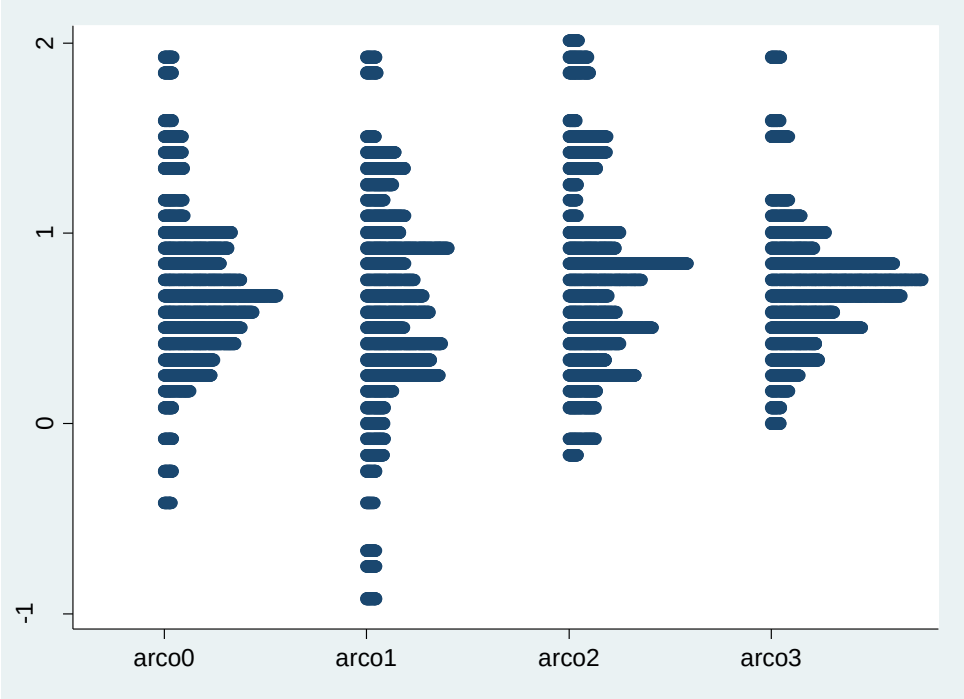
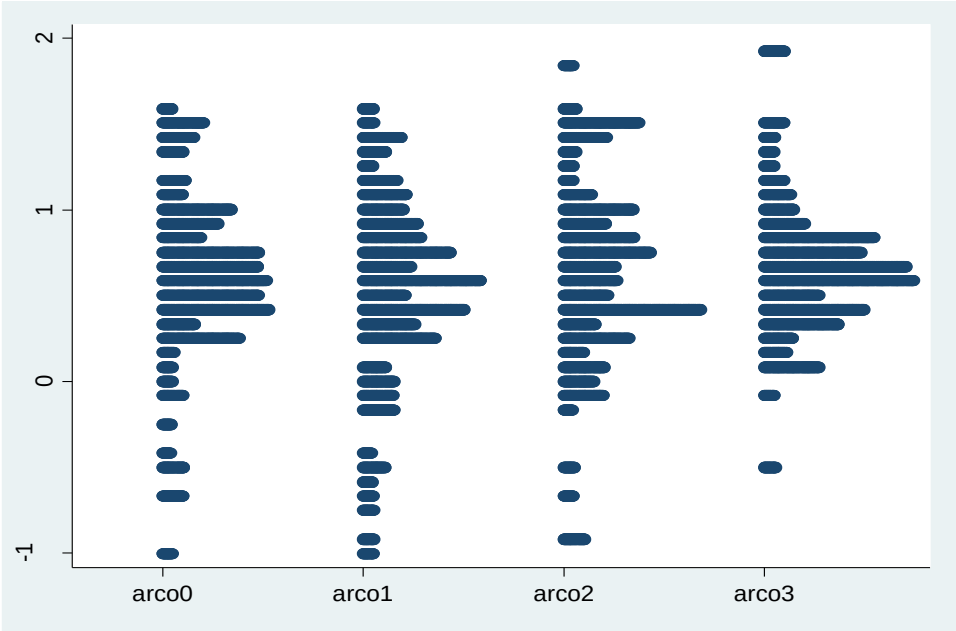


Figure 2. Individual Auto-Regressive Coefficients (With Trend) for LYS Categories (Higher Indicates More Fixity)



Source: Chinn and Wei (forthcoming).

Additional regressions include more controls that might affect current account adjustment. We also deal with the possible endogeneity of a country's nominal exchange rate regime by using instrumental variables proposed by Levy-Yeyati and Sturzenegger (2005). The basic conclusion is the same.

We also replicate the analysis with the Reinhart and Rogoff (2004) classification of exchange rate regimes. The results are reported in Tables 3a and 3b. The qualitative results are the same: there is no robust support for the view that more exchange rate flexibility yields faster current account adjustment.

To understand why this is a sensible result, we have to realize that the current account responds to the real exchange rate, not the nominal exchange rate. A large body of empirical research in international finance shows that the real exchange rate tends to be stationary and converges to the steady state in the long run. The question is whether its convergence speed is connected to a country's nominal exchange rate regime. In Table 4, we examine this connection systematically by following a specification that is similar to the current account regressions. The evidence is clear that the convergence speed of the real exchange rate is not systematically related to a country's nominal exchange rate regime.

In short, the proposition that flexible exchange rates give you a faster adjustment of current accounts is basically wishful thinking, and is not supported by a systematic data analysis.

Table 3a. Current Account Persistence, by Country Sample, by Reinhart–Rogoff Regime

	(1)	(2)	(3)	(4)	(5)	(6)
	All			Industrial countries		
	Floating	Band/crwl	Fixed	Floating	Band/crwl	Fixed
CA(-1)	0.663***	0.799***	0.719***	0.925***	0.840***	0.946***
	(0.0639)	(0.0595)	(0.0455)	(0.0427)	(0.0424)	(0.0417)
Constant	–0.005*	–0.005**	–0.015***	–0.000	–0.001	0.001
	(0.003)	(0.002)	(0.003)	(0.001)	(0.002)	(0.001)
Observations	619	1,275	1,179	204	307	200
Adjusted R^2	0.442	0.666	0.51	0.784	0.663	0.84

Note: Robust standard errors in parentheses. Significance levels: * 10 %; ** 5 %; *** 1 %. Dependent variable = CA; exchange rate regimes are based on Reinhart–Rogoff definitions; "free fall" regime observations omitted.

Table 3b. Current Account Persistence, by Country Sample, by Reinhart–Rogoff Regime

	(7)	(8)	(9)	(10)	(11)	(12)
	Non-industrial countries			Non-industrial countries ex-oil		
	Floating	Band/crwl	Fixed	Floating	Band/crwl	Fixed
CA(-1)	0.621***	0.795***	0.688***	0.656***	0.800***	0.655***
	(0.071)	(0.063)	(0.048)	(0.084)	(0.066)	(0.054)
Constant	–0.007**	–0.006**	–0.021***	–0.009**	–0.007**	–0.026***
	(0.004)	(0.003)	(0.003)	(0.005)	(0.003)	(0.004)
Observations	415	968	979	348	921	905
Adjusted R^2	0.391	0.662	0.47	0.445	0.673	0.431

Source: Chinn and Wei (forthcoming), RESTAT.

Note: Robust standard errors in parentheses. Significance levels: * 10 %; ** 5 %; *** 1 %. Dependent variable = CA; exchange rate regimes are based on Reinhart-Rogoff definitions; "free fall" regime observations omitted.

Table 4. Real Exchange Rate Persistence, by Country Sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	All			Industrial			Non-industrial			Non-industrial ex-oil		
REER(-1)	0.797	0.782	0.785	0.624	0.579	0.704	0.803	0.814	0.832	0.779	0.733	0.728
	(0.024)***	(0.056)***	(0.053)***	(0.055)***	(0.103)***	(0.102)***	(0.024)***	(0.054)***	(0.060)***	(0.030)***	(0.043)***	(0.066)***
REER(-1) x LYS1		–0.042	–0.029		0.035	–0.119		–0.063	–0.034		0.001	0.019
		(0.075)	(0.072)		(0.159)	(0.141)		(0.077)	(0.074)		(0.083)	(0.083)
REER(-1) x LYS2		–0.101	–0.115		–0.124	–0.107		–0.120	–0.125		–0.033	–0.068
		(0.111)	(0.106)		(0.152)	(0.159)		(0.110)	(0.106)		(0.095)	(0.096)
REER(-1) x LYS3		0.064	0.093		0.075	0.022		0.032	0.074		0.097	0.126
		(0.083)	(0.073)		(0.104)	(0.095)		(0.084)	(0.076)		(0.099)	(0.094)
LYS1		0.181	0.121		–0.171	0.546		0.280	0.136		–0.002	–0.092
		(0.349)	(0.340)		(0.732)	(0.647)		(0.360)	(0.353)		(0.394)	(0.403)
LYS2		0.450	0.517		0.611	0.518		0.529	0.557		0.140	0.307
		(0.507)	(0.487)		(0.701)	(0.729)		(0.503)	(0.483)		(0.444)	(0.449)
LYS3		–0.248	–0.377		–0.351	–0.106		–0.073	–0.270		–0.366	–0.500
		(0.386)	(0.339)		(0.490)	(0.445)		(0.390)	(0.352)		(0.471)	(0.450)
REER(-1) x												
Trade openness			–0.115			–0.122			–0.130			–0.134
			(0.052)**			-0.135			(0.056)**			(0.057)**
REER(-1) x												
Financial openness			–0.029			–0.055			–0.007			–0.036
			(0.024)			(0.037)			(0.029)			(0.044)
Trade openness			0.359			0.408			0.423			0.410
			(0.212)*			(0.602)			(0.233)*			(0.242)*
Financial openness			0.129			0.267			0.025			0.148
			(0.112)			(0.171)			(0.139)			(0.206)
Constant	0.956	1.001	1.129	1.749	1.957	1.454	0.932	0.840	0.918	1.037	1.205	1.420
	(0.111)***	(0.258)***	(0.255)***	(0.256)***	(0.481)***	(0.462)***	(0.112)***	(0.245)***	(0.295)***	(0.139)***	(0.205)***	(0.333)***
Observations	2,489	1,936	1,728	687	571	515	1,802	1,365	1,213	1,587	1,176	1,024
Number of cn	92	90	88	24	23	22	92	67	66	92	59	58
R-squared	0.64	0.63	0.66	0.46	0.47	0.49	0.65	0.64	0.67	0.61	0.59	0.64

Source: Chinn and Wei (forthcoming), RESTAT.

Note: Robust standard errors in parentheses. Significance levels: * 10 %; ** 5 %; *** 1 %. Dependent variable = REER; LYS1 is a dummy variable for a dirty-float regime; LYS2 is a dummy variable for dirty float/crawling peg; LYS3 is a dummy variable for fixed.

3. The Hidden Source of China's Surplus Problem

The debate on exchange rate flexibility is driven largely by a desire to get China to let go of its exchange rate management. Our discussion would not be complete if we did not dissect the red dragon in the room—namely, the role of the renminbi (RMB) exchange rate in the country's current account surplus.

The Chinese real exchange rate is widely believed to be substantially undervalued. The standard narrative one often hears goes as follows. The Chinese nominal exchange rate is undervalued largely through deliberate and massive government intervention in the currency market. The rapid accumulation of the country's foreign exchange reserve is *prima facie* evidence that the authorities have engaged in massive currency-market interventions. The undervalued currency has in turn created both a growing current account surplus and an increasing departure from purchasing power parity.

3.1. An Alternative Perspective

This narrative is not, however, the only way to piece together the real exchange rate, the current account and the foreign exchange reserve. Du and Wei (2011) investigated an alternative perspective that technology and policy shocks might have triggered a race to raise savings and to work longer and harder. These developments led to a simultaneous decline in the value of the real exchange rate and a rise in the current account (even though the exchange rate is not the cause of the current account surplus). Once the current account is put into a surplus gear, foreign exchange reserve accumulation happens largely passively as a result of the country's capital control regime, which—as with capital control regimes in many other countries—requires mandatory surrender of foreign exchange earnings by firms and households.

The initial technology shock in the new narrative was the spread of ultrasound B machines in China in the 1980s that allowed expectant parents to easily detect the gender of their fetus. The initial policy shock was the implementation of a strict version of the family planning policy. By interacting with a long-existing parental preference for sons, the combination of the two shocks started to produce an unnaturally high ratio of boys to girls at birth from the early 1980s. About 2003, the first cohort born with an

excess number of males was entering the marriage market. The competition for a marriage partner by young men has become progressively more intense since then. In 2007, the sex ratio for the pre-marital age cohort (five to twenty) was about 115 young men per 100 young women. This implies that about one out of every nine young men cannot get married, mathematically speaking.

Why would a rise in the sex-ratio imbalance trigger a significant increase in savings rates? The short answer is that family wealth is a key status indicator in the marriage market (other things being equal). As the competition for brides intensifies, young men and their parents raise their savings rate in order to improve their relative standing in the marriage market. If the biological desire to have a female partner is strong, the response of the savings rate to a rise in the sex ratio can also be quantitatively large.

I would contend that the increased sex ratio has significantly raised both the corporate and the household savings rates in China, and might have indirectly contributed to an increase in government savings as well.

3.2. How Does A Higher Sex Ratio Raise the Corporate Savings Rate?

While it is commonly claimed that the primary driver for China's high corporate savings is mis-governance of state-owned firms (that they do not pay enough dividends to their shareholders), this is an incomplete story. Bayoumi et al. (2010) examined a sample of Chinese listed companies and asked whether, within a given sector, state-owned firms systematically have a higher savings rate. The first column of Table 5 reports an insignificant coefficient on the state-owned enterprise (SOE) dummy, which means that the answer is negative. Some state-owned firms might have a high savings rate because they pay insufficient dividends to shareholders. But non–state-owned firms might also have a high savings rate—probably because they are concerned with access to bank lending and other sources of external financing when they need to invest and expand.

Table 5. Chinese Corporate Gross Savings (As a Share of Assets)

	China firm sample:		*Cross-country sample:*	
	Comparing SOEs with non-SOEs		*Comparing Chinese firms with world average*	
State-owned dummy	0.003	0.027*		
	[0.010]	[0.016]		
State-owned dummy*trend		–0.007*		
		[0.004]		
China dummy			0.0713	0.105**
			[0.0533]	[0.049]
China*Time trend				–0.0092
				[0.0062]
Firm size	0.058**	0.059**	0.223**	0.22**
	[0.018]	[0.018]	[0.075]	[0.08]
Year dummies?	Yes	Yes	Yes	Yes
Sector dummies?	Yes	Yes	Yes	Yes
Observations	6,402	6,402	132,801	132,801
R-squared	0.086	0.087	0.265	0.265

Source: Bayoumi et al. (2010).

Note: Standard errors in parentheses. P-value levels: *** < 1 %; ** < 5 %; * < 10 %. Corporate gross savings rate is Winsorized at the 1 % level; standard errors are clustered at the country level (columns 3–4).

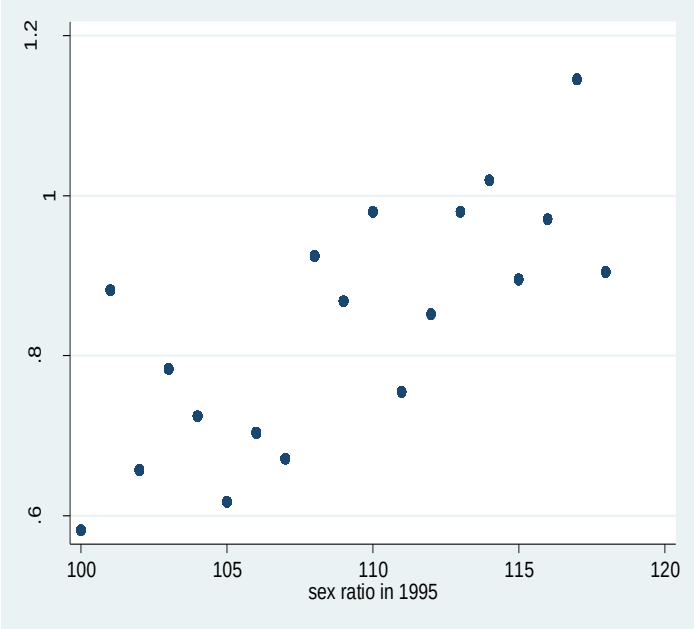
In the second column of Table 5, we examine how the pattern evolves over time by including an interaction term between a time trend and the dummy for SOEs. The result indicates that, in the earlier part of the sample (2000–03), it was indeed the case that SOEs had a higher savings rate. In the later part of the sample (2004–07), however, the reverse is true: non-SOEs tended to have a higher savings rate.

Even though non-SOEs do not have the same kind of corporate governance, their high savings rate can be understood through the lens of the difficulty they face in obtaining a bank loan. This problem is much more severe for newly established private firms that are far from being eligible for listing on a stock exchange. This is where the sex-ratio angle comes in.

A simple decomposition of China's manufacturing growth rate from 1995 to 2004 (using two censuses of all manufacturing firms in these two years) indicates that 70 percent of the growth comes from domestic private firms. A further decomposition of private-sector growth indicates that 70 percent of that comes from extensive margin growth (that is, the formation and growth of new privately owned firms). In other words, the birth and growth of new private firms are a big part of China's growth story. Wei and Zhang (2011b) find that the desire to raise one's relative wealth—which is greatly exacerbated by a rising sex-ratio imbalance—has inspired much more private business formation. In Figure 3, we plot the average growth rate in the number of domestic private firms (for all regions with a common sex ratio) against the local sex ratio. There is a clear and strong positive relationship between the two. This positive relationship continues to hold when we control for other determinants of private business formation, such as local income, education level, initial business development, and the age structure of the local population. Household-level data indicate that families with a son who live in regions with a high sex ratio are more likely to choose to be entrepreneurs (to be business owners or self-employed). Across regions, we estimate that variations in the sex ratio might account for half of the regional variations in the rate of private business formation. The relationship also holds after we do instrumental variable regressions and perform a placebo test. The instruments are regional variations in the financial penalties for violating birth quotas 15 years before and the fraction of local population that is exempted from birth quotas. We can reject the hypothesis that these are weak instruments. We also show that these instruments have a high correlation

with the local sex ratio, and they are uncorrelated with the error term in the main regression. The two stage least square regressions suggest that the relationship is likely to be causal: a higher local sex ratio causes more new private firms to emerge.

Figure 3. Initial Sex Ratios and Growth Rates of Private Firms, 1995–2004



Source: Wei and Zhang (2011b).

Note: On the horizontal axis is the sex ratio for the age cohort five–nineteen in 1995 inferred from the 1990 Population Census. On the vertical axis is the growth rate in the number of private firms from 1995 to 2004, averaged over all counties that had the same value sex ratio (up to a basis point).

Again, since new private firms have concerns about access to external financing, they have to keep most of their profits within the same for reinvestment. As a result, a combination of rising sex ratios and financial market frictions has produced a rise in corporate savings in the private sector.

3.3. How Does A Higher Sex Ratio Raise the Household Savings Rate?

The connection between the higher sex ratio and higher household savings is even more direct. Before we go to that evidence, it is useful to comment on some common misconceptions. Some researchers and opinion leaders contend that the Chinese household savings rate cannot be an important part of China's current account surplus story because: a) Chinese household income as a share of national income has been

falling in recent years; and b) in any case, corporate savings (and also government savings) has shown a strong increase in recent years. I disagree with this contention. First, the household share in national income might well be underestimated due to under-reporting of income for tax-avoidance or evasion purposes. As the range of "gray income" rises over time, the scope for under-reporting of national income might also have increased. Second, even though the Chinese corporate savings rate appears high in an absolute sense, it is in fact part of an international pattern. Bayoumi et al. (2010) formally document this pattern. Columns 3 and 4 of Table 5 present the relevant statistical evidence on this issue. In comparison, Chinese household savings as a share of national savings has no peers in the world. This suggests that, to understand why China's national savings rate is so much higher than other countries, corporate savings is no more important than household savings after all.

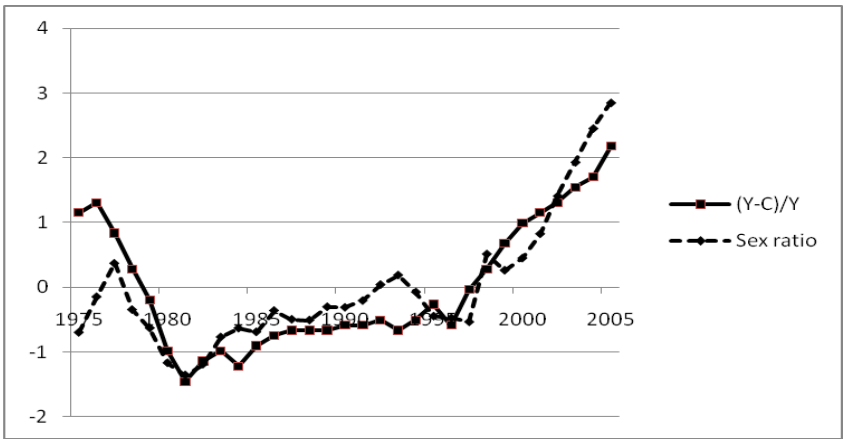
Back to the connection between the sex ratio and the household savings rate: Xiaobo Zhang and I have documented relevant evidence (Wei and Zhang, 2011a). First, across regions in China, those with a higher sex ratio also tend to have a higher savings rate, holding constant the age structure of the local population, income level, social safety net, and other factors. Second, across households with a son, those residing in a region with a higher sex ratio save more (holding constant family income and other characteristics). In comparison, for households with a daughter, their savings rate is uncorrelated with the local sex ratio. The sex ratio effect is significant. While the Chinese household savings rate approximately doubled from 16 percent (of disposable income) in 1990 to 31 percent in 2007, we estimate that the rise in the sex ratio explains more than half the increase in the household savings rate.

3.4. Overall Savings Rate

I have argued so far that the rising sex ratio in China in recent years has been an important factor underlying both a rising corporate savings rate and a rising household savings rate. To the extent that government revenue tends to be plentiful when the economy is growing well, the higher sex ratio has likely contributed to a rise in the government savings rate as well (though we do not have rigorous proof on the last point).

In Figure 4, we import from Wei and Zhang (2011a) a time-series plot of China's national savings rate together with a plot of China's sex ratio for those aged twenty years (or the sex ratio at birth lagged by 20 years, to be precise). The two lines have a striking coherence. Of course, formal regression analysis confirms that the two are highly related.

Figure 4. Sex Ratios and Saving Rates



Source: Wei and Zhang (2011a).

Note: The sex ratio is defined as the ratio at birth 20 years earlier. The saving rate is defined as the ratio of GDP–private and government consumption to total GDP, which is available from the *China Statistical Yearbook 2007*. Both variables have been rescaled by subtracting the mean and dividing by the standard deviation.

Qingyuan Du and I have also examined the connection between local sex ratios and local private-sector savings rates (the sum of household and corporate savings rates) across countries in 2006 (Du and Wei, 2010). After controlling for per capita income, the share of the population enrolled in the social security system, the age structure of the population, and continent dummies, we find that the national sex ratio is a statistically significant predictor of the national private-sector savings rate. This relationship continues to hold if we exclude China from the sample.

As long as the sex-ratio imbalance significantly raises the national savings rate, and the national investment rate does not have a correspondingly large change, a higher sex ratio would produce a higher current account surplus (without any policy actions on the nominal exchange rate front). Du and Wei (2010) have formalized this logic and provided some cross-country evidence that is consistent with this idea.

3.5. The Sex-Ratio Imbalance as a Factor Underlying the Exchange Rate

When the economy-wide savings rate rises, the real exchange rate (defined as the price of non-tradable goods relative to tradable goods) falls. To see this, we note that a rise in the savings rate implies a reduction in demand for both internationally traded goods and non-tradable goods. Since the price of internationally traded goods is approximately pinned down by the world market, this translates into a reduction in the relative price of non-tradable goods, and hence a decline in the value of the real exchange rate.

The high sex-ratio imbalance also motivates people—especially parents with a son—to work harder and longer (in order to create more wealth and be more competitive in the marriage market). As the non-tradable sector is likely to be more labor intensive than the tradable sector, this leads to a faster expansion of the non-tradable sector relative to the tradable sector. This puts additional downward pressure on the value of the real exchange rate.

Putting the two channels together, a rise in the sex ratio generates a real exchange rate that appears too low relative to purchasing power parity (or relative to the standard approach used by the IMF). Of course, other factors also have contributed to an increase in the aggregate savings rate (for example, a rise in income volatility) or an increase in the effective labor supply (for example, gradual relaxation of restrictions on rural–urban migration). These factors would reinforce the Darwinian mechanism discussed here, causing the real exchange rate to fall further and the current account to rise even more.

While the sex-ratio imbalance can induce a current account surplus without currency manipulation, the rises in the savings rate and current account are still socially inefficient. While households raise their savings rates to out-compete other families in the marriage market, the number of men who cannot get married in the aggregate will not be affected by the savings behavior. Therefore, the extra savings (and the associated current account surplus) is socially wasteful. Without an effective mechanism for households to coordinate their actions, however, no individual household dares to unilaterally cut their savings rate or work effort.

4. The Risks of A Misdiagnosis

If the perspective in this paper has some validity then the ferocious fixation of international financial institutions and some G20 discussions might not be the most productive in terms of finding solutions to the global current account imbalances. But is the fixation simply "much ado about nothing", or does it pose risks to the world economy?

In a world with limited staff resources (that is, the world we live in), the fixation on fixed exchange rates becomes a costly distraction for the staff and management of international financial institutions. This happened in the years leading up to the GFC. There was very little effort going into uncovering other potentially systematically important risk factors, such as weak financial regulations, predatory lending practices, and over-accumulation of risks in major financial institutions.

Just before the GFC became headline news, the staffs of international financial institutions were accused of being "asleep at the wheel", for not acting vigorously enough to solve the exchange rate problem. n retrospect, the accusation was misplaced. If these institutions were asleep at the wheel—in the sense of overlooking the danger signs just under their noses—they were essentially overworked by being asked to drive a car on a path that led nowhere.

The fixation on the fixed exchange rate regime poses another risk as governments in both surplus and deficit countries are mentally distracted from finding other ways to deal with structural problems that led to the global imbalances. Of course, this is not to say that a change in the real exchange rate has no effect on current accounts. Rather, a move to a more flexible exchange rate does not reliably move the real exchange rate in the right direction.

If the higher sex-ratio imbalance is a significant reason for the current account surplus then policies that help to reduce the sex-ratio imbalance can also help to narrow current account imbalances over time. Perhaps in future policy dialogue, instead of another push for more flexible exchange rates, it would be more productive to consider social policies—including family planning policies and women's social status in particular—in the context of national savings and current account imbalances. If they start now, they will not solve the global imbalances right away; however, if they do not start now, the world might still be talking about current account imbalances 10 years down the road.

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Table 6. Ln(real exchange rate) and the Sex Ratio, using Private Credit to GDP Ratio as the Measure of Financial Development

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	All countries	All countries	All countries	Excluding major oil exporters	Excluding major oil exporters	Excluding major oil exporters	Excluding major oil exporters
Sex ratio			–4.290**	–4.012**	–3.193*	–3.408**	–3.500**
			(1.667)	(1.713)	(1.797)	(1.568)	(1.754)
Ln(GDP per capita)	0.318**	0.190**	0.236**	0.233**	0.360**	0.402**	0.359**
	(0.030)	(0.038)	(0.041)	(0.044)	(0.073)	(0.063)	(0.073)
Private credit (% of GDP)		0.004**	0.004**	0.004**	0.003**	0.002**	0.002**
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Fiscal deficit					–0.007	0.002	–0.005
					(0.009)	(0.008)	(0.009)
Terms of trade					0.0002	–0.001	0.0003
					(0.001)	(0.001)	(0.001)
Capital account openness					0.060**	0.029	0.058**
					(0.027)	(0.024)	(0.027)
Dependency ratio					0.009**	0.010**	0.008*
					(0.004)	(0.004)	(0.004)
Crawling peg (RR)						–0.397**	
						(0.075)	
Managed floating (RR)						–0.036	
						(0.077)	
Free floating (RR)						–0.081	
						(0.119)	
Intermediate (LYS)							–0.078
							(0.092)
Float (LYS)							–0.145*
							(0.085)
Observations	142	132	132	123	92	89	92
R-squared	0.444	0.542	0.564	0.579	0.706	0.801	0.716

Source: Du and Wei (2011).

Note: Dependent variable = ln(RER). Standard errors in parentheses; ** $p < 0.05$; * $p < 0.1$.

Table 7. Ln(real exchange rate) and the Sex Ratio, using Financial System Sophistication as the Measure of Financial Development

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	All countries	All countries	All countries	Excluding major oil exporters	Excluding major oil exporters	Excluding major oil exporters	Excluding major oil exporters
Sex ratio			–6.192**	–6.255**	–5.051*	–4.664*	–4.430
			(1.964)	(1.995)	(2.500)	(2.802)	(2.908)
Ln(GDP per capita)	0.318**	0.480**	0.443**	0.447**	0.529**	0.526**	0.531**
	(0.030)	(0.082)	(0.077)	(0.088)	(0.123)	(0.119)	(0.127)
Financial system sophistication		0.170*	0.252**	0.245**	0.099	0.034	0.086
		(0.089)	(0.086)	(0.099)	(0.110)	(0.121)	(0.116)
Fiscal deficit					–0.022	–0.014	–0.025
					(0.015)	(0.015)	(0.017)
Terms of trade					–0.004	–0.006**	–0.005
					(0.003)	(0.003)	(0.003)
Capital account openness					0.063	0.058	0.073
					(0.042)	(0.047)	(0.047)
Dependency ratio					0.014**	0.017**	0.017*
					(0.007)	(0.007)	(0.008)
Crawling peg (RR)						–0.285*	
						(0.147)	
Managed floating (RR)						0.045	
						(0.102)	
Free floating (RR)						0.053	
						(0.173)	
Intermediate (LYS)							–0.052
							(0.137)
Float (LYS)							0.044
							(0.125)
Observations	142	54	54	49	43	42	43
R-squared	0.444	0.748	0.791	0.797	0.844	0.866	0.845

Source: Du and Wei (2011).

Note: Dependent variable = log(RER). Standard errors in parentheses; ** $p < 0.05$; * $p < 0.1$.

Table 8. Real Exchange Rate Undervaluation and Excess Current Account: The case of China

	% of RER undervaluation					Excess (non-governmental) current account				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
	Only BS	FD+BS	Add GD +TT+KA	Add DR	Add SR	Only BS	FD+BS	Add GD +TT+KA	Add DR	Add SR
Financial development index										
Private credit (% of GDP)	55.26	43.45	35.44	17.91	7.86	13.52	12.06	11.39	8.97	2.01
Financial system sophistication	55.26	46.38	31.31	16.78	2.24	13.52	10.26	10.11	7.97	0.37

Source: Du and Wei (2001), NBER Working Paper 16000.

Note: Excess RER undervaluation = model prediction – actual log RER (a positive number describes percentage undervaluation); excess current account = private-sector current account (that is, current account net of government savings) – model prediction; the five columns include progressively more regressors: 1) the only regressor (other than the intercept) is log income—a proxy for the Balassa–Samuelson (BS) effect; 2) add financial development (FD) to the list of regressors; 3) add government fiscal deficit (GD), terms of trade (TT), and capital account openness (KA); 4) add the dependence ratio (DR); 5) add the sex ratio (SR). The last two rows correspond to estimates when two different proxies for financial development are used. The first row uses the ratio of credit to the private sector to GDP, and the second row uses an index of local financial system sophistication from the *Global Competitiveness Report*.

Chapter 6

China's Export Responses to Exchange Rate Movement in Global Production Networks[1]

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This chapter examines how an appreciation of the Chinese renminbi (RMB) affects China's assembly exports in the context of global production networks, using a three-dimensional panel data set of China's trade for the period 1992–2008. This paper constructs two relevant exchange rate indices for the RMB: a bilateral real exchange rate of the RMB against China's importing countries and a real effective exchange rate of the RMB against East Asian component suppliers. It is robustly found that an RMB appreciation against component suppliers would increase China's exports by lowering the costs of exporting. This effect is found to be larger in relatively more capital and technology-intensive industries whereby Chinese value added is thinner. Hence, the evidence casts doubts on the efficacy of further unilateral reform of the RMB exchange rate regime for correcting trade imbalances. The policy implication is that use of the exchange rate tool is more complex and less predictable for countries that take part in supply chains than for those that export goods mainly containing a high proportion of domestic value added.

Keywords: International fragmentation of production, Chinese renminbi (RMB), Global trade imbalance

JEL Classifications: F14, F31

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1. Introduction

In 2010 China overtook Germany to become the world's largest exporter, having increased its share of world exports to almost 10 percent—up from about 3 percent in 1999. The rise of China as a trading powerhouse has created growing concern among the world policy circle. Industrial countries are concerned about the growing size of China's trade surplus, which has become an intense subject of debate particularly among US policymakers. It is claimed that the Chinese renminbi (RMB) has been kept at a deliberately low level in order to give a competitive edge to Chinese exports in the world market. For developing countries, concerns have mounted to a "China fear" that fierce export-market competition with China will eventually crowd out their export opportunities and growth prospects. Hence, the recent announcement of a move into a more flexible exchange rate regime for the renminbi (RMB) by the central bank of China is a crucial issue globally.

In this policy context, this chapter examines China's export elasticity to exchange rate changes from the viewpoint of China being a primal base for assembly operations of final-product exports. There has been a proliferation of studies examining the implications of China's rise as a trading powerhouse for other Asian exporters' performance. In particular, the empirical literature examining the impacts of changes in the RMB on China's trade flows typically estimates the export sensitivity (elasticity) of (nominal or real) exchange rate changes based on the imperfect substitution model between foreign and domestic goods using time-series data (Ahmed 2009; Cheung et al., 2010; Marquez and Schindler, 2007; Thorbecke, 2011; Thorbecke and Smith, 2010). Using Chinese custom trade data, most of the papers find that the sensitivity of processed exports to exchange rate changes appears to decline because of the presence of imported parts and components included in final-product exports (Thorbecke, 2011; Thorbecke and Smith, 2010. In particular, if the exchange rates of all countries in the input supply chain appreciate at the same time as the RMB, China's processed exports are reduced to an appreciable extent while an appreciation of the RMB alone has only

minor effects.[3]

With the rise of cross-border production sharing and global value chains, multinational enterprises (MNEs) increasingly set up their assembly centres in locations where comparative costs are cheaper; they source intermediate inputs (or parts and components) from various countries and assemble them into final assembled goods for export. In this process, China plays a pivotal role as an assembly centre for a wide range of manufacturing products created in Asia. This has opened up new opportunities for countries that specialize in the various tasks of the production process. At the same time, Asian exporters increasingly find export opportunities in China by supplying parts and components to China (Athukorala, 2009). Hence, a standard analysis of the effects of exchange rates on exports is no longer appropriate for analysing export elasticities to exchange rate movements when imports are sourced from a set of countries and final assembled goods are exported to another set of countries. Real exchange rate appreciation makes the foreign export price of goods more expensive, while making the imported input more affordable. This eventually reduces the sensitivity of exchange rate changes on export responses, compared with the normal adjustment case. The net effect on export response is an interesting empirical question to be examined.

This chapter further extends the literature in the following ways. First, we construct two components of exchange rate changes for the RMB: one is the bilateral real exchange rate of the RMB and the other is the real effective exchange rates of the RMB against East Asian component suppliers. Using these two components of RMB exchange rate indices leads to a more nuanced and richer understating of China's export

[3] These studies use trade data distinguished into processed and ordinary trade published by China Customs Statistics (CCS). The CCS data contain the Harmonized System (HS) eight-digit product level of China's trade flows administered by the Customs Office with information of the type of trade (processing exports using imported intermediate inputs, using locally sourced inputs, normal exports and imported intermediate inputs for the purpose of exports), trading partner countries, the type of trading firms (whether multinational enterprises, pure local firms or international joint ventures), the location of exporters and importers in the regions and cities, the values in US dollars and the quantity in eight different units. Based on this, we compute imported inputs weighted and export-weighted effective exchange rates. Processing trade includes imports that enter the country duty-free and will be incorporated into exported goods, and exports based on processing imports. Ordinary trade includes imports that enter China for domestic consumption, not used for exporting, or exports that do not rely on imported parts and components but using domestically sourced intermediate inputs.

elasticity to exchange rate changes. In particular, we robustly found that an RMB appreciation against component suppliers in East Asia would increase China's exports by reducing the costs of imported parts and components.

Second, most of the existing studies use highly aggregated and time-series Chinese trade data. This paper constructs a panel of bilateral Chinese exports to Organization for Economic Cooperation and Development (OECD) countries for the period 1992–2009 at the two-digit industry level. It will be shown that the degree of export elasticity to exchange rate changes would be higher in the relatively capital and technology-intensive industries in which the bulk of imported parts and components come from East Asian countries.

2. China's Export Performance

Figure 1a depicts the rise of China in world manufacturing exports. In 1992 China's exports accounted for a tiny share (about 2 percent) of world exports. The data show that China's export growth took off about the early 2000s. Since then, China has achieved formidable export expansion by overtaking Germany as the world's largest exporter, in 2007–08, accounting for 12 percent of world manufacturing exports. In Figure 1, only China's export share has been growing without any disruptions, while the world shares of Japan, the United States and Germany have not grown since 2000. At the same time, China has also been growing to become an important country in the global market (Figure 1b). While the United States still accounts for the bulk of world manufacturing imports (about 15–20 percent in world imports), its share has been declining since 2000. Meanwhile, China's share has been steadily increasing, accounting for close to 9 percent in 2009—up from 3 percent in 1992.

Figure 1. The Rise of China in World Manufacturing Exports (percent)

Figure 1a. Export (Percentage share in world manufacturing exports)

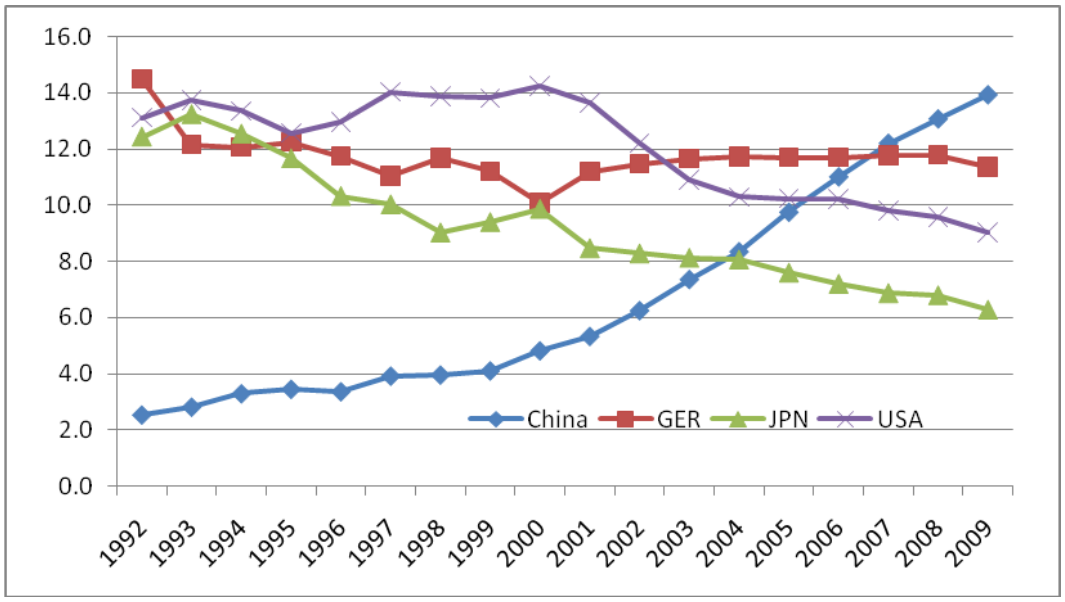
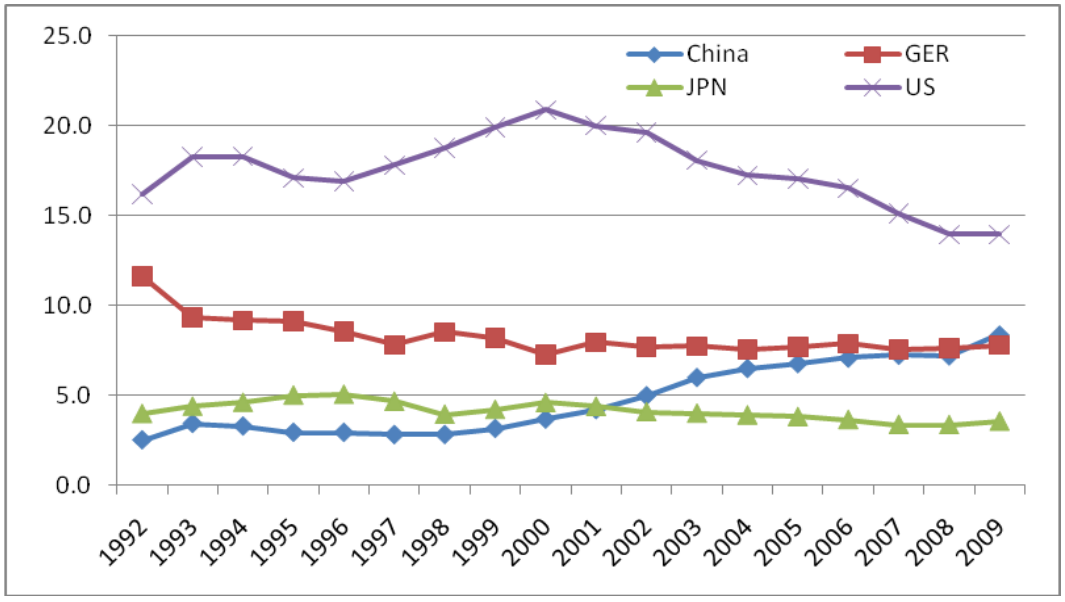


Figure 1b. Imports (Percentage share of world manufacturing imports)



Source: UN Comtrade.

With the rise of China in world trade, Table 1 also highlights product compositional change in China's trade (product composition of trade structure at one and two-digit levels of SITC product categories). China clearly changed its specialization of trade from relatively labor-intensive products towards more capital and technology-intensive

products. In 1992–93, miscellaneous manufacturing (including clothing, footwear, and toys and games) accounted for about 60 percent of China's manufacturing exports. Its share continuously declined, however, and dropped to 34 percent in 2004–05. On the other hand, the export share of machinery and transport equipment jumped from 21 percent in 1992–93 to 49 percent in 2004–05. In particular, the export composition is highly concentrated in information communication technology (ICT) product categories under SITC 75, 76 and 77. The share of office machines under SITC 75 increased from 2.3 percent of China's manufacturing exports in 1992–93 to 16 percent in 2004–05. Telecommunication sound equipment (including mobile phones) increased from 8 percent to 14 percent in 2004–05 and electrical machinery appliances (SITC 77) were up from 5.8 percent to 12.5 percent. While the dominant products in China's exports are electronic related, transport-related products such as automobiles still account for a small share. The share of road vehicles (SITC 78) accounted for 1 percent in 1992–93, and this share virtually remained the same until 2004–05.

Table 1. Product Composition of China's Manufactured Exports and Imports, 1992–2005

SITC	Product description	China, export			China, import		
		1992–93	2000–01	2004–05	1992–93	2000–01	2004–05
5	Chemicals	3.9	3.5	3.6	13.8	17.3	15.5
6	Manufactured goods	16.2	14.1	14.1	31.5	23.3	16.8
68	Non-ferrous metals	0.7	0.9	1.1	2.6	3.6	3.4
7	Transport equipment	20.8	36.7	49.2	49.6	55.3	59.0
71	Power—general machines	0.9	1.2	1.0	3.2	2.9	2.4
72	Special industrial machinery	0.6	0.6	0.9	14.1	6.5	5.2
73	Metal-working machinery	0.2	0.2	0.2	2.7	1.8	2.1
74	General industrial machinery	1.7	2.2	3.1	5.1	4.9	5.1
75	Office machines	2.3	9.9	16.0	1.9	6.5	7.1
76	Telecommunication sound equipment	8.0	10.2	14.0	5.8	7.1	5.9
77	Electrical machinery appliances	5.8	11.0	12.5	7.2	21.0	27.0
78	Road vehicles	1.0	1.2	1.3	5.8	2.3	2.7
79	Other transport equipment	0.2	0.2	0.2	3.8	2.3	1.5
8	Miscellaneous manufactured articles	59.8	46.6	34.1	7.7	7.7	12.0
84	Clothing	23.1	14.9	10.6	0.7	0.7	0.3
85	Footwear	9.0	5.8	3.6	0.5	0.2	0.1
894	Baby carriages, toys, games	10.4	8.8	5.7	0.4	0.1	0.1
5–8	Manufactured goods	100.0	100.0	100.0	100.0	100.0	100.0

Source: UN Comtrade

On the import side, the share of miscellaneous manufactured products (including toys, footwear and clothing) has stayed at a relatively low level compared with the export side. Instead, the electrical and transport equipment (SITC 7) category accounts for close to half of China's manufacturing imports: in 1992–93 its share was 49.6, and grew to be close to 60 percent in 2004–05. Among them, the share of electrical machinery appliances of SITC 77 increased from 7 percent in 1992–93 to 21 percent in 2000–01 and 27 percent in 2004–05.

Table 2 summarizes the percentage share of parts and components in total manufacturing trade for China and other East Asian countries for 1992–2009. The percentage share of components in manufacturing trade indicates a quite distinctive specialization of vertical trade for China. While the component share in total manufacturing exports remains relatively low compared with other East Asian countries, there has been an increase of the component share in total manufacturing imports in China. In 2005–06 the share of components in China's manufacturing exports stood at about 20 percent, while that of Association of South-East Asian Nations (ASEAN) countries accounted for 40 percent, 33 percent for South Korea and 46 percent for Taiwan. On the other hand, the share of components in China's total manufacturing imports dramatically increased—from 19 percent in 1992–93 to 44 percent in 2005–06. This share is quite comparable with average ASEAN countries and other key East Asian importers. Perhaps, these figures suggest that China predominantly imports components within manufacturing and exports final products after undertaking assembly using imported parts and components in Chinese domestic factories.

Table 2. Percentage Share of Parts and Components (P&Cs) in Total Manufacturing Trade, 1992–2009

	Export (%)				Import (%)			
	1992–93	2000–01	2005–06	2008–09	1992–93	2000–01	2005–06	2008–09
China	5.2	14.2	20.2	15.5	19.3	34.5	43.8	24.1
Hong Kong (China)	18.8	27.5	26.5	14.9	16.8	30	36	21
ASEAN6	27.4	38.6	40.2	18.1	34.6	48.8	43.4	24.9
Malaysia	33.4	46.1	48	20.5	42	57.4	53.1	25.4
Philippines	34.4	58.2	66.6	21.6	33.9	55.1	51.1	23.8
Singapore	33.8	43.2	43.5	18.2	38.6	50.4	46.5	25.7
Vietnam	1.4	9.9	10.2	9.2	8.9	18.5	17.2	15.7
Thailand	21.2	27.2	27.4	18	29.1	43.6	38.2	27.5
Indonesia	3.2	12.4	19.7	15.4	24	31	32.9	26.4
Japan	26.9	34.1	32.4	24.4	18.5	26.7	25.2	19.2
Rep. of Korea	19.1	27.4	33.1	18.5	29.2	36.7	31.9	19.4
Taiwan	21.1	36.9	45.9	19.2	30.5	39.1	37.7	17.6
USA	30.3	35.6	31.2	23.8	24.5	24.1	21.5	17.7
NAFTA	29.6	32.2	29	22.8	27.4	27	23.7	19.4
EU15	18.6	20.7	19.6	18	19.1	21.7	19.7	16.6
Low income	2.9	5.4	6.5	7.3	15.3	17.1	16.1	14.9
Low–middle income	8.1	17.5	21.7	15.3	21.6	31.3	34.3	22.1
High income	22.7	26	24	19.4	21.3	24.2	22.1	17.5
World	20.8	25.1	24.1	18.2	21.7	25.6	23.9	18.2

Source: UN Comtrade.

The share of components in total manufacturing trade dropped sharply during the Global Financial Crisis (GFC) in 2008 and 2009 (for fuller exposition, see Athukorala, 2011). As became apparent, a substantial drop in the volume of trade in 2008–09 was caused largely by a sharp decline in demand for consumer durable goods (ITC products and motor vehicles) in industrial countries. This sharp drop of demand had a consequence for components trade in supply chains because of direct linkages with demand for final products. For China, the component share in total manufacturing imports dropped from 44 percent in 2005–06 to 24 percent in 2008–09. ASEAN countries' average share of components in manufacturing also dropped sharply—to 25 percent in imports and 18 percent in exports in 2008–09.

Table 3 summarizes China's export destinations and import sourcing countries from 1992 to 2009. Major trading countries are broken down into ASEAN countries, South Korea and Taiwan, Japan, the United States and EU15 countries. Table 3 also separates China's trade patterns into parts and components and final goods. In machinery and transport equipment (SITC 7), China's component sourcing from ASEAN countries accounted for only 2.2 percent in 1992–93 but ASEAN's share grew to be about 13 percent in 2000–01 and 17 percent in 2005–06 (panel A of Table 3). The lion's share of China's component imports comes from other East Asian countries, South Korea, Taiwan and Japan (excluding Hong Kong, China). In 2005–06, South Korea and Taiwan accounted for 30 percent and Japan for 18 percent of China's component imports. On the other hand, the share of the United States has declined from 11 percent in 1992–93 to less than 6 percent in 2005–06, and the share of the EU15 dropped from 19 percent in 1992–93 to 9.4 percent in 2005–06. During the recent crisis period in 2008–09, the share of ASEAN in China's component imports declined substantially—down to 8 percent in 2008–09. Similarly, the shares of South Korea and Taiwan dropped.

Table 3. Directions and Sources of China's Trade in Components and Final Products, 1992–2009 (percent)

(A) —Imports

	Parts and components in machinery and electrical (SITC 7)					Final products in machinery and electrical (SITC 7)				
Year	ASEAN	Korea+Taiwan	Japan	US	EU15	ASEAN	Korea+Taiwan	Japan	US	EU15
1992–93	2.2	15.0	33.4	10.7	19.1	1.1	15.5	28.5	14.1	25.6
2000–01	13.3	20.3	24.1	9.4	17.2	5.2	15.9	20.6	17.3	26.0
2005–06	17.2	30.1	18.2	5.7	9.4	12.1	14.1	21.5	10.2	24.3
2008–09	8.0	19.7	23.4	6.3	19.0	17.5	23.5	16.2	8.0	15.4

	Part and components in toys and clothing (SITC 8)					Final products in toys and clothing (SITC 8)				
Year	ASEAN	Korea+Taiwan	Japan	US	EU 15	ASEAN	Korea+Taiwan	Japan	US	EU 15
1992–93	1.0	22.1	30.5	7.2	5.2	1.4	20.5	25.0	14.9	8.6
2000–01	5.5	16.6	36.1	9.0	13.6	3.1	16.4	20.8	19.4	18.0
2005–06	4.6	31.3	30.0	7.9	8.0	4.0	44.0	16.5	7.4	8.7
2008–09	5.6	25.1	28.0	7.4	13.6	4.2	41.8	15.4	8.0	11.2

(B) —Exports

	Parts and components in machinery and electrical (SITC 7)					Final products in machinery and electrical (SITC 7)				
Year	ASEAN	Korea+Taiwan	Japan	US	EU15	ASEAN	Korea+Taiwan	Japan	US	EU15
1992–93	7.8	6.2	15.8	17.5	13.0	6.2	3.0	8.6	22.3	15.2
2000–01	12.8	7.8	14.9	15.4	12.8	7.0	5.2	11.1	24.4	21.3
2005–06	11.6	9.5	10.1	15.6	13.4	5.2	4.0	8.2	26.4	23.2
2008–09	8.6	7.1	8.8	14.5	16.7	8.6	5.9	5.8	19.9	17.8

	Parts and components in toys and clothing (SITC 8)					Final products in toys and clothing (SITC 8)				
Year	ASEAN	Korea+Taiwan	Japan	US	EU15	ASEAN	Korea+Taiwan	Japan	US	EU15
1992–93	3.9	5.5	13.0	16.8	9.6	1.5	2.3	16.0	27.1	14.5
2000–01	4.6	5.3	19.7	27.4	9.5	2.1	3.5	20.5	27.4	14.2
2005–06	5.9	7.7	25.3	19.4	9.1	2.9	3.5	12.9	26.6	18.2
2008–09	9.1	6.7	13.4	18.4	12.1	4.8	3.2	10.6	24.0	21.4

Source: UN Comtrade.

The recent crisis had little impact on China's final goods imports from ASEAN countries, in contrast with component imports. The share of ASEAN actually went up—from 12 percent in 2005–06 to 17.5 percent in 2008–09, while the shares of Japan, the United States and the EU15 all went down in the same period. The share of Japan in China's final-product imports declined from 20 percent in 2000–01 to 16 percent in 2008–09. Similarly, the share of the United States dropped from 17 percent in 2000–01 to 8 percent in 2008–09, and the share for EU15 countries went down from 26 percent to 15 percent.

Table 3b looks at the export directions of China's exports in parts and components and final products. Similarly to the import pattern, here, the share of ASEAN countries has substantially increased since the early 1990s. ASEAN's share went up from 7.8 percent in 1992–93 to 12.8 percent in 2000–01 and 11.6 percent in 2005–06, while the shares of other country groups have not changed dramatically in the same period. The United States and EU15 countries account for about 40 percent of China's final-product exports, the importance of which has not changed in the past 20 years. This indicates that China still finds export markets for its manufacturing exports in rich Western countries. In 1992–93, 22 percent of China's final-goods exports went to the United States and 15 percent to the EU15. In 2008–09, the United States' share stood at 20 percent, while it was 18 percent for EU15 countries.

China's trade in miscellaneous manufactured articles (SITC 8)—mainly toys and clothing—shows a quite different pattern. ASEAN countries continue to make up a small portion of China's imports and exports in this product category, while imports from South Korea and Taiwan dominate. About 40 percent of China's final-goods imports in this product category comes from these two East Asian countries. On the export side, the majority of Chinese products are directed towards Japan, the United States and EU15 countries. All in all, Table 3 clearly suggests the role of China as a major final-assembly country. The majority of China's component imports are sourced from East Asian countries, including Japan, while China's final-product exports are directed towards the United States and EU15 countries.

3. Empirical Analysis

This section undertakes gravity modelling to estimate China's export elasticity of exchange rate changes. As theoretically and empirically demonstrated in Baldwin and Taglioni (2011), a standard formation of the gravity equation might not be appropriate for explaining trade flows where trade in parts and components is prevalent. They point out the potential problem of regressing trade in parts and components on the typical gravity variables. A typical form of the gravity equation postulates demand and supply in a bilateral trade relationship—simply represented by GDP and GDP per capita of importing and exporting countries. The GDP of importing countries might, however, not strictly represent demands for imports because of demand coming from the third countries.

As shown in Section 3, China primarily imports parts and components from other East Asian countries, and then exports final-assembly products to the United States and EU15 countries. Hence, our dependent variable is China's final-product exports to developed countries in the West, rather than the reported volume of China's exports, as in Baldwin and Taglioni (2011) (refer to our data approach of identifying final products in China's exports separated from parts and components in the Data Appendix). Of course, this is not a perfect solution. As is well known, the trade data collected are gross flows, not value added. The input–output (I/O) table is required to measure value-added contents of China's exports, netting out imported and domestically sourced parts and components. The I/O table is, however, published only in discrete time (for example, every five years), hence it is difficult to associate value-added exports from the I/O table to a more dynamic analysis of exchange rate fluctuations. Hence, even if our approach is able to separate final products from parts and components in China's trade statistics, they are not value-added measures. Our measure of the volume of final-good exports contains imported as well as domestically sourced parts and components.

Our estimation strategy incorporates two relevant exchange rates for the RMB. The first refers to the real bilateral exchange rates between China and its importing countries. The second one is the effective exchange rates of the RMB against currencies of

component-sourcing countries (the variable definition given below). The regression specification takes the following form:

$$\ln CHE_{ijt} = \alpha + Z'_{it}\beta + \phi_1 \ln BER_{it} + \phi_2 \ln RER_{jt} + \varepsilon_{ijt}, \quad (1)$$

in which subscript *i* denotes importing countries, *j* denotes industry and *t* year. The dependent variable (*CHE*) is the volume of China's exports of final products to a set of trading-partner countries (US and euro countries). *Z* is a vector of variables (other than exchange rate variables) that determines the volume of China's final-goods exports. *BER* denotes real bilateral exchange rates for the RMB against currencies used in importing countries (defined as a foreign currency per RMB). Hence, an increase in BER means appreciation of the RMB. The expected sign for BER is negative. *RER* is an industry-level RMB real effective exchange rate (RER) computed at SITC two-digit level (see below for a formula). The computation closely follows the industry-level computed RER in Goldberg (2004). The symbol *ln* before a variable denotes the natural logarithm. ε is a random variable that is *i.i.d.* normal with mean zero and variance u_u.

As shown in Section 3, the majority of China's component imports come from East Asian countries, and China's final product exports are mainly destined for industrial countries in North America and Europe. Hence, in construction of relevant exchange rates, we use the RMB's RER against the currencies of nine East Asian countries (Japan, Hong Kong—China, Taiwan, South Korea, Singapore, Malaysia, Indonesia, Thailand, and the Philippines) for component suppliers' RER. Each industry is indexed in *j* in SITC two-digit level and East Asian exporters to China are indexed as *c*. The weight is determined by the share of that country *c* in China's component imports in each industry.

$$RER_t^j = \sum_c w_t^{jc} er_t^c, \quad \text{where } w_t^{jc} = \frac{M_t^{jc}}{\sum_c M_t^{jc}}, \quad (2)$$

where *M* stands for China's component imports for those East Asian countries and *er* represents the bilateral exchange rates of each of China's component sourcing countries—*c* against the RMB. The bilateral real exchange rates are constructed by multiplying a country's nominal exchange rate (defined as a local currency per RMB) by the ratio of the consumer price indices of China against East Asian suppliers. The

subscript *t* means that the weight varies through time. A real appreciation of the RMB's RER against currencies of component providers would essentially lower the marginal costs of importing, exerting upward pressure on China's final-good exports.

For a vector of explanatory variables contained in *Z*, a gravity specification is formed by including a constant, the GDP of importing countries (to measure market size), the distance between China and trading countries, and a dummy variable for country pairs that share a common language. All variables except the dummies and the constant are in logarithm.

The data on the bilateral trade at five-digit commodity level are drawn from the UN Comtrade database. We use annual data series for the period 1992–2008. The initial year is set to 1992 because from this year more countries started reporting under SITC Revision 3, and the end year is 2008 for which the latest data are available. This time span also covers the period when China's exchange rate to the US dollar became flexible to some extent: 2005–08. GDP and GDP per capita of China and her trading-partner countries are drawn from the World Bank's *Development Indicators*.

4. Results

We employ the fixed-effect model of the panel data estimation methods because it will address the multilateral resistance terms accounting for cross-country price variations in the gravity modeling (Anderson and van Wincoop, 2004; Feenstra, 2004).[4] Regression results of fixed-effect models are presented in Table 4 and results for the fixed effect with time dummies are presented in Table 5. Columns 1–3 report the regression results including all two-digit industries of both SITC 7 (machinery and transport equipment) and SITC 8 (miscellaneous manufacturing). As shown in Table 1, SITC 8 includes relatively more labour-intensive goods such as clothing and footwear. The results only for industries within SITC 7 are presented in columns 4–6, and columns 7–9 show results for products under SITC 8. We run separate regressions for

[4] Of course, one limitation of the fixed-effect estimator for the gravity modeling is that it will automatically drop a time-invariant variable (a geographical distance).

two industries because the degree of imported parts and components contained in China's final product exports might differ between two industries. We expect higher elasticity of exchange rate changes for the machinery and transport equipment industry (SITC 7) than for SITC 8 because of a higher content of imported parts and components. We also introduce the RMB's BER and supplier-weighted RER in separate regressions because of high correlation between two exchange rate indices.

Results in Table 4 show that an appreciation of the RMB's bilateral real exchange rates (BER) on average would decrease China's final-product exports as expected (column 1). A 1 percent appreciation of BER would decrease China's final-product exports by 0.96 percent. Considering the fact that the RMB has been pegged to the US dollar for most of the estimation period, this effect is quite large. An appreciation of the RMB's real effective exchange rate (RER), as expected, would increase China's exports: a 1 percent appreciation of RER would increase them by 0.66 percent. These effects are found to be statistically significant at the 1 percent level. These findings show that the RMB's appreciation against both importing countries and component suppliers would have offsetting effects on China's exports. Once BER and RER are estimated separately, however, in columns 2 and 3 in Table 4a, the statistical significance of BER is lost, although the estimated sign remains negative. Perhaps this is driven by a high correlation between BER and RER (a correlation coefficient is about 0.84), while the estimated coefficient for RER in column (3) remains similar to the one found in column (1) and retains a 1 percent statistical significance. This makes sense since most of the value added in China's final exports comes from those East Asian countries.

We also found that export elasticity is greater in machinery and transport equipment (SITC 7) than more relatively labour-intensive industries in SITC 8, as expected. A 1 percent appreciation of RER leads to an increase of China's exports by 1.15 percent (column 4), whereas the same effect shows only 0.3 percent in SITC 8 (column 7). Again, this difference in the estimated magnitude comes from greater contents of imported parts and components in the electronics and transport equipment industries.

Table 5 presents results of the fixed-effect model with the year fixed effects. The results change somewhat, although it is understandable that the year effects drive time-series components of growing China's exports under the estimation period. Now it is

found that the estimated sign for the RMB's RER turns to negative, while that of BER remains an expected negative sign. This implies that a 1 percent appreciation of BER would decrease China's exports by 0.6 percent, and also a 1 percent appreciation of RER would decrease them by 0.1 percent (column 1). In columns (2) and (3) of Table 5, the estimated coefficients for both BER and RER virtually remain the same with statistical significance. Column (4), however, shows the expected signs for RER: a 1 percent appreciation of RER would increase China's exports by 0.3 percent, which is lower than the one shown in Table 4. Moving into column (7), the estimated coefficient for RER for more labour-intensive products changes again. These findings show that the exchange rate effect on China's exports, especially RER, is quite sensitive to the specifications.

We briefly summarize other variables. As found in other studies, an income elasticity of China's exports is found to be about unity and the income effects are larger in the machinery and transport equipment industry (SITC 7). This is consistent with a view that income elasticity for technology-intensive products (such as digital cameras and laptop computers) is more elastic than for relatively labour-intensive products such as clothing and footwear. The income elasticity is also, however, not robustly estimated. In Table 5, income elasticity shows an unexpected negative sign and is hardly statistically significant for all regressions. As found in Thorbecke (2011), the WTO effect is positive and statistically significant in all regressions.

Table 4. Export Elasticity of Exchange Rate Changes to China's Final Products (Fixed Effect)

	SITC 7 and 8			Electronics and transport equipment (SITC 7)			Miscellaneous Manufactured (SITC 8)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Importer GDP	0.84	0.98	1.12*	1.05**	1.16	1.39**	0.58	0.69	0.81
	[0.511]	[0.675]	[0.569]	[0.474]	[0.737]	[0.577]	[0.522]	[0.593]	[0.545]
BER	**–0.96*** **	**–0.76**		**–1.24*** **	**–0.82**		**–0.74** **	**–0.68**	
	[0.319]	**[0.481]**		**[0.327]**	**[0.545]**		**[0.330]**	**[0.409]**	
RMB RER	**0.66*** **		**0.61*** **	**1.15*** **		**1.06*** **	**0.30*** **		**0.28*** **
	[0.074]		**[0.084]**	**[0.093]**		**[0.106]**	**[0.057]**		**[0.066]**
WTO	1.11***	1.62***	1.11***	0.89***	1.80***	0.91***	1.13***	1.36***	1.12***
	[0.133]	[0.223]	[0.160]	[0.131]	[0.248]	[0.161]	[0.139]	[0.196]	[0.158]
Constant	–8.85	–10.33	–15.03	–16.82	–15.99	–24.09	0.26	–1.74	–4.94
	[13.062]	[17.388]	[14.926]	[12.087]	[18.984]	[15.085]	[13.355]	[15.308]	[14.341]
Obs	4,976	4,976	5,101	2,985	2,985	3,062	1,991	1,991	2,039
R-squared	0.643	0.587	0.635	0.689	0.589	0.677	0.658	0.632	0.648

Note: SITC 7 = electronics and transport equipment and SITC 8 = miscellaneous manufactured articles. Standard errors based on White's heteroscedasticity correction cluster by importing countries for SITC two-digit industry level are given in parentheses with statistical significance (two-tailed test) denoted as: *** 1%; ** 5%; and * 10%.

Table 5. Export Elasticity of Exchange Rate Changes to China's Final Products with the Year Effect (Fixed Effect with the Year Effects)

	SITC 7 and 8			Electronic and transport equipment (SITC 7)			Miscellaneous Manufactured (SITC 8)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Importer GDP	–0.29	–0.28	–0.35	–0.3	–0.31	–0.35	–0.26	–0.25	–0.34
	[0.352]	[0.351]	[0.416]	[0.405]	[0.408]	[0.469]	[0.333]	[0.334]	[0.396]
BER	**–0.60***	**–0.60***		**–0.48**	**–0.49**		**–0.76****	**–0.75****	
	[0.339]	**[0.335]**		**[0.402]**	**[0.408]**		**[0.278]**	**[0.266]**	
RMB RER	**–0.10*****		**–0.10*****	**0.33*****		**0.35*****	**–0.25*****		**–0.24*****
	[0.024]		**[0.025]**	**[0.069]**		**[0.068]**	**[0.018]**		**[0.018]**
WTO	3.92***	2.53***	3.86***	2.17***	2.29***	1.30***	2.07***	2.74***	1.75***
	[0.218]	[0.241]	[0.244]	[0.315]	[0.269]	[0.145]	[0.224]	[0.112]	[0.137]
Constant	22.84**	22.55**	25.27**	21.92**	22.69**	23.78*	23.27**	22.45**	26.37**
	[9.306]	[9.302]	[11.056]	[10.412]	[10.519]	[12.408]	[9.195]	[9.242]	[10.557]
Obs	4,976	4,976	5,101	2,985	2,985	3,062	1,991	1,991	2,039
R-squared	0.760	0.759	0.761	0.761	0.758	0.764	0.842	0.831	0.835

Note: SITC 7 = electronic and transport equipment and SITC 8 = miscellaneous manufactured articles). Standard errors based on White's heteroscedasticity correction cluster by importing countries for SITC two-digit industry level are given in parentheses with statistical significance (two-tailed test) denoted as: *** 1%; ** 5%; and * 10%.

5. Conclusion

China's emergence as an exporting powerhouse in recent years has attracted much attention from policymakers around the world. Industrial countries are concerned about the ever-growing size of trade deficits with China. Developing countries in East Asia fear export competition with China in third-country markets. Many of them accuse China of unreasonably maintaining a low value of the Chinese currency to give a competitive edge to China's exports in the world market. This chapter contributes to this debate by examining China's export elasticity to changes in the RMB from the perspective of China as a final-assembly country. China's trade specialization is based on processing whereby the assembly of final products uses imported parts and components from East Asian countries that are then exported to industrial countries in the West. We computed two relevant exchange rate indices of the RMB for China's exports: one against prices of component-supplying countries' currencies and the other against prices of Western industrial countries. We found that a 1 percent appreciation of the RMB against industrial countries in the West would decrease China's final-product exports by 0.96 percent, but a 1 percent appreciation of the RMB's component import-weighted real effective exchange rate (RER), *ceteris paribus*, would increase China's exports by 0.66 percent. This is because an appreciation of the RMB against component suppliers in East Asian countries would increase China's exports by importing parts and components more cheaply. This effect is greater in the machinery and transport equipment industry in which reliance on imported parts and components remains high and the Chinese value added remains low. This finding implies that a bilateral exchange rate change of the RMB alone will have less than the expected impact on the volume of China's exports and thus will contribute less to correcting some of the growing trade imbalance with China. The policy implication is that the use of the exchange rate tool is more complex and less predictable for countries that take part in supply chains than for those that export goods containing mainly a high proportion of domestic value added.

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Data Appendix

There is no unique way of quantifying the magnitude and pattern of vertical specialization of trade.[5] The approach taken in this chapter relies on published international trade statistics on parts and components identified at the most highly disaggregated commodity level (that is, five digits). This method was pioneered by Yeats (2001) who used a list of commodity classifications based on Standard International Trade Classification (SITC) Revision 2 and extended by Athukorala (2005) using SITC Revision 3. We make extensions to Yeats (2001) and Athukorala (2005). Identification of trade in parts and components in this paper takes a more systematic approach following the commodity classification system provided by the UN Broad Economic Category (BEC), whereas Yeats (2001) and Athukorala (2005) simply identify a list of components by focussing on the product description at the five-digit level. The BEC classification system is intended to categorize product-based SITC trade statistics into an economic activity-based classification.[6]

Among seven major commodity categories under BEC, industrial supplies (BEC 2), capital goods (BEC 4), and transport equipment (BEC 5) include a subcategory for "parts and accessories". The corresponding subcategories are BEC22, BEC42 and BEC53. Not all of the items classified under BEC 22, 42 and 53, however, correspond with parts and components. Only the items under these three subcategories that at the same time correspond with SITC 7 (machinery and transport equipment) are identified as parts and components in this study. Limiting items to SITC 7 prevents the inclusion of some components traded as "products in their own right" under specific trade names (for example, automobile tyres, which belong to SITC 6). The final list prepared

[5] Feenstra and Hanson (1996) also develop a measure of international outsourcing in their widely cited papers. Their measure, however, captures only the *intensity* of foreign outsourcing for given industries, not the extent of the associated trade flows. Hence, we do not discuss the Feenstra–Hanson approach here. See Yamashita (2010) for more detailed discussion on this measurement issue.

[6] The original BEC was published in 1971, Revision 1 was issued in 1976 and Revision 2 in 1986. The BEC was developed in such a way that it would provide the elements that enable the construction of aggregates of trade goods approximately comparable with those for the three basic classes of goods in the 1968 Social National Account (SNA). See a more detailed description of the BEC at: http://unstats.un.org/unsd/cr/family2.asp?Cl=10.

through this procedure contains a total of 264 items.[7] We also define the final assembled products that are not specified as components within the machinery sector.

A focus on the machinery product category is justified for the following reasons. First, the United Nations' currently available commodity trade classification permits the systematic separation of trade in parts and components in the machinery and transport equipment industry of SITC 7. Vertical specialization of trade in other sectors such as clothing, chemicals and toys has been increasingly important, but the current data-recording system does not permit a satisfactory separation of those commodities. Second, many have argued that vertical specialization of trade in the high-tech machinery industry has been the driving force of the recent international fragmentation of production (Athukorala and Yamashita, 2006; Krugman, 2008). Furthermore, as shown in the China Custom Statistics, electronic and electrical machinery and transport equipment industries account for the bulk of processing exports that use most of the imported parts and components (Feenstra and Wei, 2010; Wang and Wei, 2010). Hence, the focus of this industry is not a major limitation.

Alternatively, some studies have used the input–output (I/O) table to quantify the degree of vertical specialization of trade for China (Dean et al., 2007; Hummels et al., 2001). The following formula is frequently employed to compute the extent of vertical specialization in trade (Dean et al., 2007; Ishii et al., 2001):

$$VS = \mathbf{u}\mathbf{A}^{\mathbf{m}}\left[\mathbf{I} - \mathbf{A}^{\mathbf{D}}\right]\mathbf{X},$$

where $\boldsymbol{u}$ is a 1 x n vector of 1s, $\boldsymbol{A^M}$ is an n x n imported coefficient matrix, $\boldsymbol{I}$ is the identity matrix, $\boldsymbol{A^D}$ is the n x n domestic coefficient matrix and $\boldsymbol{X}$ is n x 1 export vector. Hence, *VS* measures all the imported inputs including those iterated over the entire production system of China, which are used to produce exports from all n sectors. While the I/O table approach can precisely measure the degree of vertical specialization in trade, the long continuous-time period coverage of the data does not exist because of the very nature of the table. The state statistical agency normally publishes the I/O table every five years. In the case of China, a study by Dean et al. (2007) reports only two

[7] A complete list of parts and components identified by BEC is available from the author upon request.

years: 1997 and 2002. In addition, the I/O table focuses only on the import side by construction. The estimate of vertical specialization in trade confines only to the estimate of imported intermediate inputs used for exports. The trade data approach described above can, however, cover both the export and the import side. Dean et al. (2007) compared two alternative methods—trade data and the I/O table—of quantifying vertical specialization in trade for China and concluded that estimates from two methods do not differ significantly.

CHAPTER 7

Do Asian Countries Fear Appreciation Against the Renminbi?

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Our study brings out the evidence of a fundamental role for the Chinese renminbi in shaping the exchange rate behavior of other major Asian currencies. Our results suggest that there is an additional dimension to the 'fear of appreciation' or 'fear of floating in reverse'—a term initially coined by Levy-Yeyati and Sturzenegger (2007). In particular, we find that there is a greater degree of aversion to appreciation of the same Asian currencies against the renminbi than against the US dollar during the period that characterized the heavy reserve accumulation of 2000–06 and prior to the Global Financial Crisis (GFC). While this phenomenon all but disappeared during the GFC, there are indications in the results that a reassertion of this fear of appreciation after the GFC has re-emerged among Asian currencies, particularly against the US dollar but not against the Chinese renminbi. Nonetheless, it is most likely the case that this fear of appreciation against the Chinese currency will re-emerge in the near term in view of direct trade competition between countries in the region as well as in third markets. The policy implication may be that for the process of global rebalancing to begin in Asia governments must be able to address the wariness of other Asian currencies to losing their competitiveness to China as well as their general fear of appreciation.

Keywords: exchange rate asymmetry, fear of floating, fear of appreciation, regime switching model

JEL Classifications: E58, F31, F41

* The views expressed in this study are those of the authors alone, and do not represent the official views of the SEACEN Center.

1. Introduction

It has been argued that one of the biggest inconsistencies in the global economy today is the fact that emerging Asian economies have rebounded faster than any other region, with a widening gap between their average growth rate and that of developed economies, yet most of their currencies have fallen since 2008 in real trade-weighted terms (The Economist, 2009). Moreover, concerns about the global consequences of exceptionally loose monetary policy in the United States and other developed markets continue as capital flows to emerging markets around the globe, especially in Asia, have been picking up and fears of appreciating local currencies remain a key policy concern.

Against this backdrop, the objectives of our paper are as follows. The first is to investigate and assess the exchange market interventions carried out by selected central banks in the East and Southeast Asian region—namely, Bank Indonesia, Bank of Korea, Bangko Sentral Ng Pilipinas, Bank of Thailand and the Monetary Authority of Singapore. For this purpose and noting that these five Asian countries do not release their respective foreign exchange positions to the public, we will imperfectly resort to exploiting the underlying concept of an exchange market pressure (henceforth EMP) and construct the EMP index for these five major Asian currencies. In doing so, we hope that, based on the sign and magnitudes of the EMP index, we are able to initially ascertain the *de facto* exchange rate policy stance of these five Asian countries. This is understandably important as four of the five countries we examined in this paper have officially adopted inflation-targeting regimes and, as such, we intrinsically expect that being official inflation targeters should lead to greater flexibility in their exchange rates. In conformity with the voluminous literature on the fear of floating, however, there is a general reluctance on the part of emerging market countries, including the five economies examined here, to float their currencies freely.[1]

Nonetheless, a current nuance of the apparent move towards allowing some greater flexibility in exchange rates is that for various reasons it is possible that the degree of

[1] The typical reasoning advanced is that in the presence of large stocks of un-hedged foreign currency-denominated debt and high pass-through, allowing currencies to float freely means tolerating the substantial exchange rate volatility that ensues, which can be harmful to the economy.

flexibility is significantly higher on one side of the market.[2] In other words, the monetary authorities in these four Asian economies can asymmetrically manage their exchange rates wherein they can allow for some currency depreciation while substantially limiting the extent of currency appreciation. For lack of better alternatives, this exchange rate intervention behavior has been called by Levy-Yeyati and Sturzenegger (2007) "fear of floating in reverse" or "fear of appreciation". Accordingly, the next important objective of this paper is to verify evidence of asymmetrical exchange rate behavior—that is, the presence, if any, of fear of appreciation on the part of the five monetary authorities mentioned. Lastly, we also investigate whether this fear, if it exists, extends not just to the exchange rates of the five Asian currencies with respect to the US dollar but also *vis-à-vis* the Chinese renminbi.

There have been a few recent works that examine such central bank aversion to exchange rate appreciations in East Asia. Ramachandran and Srinivasan (2007), for instance, employ a simple dummy variable to account for depreciations and appreciations. On the other hand, Srinivasan et al. (2008) explore a cubic loss function to account for possible asymmetrical behavior. The study of Stigler et al. (2009) applies time-series techniques in the context of structural change of the exchange rate regime. Furthermore, Pontines and Rajan (2010) similarly employ the cubic loss function of Srinivasan et al. (2008) and test the model that includes not only India, but also a broader set of emerging Asian economies known to operate a variety of managed floats: Indonesia, Korea, the Philippines, Singapore and Thailand.

None of these earlier studies, however, goes further and examines possible factors contributing to this asymmetrical exchange rate behavior in Asia. In particular, none has considered the plausible influence of the Chinese renminbi on asymmetrical exchange rate management of these Asian currencies, especially post the 2005 exchange rate policy reform in China.[3] It is quite surprising that in spite of the rapidly emerging

[2] See, for instance, Stigler et al. (2009) for this set of plausible reasons.

[3] In July 2005, the People's Bank of China (PBC) announced its policy intention to set the value of the renminbi with reference to a basket of foreign currencies, and to allow the currency to move more flexibly. The outcome was arguably a more measured and deliberate approach akin to a managed crawl whereby the currency was allowed to appreciate by about 20 percent against the US dollar from 2005 to late 2008.

role of the Chinese economy in Asia in particular, and in the world in general, the literature to our knowledge has been silent on the possible influence of the renminbi with regards to the issue of asymmetrical exchange rate behavior in Asia. In view of the potential ramifications of this fear of appreciation in Asia to the issue of global rebalancing, let alone that it touches on sensitive regional 'competitiveness' issues, the latter of which we will expound on later in the analysis, it is a logical and interesting research issue that is worth pursuing.

The rest of the paper is set out as follows. Discussion on exchange rate intervention and its underlying motivation is presented next. Section 3 discusses model specifications and the econometric testing employed to assess the degree of asymmetrical exchange rate behavior. The key empirical findings are analyzed and highlighted in Section 4. In the following section, we present and examine bilateral trade patterns of the five Asian economies. The main objective of this section is to further substantiate the analyses presented in Section 4. A brief concluding section ends the paper.

2. Exchange Rate Intervention and Exchange Market Pressure

As is illustrated and documented in early seminal works, countries often intervene to limit a sudden or large currency depreciation (Calvo and Reinhart, 2002) or strongly fear a sudden or large currency appreciation (Levy-Yeyati and Sturzenegger, 2007). In other words, even under an observed shift to flexible exchange rate regimes, the pursuit of an active exchange rate policy as part of a "leaning against the wind exchange rate policy" might still be the norm.[4] To initially investigate the possibility of what can be labeled an asymmetrical exchange rate regime, we resort to a useful and commonly applied concept of EMP index in the spirit of Kaminsky et al. (1998) and Kaminsky and Reinhart (1999), which can be formally expressed as follows:

[4] The earlier study of Almekinders and Eijffinger (1996) finds that during the post-Louvre period, US and German central banks tried to counteract appreciations of their currency more strongly than depreciations.

$$EMP_{i,t} = \frac{\Delta e_{i,t}}{e_{i,t}} - \frac{\sigma_e}{\sigma_r}\frac{\Delta r_{i,t}}{r_{i,t}} + \frac{\sigma_e}{\sigma_{\text{int}}}\Delta \text{int}_{i,t}, \quad (1)$$

where $\left(EMP_{i,t}\right)$ is the exchange market pressure index for country (i) in period (t); $e_{\text{i,t}}$ is the unit of country *i*'s currency per US dollar in period *t*; (σ_e) is the standard deviation of the rate of change in the exchange rate $\left(\frac{\Delta e_{i,t}}{e_{i,t}}\right)$; $(r_{i,t})$ is the gross foreign reserves of country (i) in period *t*; and (σ_r) is the standard deviation of the rate of change in reserves $\left(\frac{\Delta r_{i,t}}{r_{i,t}}\right)$; $(\text{int}_{i,t})$ is the nominal interest rate for country (i) in period *t*, and (σ_{int}) is the standard deviation of the change in the nominal interest rate, $(\Delta \text{int}_{i,t})$.

As contrasted with similar constructions of the EMP index,[5] in the above equation, one can see the different weights given to these three key components of the exchange market pressure index. In particular, the weights of the interest rate and reserve fluctuations depend on the relative size of their standard deviations—(σ_r) and (σ_{int}), respectively—against that of the exchange rate, (σ_e). Hence, a positive (negative) EMP index suggests the presence of selling/depreciation (buying/appreciation) pressures on the local currency.

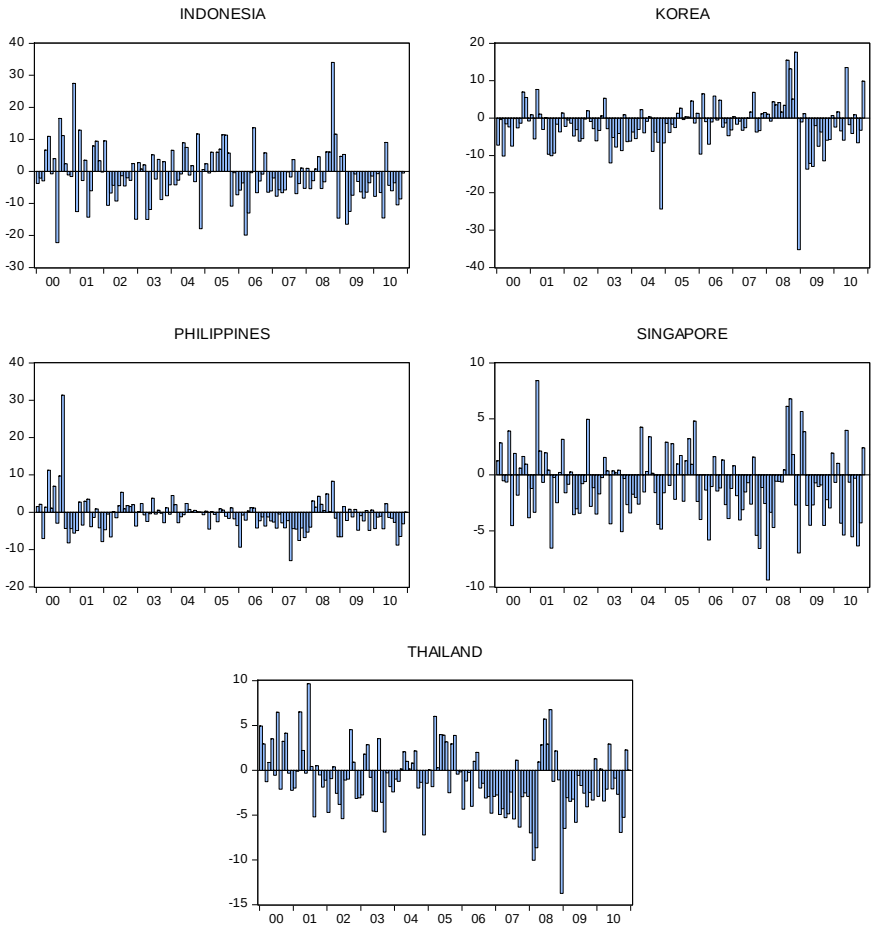
Given the lack of either official disclosure on the foreign exchange intervention or the currency composition and denominations of foreign exchange reserves of these five economies included in our study, we follow the standard approach of calculating the EMP based on the US dollar exchange rate and the foreign exchange reserves expressed in US dollars. For the basic purpose of tracing the presence of active foreign exchange market intervention, it is sufficient for the EMP construction to be derived as above.

In general, we found all currencies included in our study experienced buying pressure (negative EMP) before the Global Financial Crisis (GFC: 2000–07) and for

[5] See, for instance, Eichengreen et al. (1995, 1996).

most of 2008–10, with the exception of the last quarter of 2008 and the first quarter of 2009, when the currencies of most emerging markets were under selling pressure following the closure of Lehman Brothers (Figure 1). We also found, during most parts of 2000–10, a steady accumulation of foreign exchange reserves. Combining this evidence of buying/appreciation pressures and reserve accumulation, one cannot dismiss the possibility of a "leaning against the wind" policy stance adopted by the central banks of these countries during the period of observation. The trends and individual components of the EMP provide indications of policy interventions to manage the volatility of the local currencies. More importantly, the initial evidence also shows that the efforts tend to be biased towards mitigating appreciation pressures rather than depreciation pressures. Hence, there seems to be evidence of asymmetrical exchange rate intervention behavior. In turn, a set of empirical testing will be carried out to formally confirm the presence of fear of appreciation and to trace the possible role of the Chinese renminbi in this asymmetrical exchange rate intervention behavior.

Figure 1. Exchange Market Pressure Index



3. Empirical Approach

3.1. Smooth Transition Auto-Regressive (STAR) Model

The smooth transition auto-regressive (STAR) model is a nonlinear time-series model that allows the variable under investigation—in the present case denoted as $\Delta\ln exr$, the first difference of the log of the nominal exchange rate (local currency per US dollar or the Chinese renminbi)—to adjust smoothly every moment within different regimes. This model may be written as:

$$\Delta\ln exr = \alpha_0 + \sum_{i=1}^{p}\alpha_i(\Delta\ln exr_{t-i}) + \left[\beta_0^* + \sum_{i=1}^{p}\beta_i^*(\Delta\ln exr_{t-i})\right]F(\Delta\ln exr_{t-d}) + \varepsilon_t \quad (2)$$

,

where α_0 is the linear intercept term; α_i (i = 1, …, p) stand for the linear auto-regressive parameters; β_0^* is the nonlinear intercept term, β_1^* (i = 1, …, p) stand for the nonlinear auto-regressive parameters, $F(\Delta\ln exr_{t-d})$ is the transition function that characterized the smooth transition between two regimes that depend on the lagged term of the first difference of the log of the nominal exchange rate, $\Delta\ln exr_{t-d}$, where d is the delay lag length, and ε_t is a white noise with zero mean and constant variance.

The theoretical and empirical aspects of this model are rather involved and extensively discussed in a number of studies. Interested readers should refer to Dijk et al. (2002) and Terasvirta and Anderson (1992) for a thorough discussion of STAR models. Nonetheless, depending on the specification of the transition function, the natural starting point in describing the STAR model is the two-regime LSTR1 model with the following general logistic transition function, which takes values in the interval between zero and one:

$$F(\gamma, c; y_{t-d}) = \frac{1}{1+\exp(-\gamma(y_{t-d}-c))}, \quad \gamma > 0 \quad (3)$$

,

where γ is the slope parameter (the magnitude of which measures the speed of transition between the two regimes), c is the threshold parameter (the value of which indicates the location of the transition) and y_{t-d} is the transition variable with the associated delay parameter d.

It turns out that a variant of the LSTR1 model is well suited to testing whether East Asian currencies exhibit aversion to appreciations. In particular, one can resort to the LSTR2 model suggested in Terasvirta (1998).[6] The transition function of the LSTR2 model is the second-order logistic function:

$$F(\gamma, c_L, c_H; y_{t-d}) = \frac{1}{1+\exp(-\gamma(y_{t-d}-c_L)(y_{t-d}-c_H))}, \quad \gamma > 0 \qquad (4)$$

.

Notice that the LSTR2 transition function resembles the transition function of the LSTR1 model but the LSTR2 transition function involves two threshold parameters: c_L (the lower or appreciation threshold) and c_H (the upper or depreciation threshold). These lower (c_L) and upper (c_H) threshold parameters can be utilized to test for asymmetrical exchange rate behavior as these thresholds measure the relative tolerance of monetary authorities of exchange rate variations. To be more specific, if the upper threshold, c_H, is larger than the (absolute value of the) lower threshold, c_L, this suggests monetary authorities' aversion to currency appreciations.[7]

4. Empirical Results

Our estimation is based on weekly data for the five Asian countries—namely, Indonesia, Korea, the Philippines, Singapore and Thailand—and we divided the estimation into three distinct periods: pre GFC (January 2000 – December 2006), GFC (January–July 2009), and post GFC (August 2009 – March 2011). All nominal exchange rate (domestic currency per US dollar and Chinese renminbi, respectively) data for these countries are obtained from the Pacific Exchange Rate Service (http://fx.sauder.ubc.ca). The rationale for the choice of the three distinct periods is

[6] The other possible choice of the transition function is given by the exponential transition function: $F(\gamma,c; y_{t-d}) = 1 - \exp(-\gamma(y_{t-d} - c)^2)$. One limiting behavior though of the ESTAR model is that for large values of γ, this model becomes practically indistinguishable from a linear model.

[7] It should be noted at this point that since the nominal exchange rate is defined in this paper as the local currency with respect to either the US dollar or the Chinese renminbi, the lower (c_L) threshold parameter corresponds with the central banks' tolerance of appreciation (appreciation threshold), whereas the upper (c_H) threshold parameter corresponds with the central banks' tolerance of depreciation (depreciation threshold) of its local currency with respect to the two benchmark currencies.

based on the view that the bulk of reserve accumulation occurred during the pre-GFC period, as evidenced from official reserves data and numerous academic studies; the period of the GFC captures the massive volatilities experienced by the countries examined and, consequently, led to the drawdown or de-accumulation of reserves by these same countries; while the post-GFC period correspond with the several months after the collapse of Lehman Brothers and is in agreement with official announcements and publications by international multilateral institutions of a global economic recovery that is under way.

In general, the construction of STAR models follows the same steps as in the ARIMA–Box–Jenkins modeling approach,[8] wherein the modeling cycle consists of model specification, parameter estimation, and diagnostic evaluation. While the linearity tests conducted easily reject in favor of STAR-type models in all cases, in view of the stated objective of this paper, it is only sensible that we automatically resort to fitting a LSTR2 model to the data and leave to the diagnostic stage the question of whether this choice is appropriately supported by the data.[9] Appendix Tables A1a–c present the estimation results of our LSTR2 models for the pre-GFC (Table A1a), GFC (Table A1b), and post-GFC periods (Table A1c) in that respective order using the first-difference of the log of the nominal exchange rate defined as the domestic currency per US dollar. The Appendix Tables A2a–c present the estimation results of our LSTR2 models using the first-difference of the log of the nominal exchange rate defined as the domestic currency per Chinese renminbi for the same respective periods of the pre-GFC (Table A2a), GFC (Table A2b), and post-GFC periods (Table A2c) also in that respective order.

In every table, the first two rows of results present the auto-regressive order p chosen (first row) and the optimal delay lag length d (second row).[10] From these reported p and d values in each table, Appendix Tables A1a–c and A2a–c also report the

[8] See Box and Jenkins (1970).

[9] For more discussion of this procedure, see Terasvirta (1998).

[10] The reported auto-regressive order p was chosen according to the partial auto-correlation function (PACF) and selection criterion such as the Akaike information criterion, whereas the reported optimal delay lag length d was chosen according to the smallest p-value of the linearity tests. These results are not reported here for the sake of brevity, but are available from the authors upon request.

corresponding estimation results of fitting LSTR2 models for the five East Asian currencies. The majority of the estimated coefficients in each table is statistically different from zero. More importantly, as reported in the last row of Appendix Tables A1a–c and A2a–c, the residuals from the fitted LSTR2 models are all random and white noise, which suggests the suitability of fitting an LSTR2 model in the nominal exchange rate data of the five East Asian currencies.

We now examine our main focus of interest: the lower or appreciation threshold (c_{L}) and upper or depreciation thresholds (c_{H}) from the fitted LSTR2 models, which are presented in Table 1. This table is divided into three panels: the upper panel contains the estimated lower and upper thresholds for the pre-GFC period, the middle panel reports the lower and upper thresholds for the GFC period, and the lower panel contains the lower and upper thresholds for the post-GFC period. Each period would then report the lower and upper thresholds for the two nominal exchange rate definitions of the domestic currency with respect to the US dollar and the Chinese renminbi, respectively. Turning first to the estimated lower and upper thresholds for the pre-GFC period (domestic currency with respect to the US dollar), these are at 1.34and 3.83 percent, respectively, for the Indonesian rupiah; 1.49 and 2.12 percent for the Korean won; –1.8 and 3.88 percent for the Philippine peso; –0.39 and 0.71 percent for the Singapore dollar; and –0.07 and 1.9 percent for the Thai baht. This shows that in all five of the East Asian currencies considered, the upper threshold, c_H, is larger than the (absolute value of the) lower threshold, c_L, which indicates a lower threshold tolerance or aversion from the concerned monetary authorities in these countries to currency appreciations against the US dollar. This is likewise the outcome we obtain when we examine the case of the nominal exchange rate defined in terms of the domestic currency per Chinese renminbi: 0.84 and 7.02 percent, respectively, for the Indonesian rupiah; 1.2 and 2.49 percent for the Korean won; 0.26 and 0.24 percent for the Philippine peso; 0.57 and 1.93 percent for the Singapore dollar; and 0.95 and 1.96 percent for the Thai baht.

In other words, our results firmly support the case that during the pre-GFC period the monetary authorities in these five countries exemplified a lower threshold tolerance of or aversion to currency appreciations regardless of whether one looks at the nominal exchange rate defined as the domestic currency against the US dollar or the Chinese

renminbi. More interestingly, it is also clear from the absolute differences between c_H and c_L that, with the lesser exception of the Philippine peso, the remainder of the East Asian currencies considered exemplify a much greater aversion to appreciations when the Chinese renminbi is used as the comparator base currency. Furthermore, apart from the clear absence of a relative tolerance or allowance for sizeable appreciations against the Chinese renminbi, we also observe a greater relative tolerance (based on c_H) for currency depreciations against the Chinese renminbi than against the US dollar.

Table 1. Threshold Values (percent)

	Pre-GFC period, January 2000 – December 2006			
	per US$		per Chinese renminbi	
	Lower threshold (c_L)	Upper threshold (c_H)	Lower threshold (c_L)	Upper threshold (c_H)
Indonesian rupiah	1.34 (0.01)***	3.83 (0.28)***	0.84 (0.07)***	7.02 (0.06)***
Korean won	1.49 (0.04)***	2.12 (0.08)***	1.20 (0.18)***	2.49 (1.09)**
Philippine peso	–1.80 (0.18)***	3.88 (0.03)***	0.26 (0.02)***	0.24 (0.06)***
Singapore dollar	–0.39 (0.11)***	0.71 (0.13)***	0.57 (0.02)***	1.93 (0.02)***
Thai baht	–0.07 (0.01)***	1.90 (0.08)***	0.95 (0.05)***	1.96 (0.05)***
	GFC period, January 2007 – July 2009			
	per US$		per Chinese renminbi	
	Lower threshold (c_L)	Upper threshold (c_H)	Lower threshold (c_L)	Upper threshold (c_H)
Indonesian rupiah	–0.78 (0.02)***	0.88 (6.9)	–1.46 (0.07)***	–0.24 (0.04)***
Korean won	–0.37 (0.02)***	1.61 (1.20)	–3.17 (0.19)***	10.0 (27.4)
Philippine peso	–2.57 (0.06)***	–1.58 (0.05)***	–1.76 (0.34)***	–0.80 (0.10)***
Singapore dollar	–2.07 (0.17)***	–1.11 (4.15)	–2.40 (0.05)***	–0.22 (0.04)***
Thai baht	–3.02 (0.23)***	–1.25 (0.16)***	–1.43 (0.02)***	0.58 (0.47)
	Post-GFC period, August 2009 – March 2011			
	per US$		per Chinese renminbi	
	Lower threshold (c_L)	Upper threshold (c_H)	Lower threshold (c_L)	Upper threshold (c_H)
Indonesian rupiah	0.44 (0.06)***	1.31 (0.23)***	0.59 (0.04)***	1.35 (0.32)***
Korean won	–1.60 (0.09)***	3.09 (0.07)***	–1.64 (0.18)***	3.08 (0.15)***
Philippine peso	0.22 (0.05)**	2.12 (0.13)***	0.84 (0.06)***	1.77 (0.08)***
Singapore dollar	0.10 (0.01)***	0.24 (0.01)***	0.09 (0.05)	0.63 (0.10)***
Thai baht	–0.69 (0.10)***	0.87 (0.02)***	0.10 (0.07)	0.22 (0.08)***

Note: Numbers in parentheses are standard errors. Significance levels: * 10%; ** 5%; *** 1%.

According to our findings, however, this phenomenon of fear of appreciation all but disappeared during the height of our chosen period of the GFC. Understandably, the preference of the monetary authorities in these countries is to avoid a free fall in the value of their currencies so they adopt the typical strategy during financial turmoil of resisting or leaning against the significant selling pressures that are brought to bear on these currencies by international financial markets. In light of the proposed testing strategy laid out in this paper, this is interpreted as either significantly negative lower and upper thresholds or a significantly negative lower threshold but with an insignificant upper threshold.[11] As reported in the middle panel of Table 1, the former applies to the cases of the Philippine peso, Singapore dollar and Thai baht *vis-à-vis* the US dollar as well as the cases of the Indonesian rupiah, Philippine peso and Singapore dollar *vis-à-vis* the Chinese renminbi. The latter applies to the cases of the Indonesian rupiah and Korean won *vis-à-vis* the US dollar as well as to the cases of the Korean won and Thai baht this time *vis-à-vis* the Chinese renminbi.

More interestingly, once this tumultuous period of the GFC subsided, can we find a reappearance of the behavior akin to the pre-GFC period of fear of or aversion to currency appreciation? And, more so, similar to what we find in the pre-GFC period, is this fear of or aversion to appreciations exemplified to a greater extent in the case of the Chinese renminbi than with the US dollar in the aftermath of the GFC? As to the first question, based on the most recent data at the time of writing, there are indications that the GFC only briefly and temporarily interrupted this behavior and as such this phenomenon might have reasserted itself on the part of the monetary authorities in these countries. To varying degrees, all five countries show a revealed preference for limiting the extent of strengthening their currencies against the US dollar (0.44 and 1.31 percent, respectively, for the Indonesian rupiah; –1.60 and 3.09 percent for the Korean won; 0.22

[11] Both of these cases are the results we expect and this is reasonably logical since in any crisis situation, the preference of a monetary authority is to mitigate or alleviate the pressure of its currency depreciating or sliding in a free fall such that both threshold parameters (c_L and c_H) must either be significantly negative (indicating its preference for its currency to strengthen) or, to a lesser extent, a significantly negative lower threshold but with an insignificant upper threshold (again to indicate that it is willing to accept a much stronger currency in a crisis situation, while averting the possibility of a free fall in the value of its own currency).

and 2.12 percent for the Philippine peso; 0.10 and 0.24 percent for the Singapore dollar; and –0.7 percent and 0.87 percent for the Thai baht).

In other words, it is only understandable that after coming out of a tumultuous period punctuated by sharp and volatile movements in their exchange rates, it is necessary for these countries to slow the pace of the depreciation of their currencies with respect to the US dollar, while at the same time retain their preference to restrain the strengthening of their currencies against the US dollar. For instance, when compared with their respective pre-GFC behavior, we observed that this analysis applies in the cases of the Indonesian rupiah, Singapore dollar and Thai baht. In the case of the Korean won, however, which can be depicted as the most affected amongst the five Asian currencies in the group during the GFC, we observe some loosening in the resistance to the appreciation of this currency against the US dollar after the GFC, which is in marked contrast with the outcome found during the pre-GFC period. Furthermore, to some extent, this alleged reappearance, akin to the pre-GFC period, of fear of or aversion to currency appreciations can also be argued to apply in the case of the Chinese renminbi as the base comparator currency (0.59 and 1.35 percent, respectively, for the Indonesian rupiah; –1.64 and 3.08 percent for the Korean won; 0.84 and 1.77 percent for the Philippine peso; 0.09 and 0.63 percent for the Singapore dollar; and 0.1 and 0.22 percent for the Thai baht).

With regards to the second question posed earlier as to whether the pre-GFC finding of a greater fear of appreciating against the Chinese renminbi than the US dollar also applies in the aftermath of the GFC—as depicted in the lower panel of Table 1, the relative values of the lower and upper thresholds seem to indicate that the greater fear of appreciation of these currencies pre-GFC with respect to the Chinese renminbi than against the US dollar is not yet strongly supported in the data. Only the further passage of time can validate this important exchange rate policy question for this set of economies.

5. Bilateral Trade Patterns and Beyond: The dominant role of Mainland China

How can we possibly explain the renminbi having such an influential role on the Asian currencies? One of the frequently advanced factors behind the increasing influence of the Chinese renminbi is the rise of China as a major trading partner of countries around the globe, including the five Asian economies in our study. In fact, China has become both a major exporter and a major importer of tradable goods in Asia. China, the second-largest economy in the world, ultimately accounted for about 50 percent of all trade flows in imported inputs in Asia in 2009—more than double its share in 1995 (IMF, 2011). At the same time, China's share of direct and indirect intermediate goods exports within Asia doubled to nearly 30 percent in 2009—from 15 percent a decade earlier.

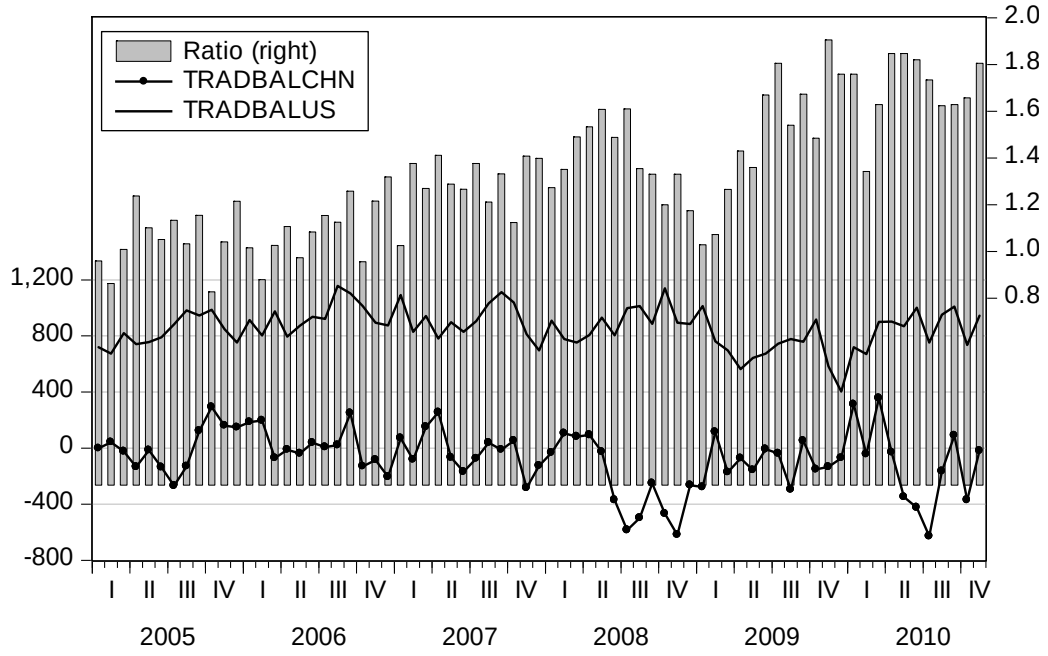
A simple calculation of trade ratios for all five Asian economies in terms of their bilateral trade patterns with China, the United States and Japan consistently reveals the rapidly emerging dominant role of China as a major trading partner (Figures 2–6).[12] The steep increase in total trade with China started to be noticeable in the early 2000s—only a few years after the 1997 East Asian crisis in all five Asian economies examined. The monthly total trade of Indonesia with China, for instance, was averaging only about 52 percent and 31 percent of the country's trade with the United States and Japan, respectively, in 2000. In 2006, just before the outbreak of the sub-prime crisis, the average monthly trade with China rose to less than 10 percent of the trade with the US economy. By 2010, Indonesia's average monthly trade with China was about 70 percent higher than with the United States, and about 1.1 times the monthly trade with Japan. The story of rising Chinese influence and trade importance for these major East

[12] The calculation of the trade ratio proceeds as follows. We take the ratio of total trade (exports plus imports) with China and total trade with the United States and Japan, respectively. So, for the case of Indonesia, for instance, the ratio of total bilateral exports and imports of Indonesia with China against the total bilateral exports and imports of Indonesia with the United States is calculated. We also do this for the ratio of total bilateral exports and imports of Indonesia with China against the total bilateral exports and imports of Indonesia with Japan. An increasing ratio, therefore, suggests the relative increasing role of China in the bilateral trade patterns of the five Asian economies, and a diminishing one for both the United States and Japan.

and Southeast Asian economies can be very much repeated for all five economies included in our study. In particular, the rapid rise of China's bilateral trade with its regional neighbors is most evident in the case of Korea. By the end of 2010, Korea's monthly trade with China was averaging about 2.4 times the country's trade with the traditional markets: the United States and Japan.

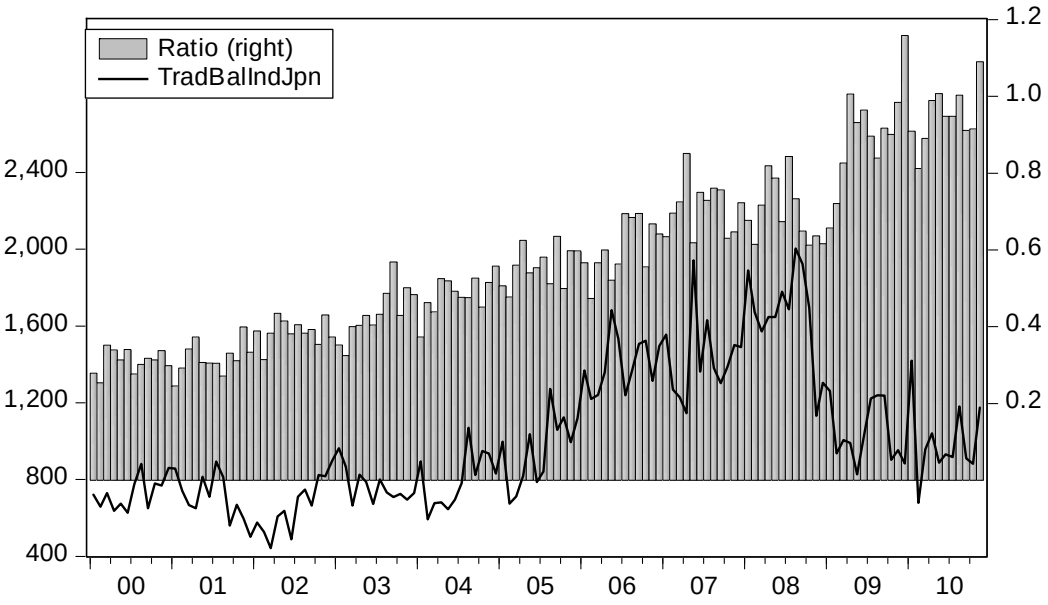
More importantly for policymakers in these East and Southeast Asian regions, maintaining trade surpluses with China is critical to achieve an overall strong current account position. W ith the exception of Indonesia and Singapore, and to a lesser extent the Philippines, the other major Asian countries had successfully maintained trade surplus positions during the past decade with China. Korea and Thailand, in particular, saw a growing trade surplus with China during the latter half of the past decade. Indonesia, on the other hand, saw its monthly marginal trade surplus of about US$70 million during the first half of the 2000s (until 2006) turn into a deficit of about US$150 million following the sub-prime crisis. As an export-processing economy, Singapore has been the processing hub of imported goods from all three major trading partners (China, Japan and the United States).

Figure 2. Indonesia



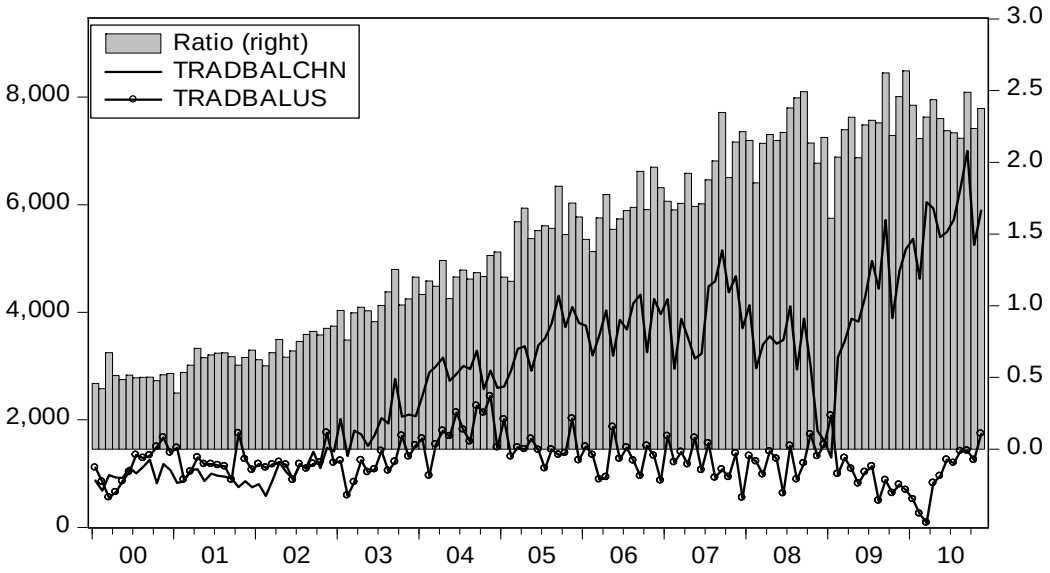
Note: Ratio is the ratio of total trade with China (exports and imports) and total trade with the United States. TRADBALCHN and TRADBALUS are trade balances with China and the United States, respectively. Trade balance is calculated as export minus import.

Figure 2b. Indonesia–Japan–China



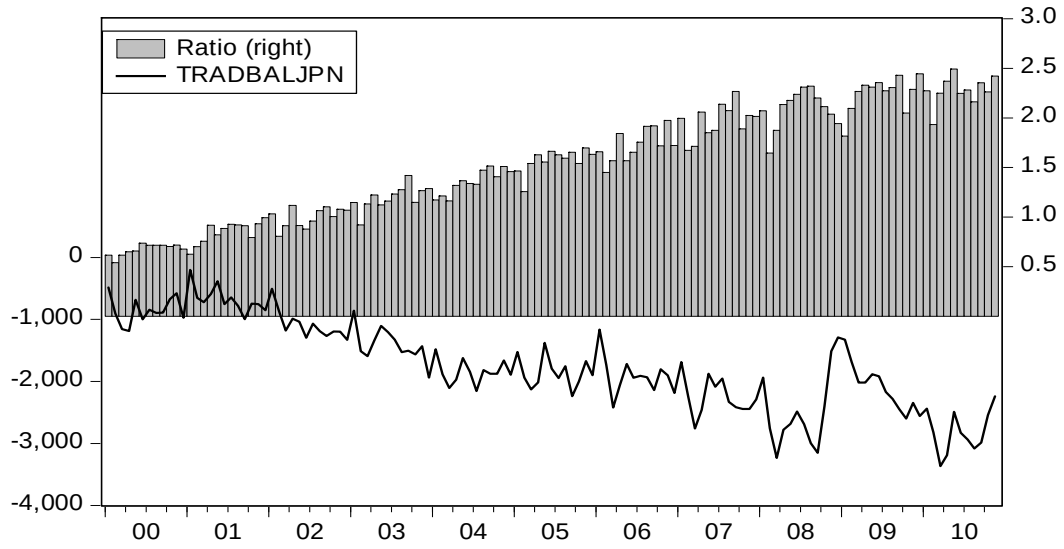
Note: Ratio is the ratio of total trade with China (exports and imports) and total trade with Japan. TRADBALJPN is trade balance with Japan. Trade balance is calculated as export minus import.

Figure 3. Korea–China–US Trade



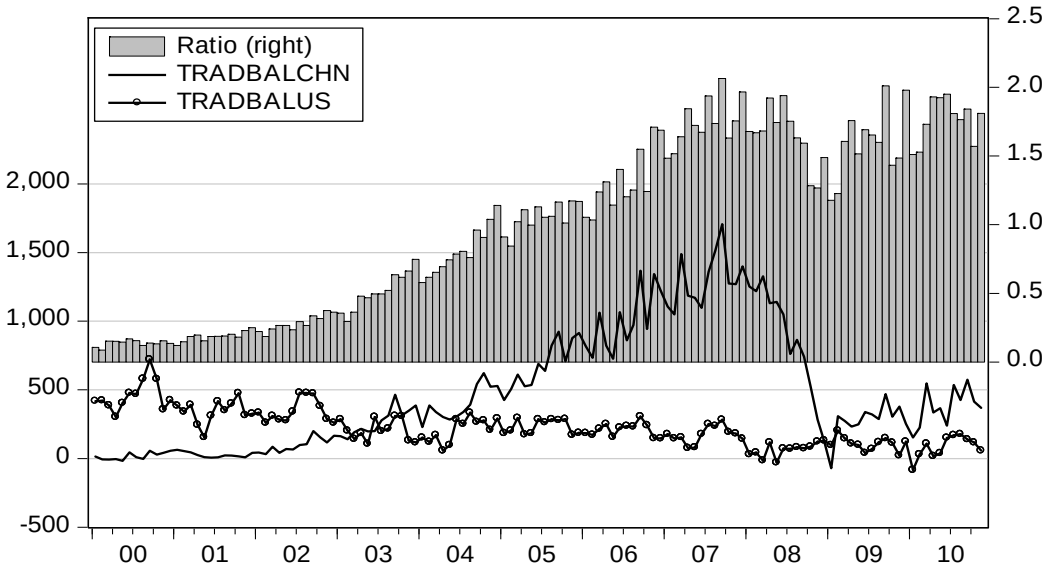
Note: Ratio is the ratio of total trade with China (exports and imports) and total trade with the United States. TRADBALCHN and TRADBALUS are trade balances with China and the United States, respectively. Trade balance is calculated as export minus import.

Figure 3b. Korea–China–Japan



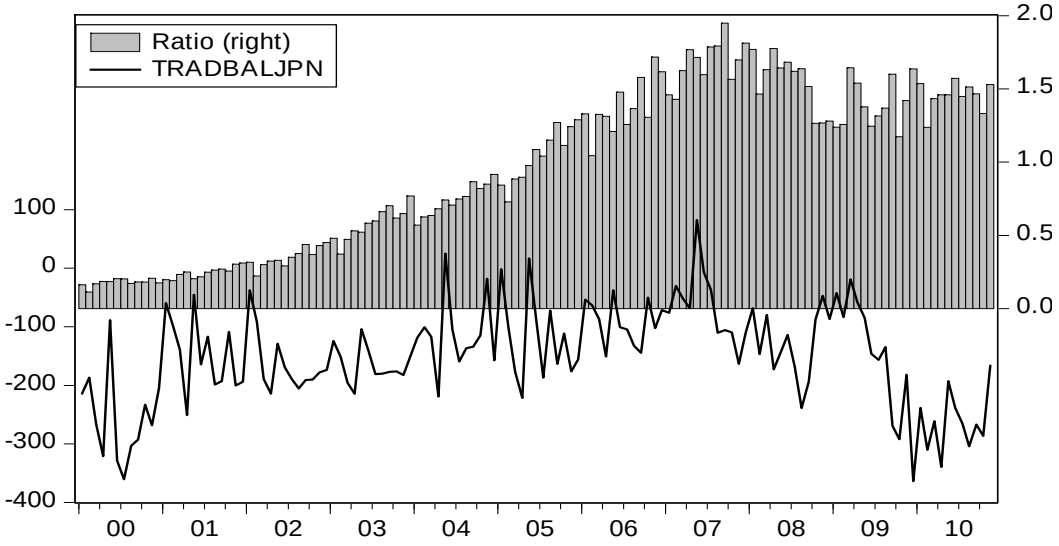
Note: Ratio is the ratio of total trade with China (exports and imports) and total trade with Japan. TRADBALJPN is trade balance with Japan. Trade balance is calculated as export minus import.

Figure 4. The Philippines–China–US Trade



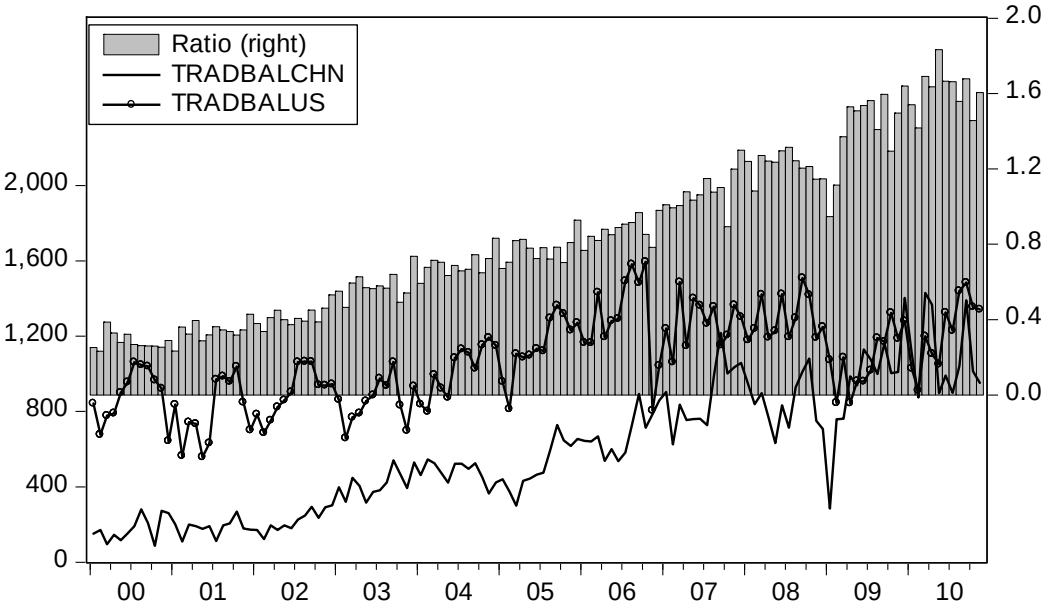
Note: Ratio is the ratio of total trade with China (exports and imports) and total trade with the United States. TRADBALCHN and TRADBALUS are trade balances with China and the United States, respectively. Trade balance is calculated as export minus import.

Figure 4b. The Philippines–China–Japan Trade



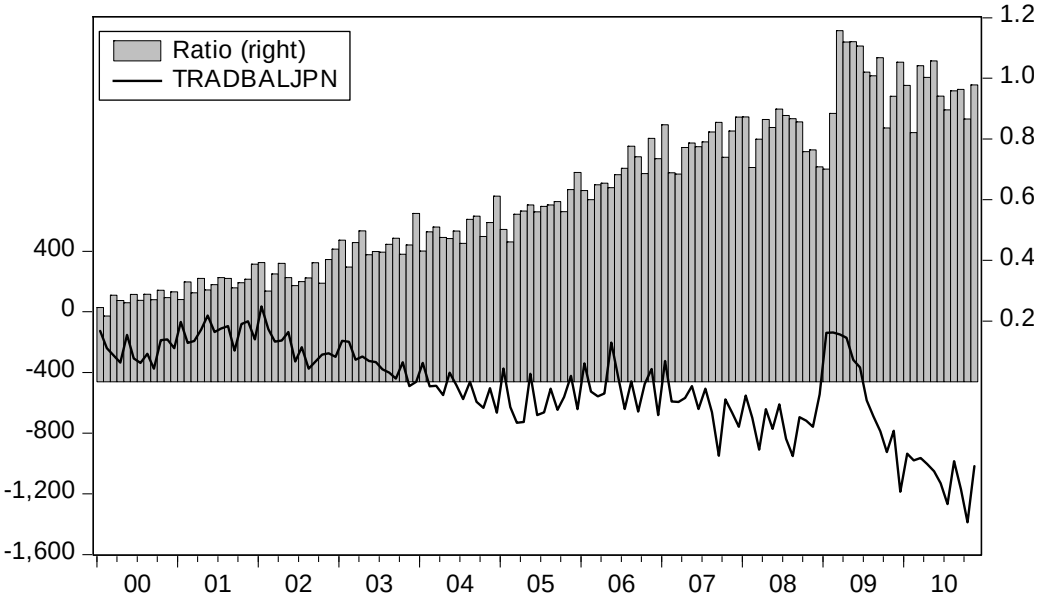
Note: Ratio is the ratio of total trade with China (exports and imports) and total trade with Japan. TRADBALJPN is trade balance with Japan. Trade balance is calculated as export minus import.

Figure 5. Thailand–China–US Trade



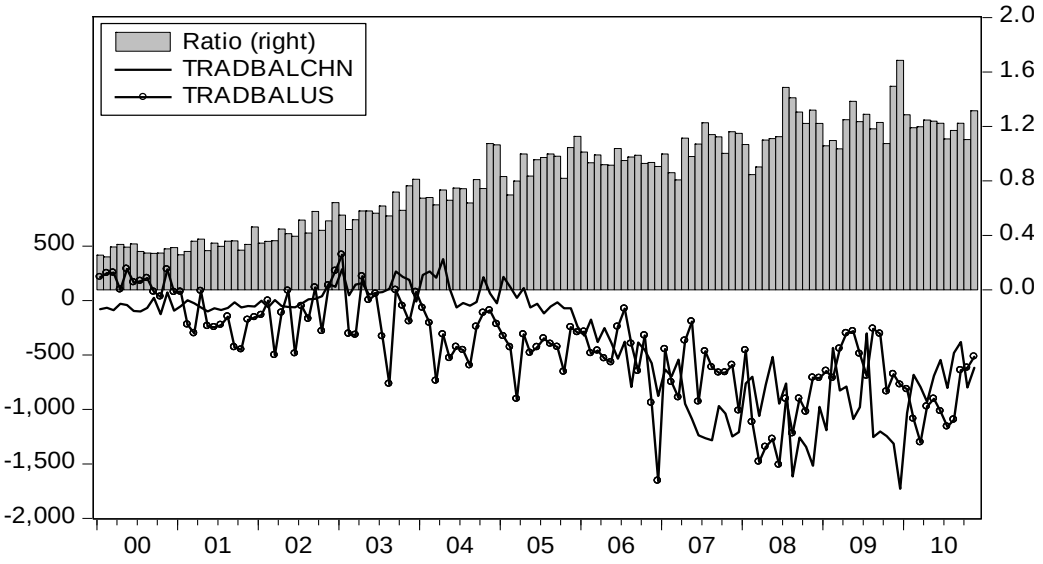
Note: Ratio is the ratio of total trade with China (exports and imports) and total trade with the United States. TRADBALCHN and TRADBALUS are trade balances with China and the United States, respectively. Trade balance is calculated as export minus import.

Figure 5b. Thailand–China–Japan



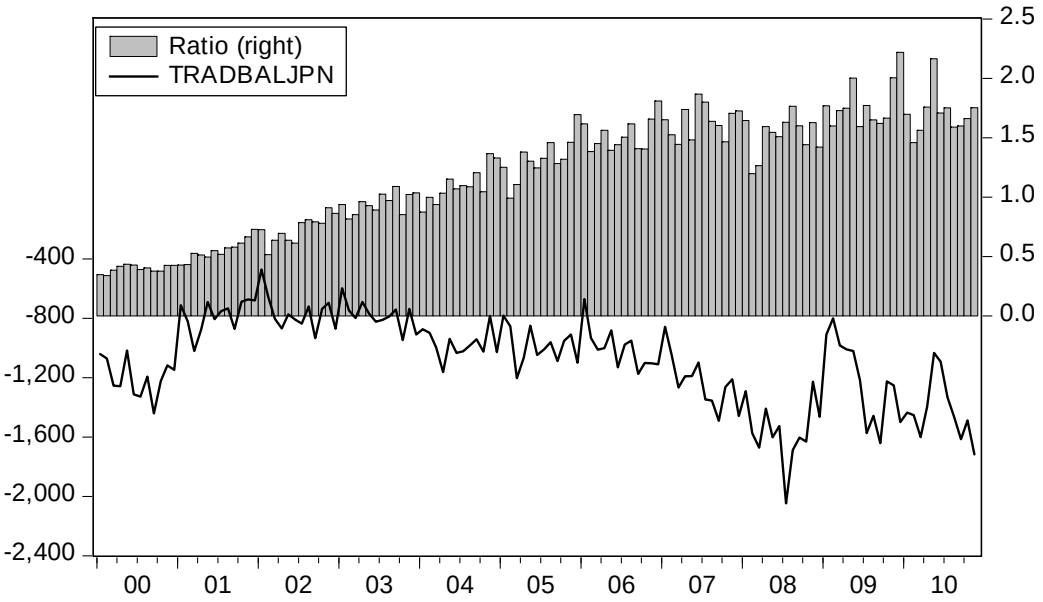
Note: Ratio is the ratio of total trade with China (exports and imports) and total trade with Japan. TRADBALJPN is trade balance with Japan. Trade balance is calculated as export minus import.

Figure 6. Singapore–China–US



Note: Ratio is the ratio of total trade with China (exports and imports) and total trade with the United States. TRADBALCHN and TRADBALUS are trade balances with China and the United States, respectively. Trade balance is calculated as export minus import.

Figure 6b. Singapore–China–Japan



Note: Ratio is the ratio of total trade with China (exports and imports) and total trade with Japan. TRADBALJPN is trade balance with Japan. Trade balance is calculated as export minus import.

To understand further the influence of Chinese trade on these five Asian economies, it is imperative to look further into the structures of trade in what is the world's second-largest economy. It is estimated that processing trade accounted for more than 40 percent of China's total trade by the mid-2000s, and these processing trades explained most of China's trade balances with its trading partners globally (Xing, 2011).[13] Four of our East and Southeast Asian economies examined here—namely, Korea, the Philippines, Thailand and Singapore—have been competing in this processing trade. In 2008, these four economies were in fact listed as among the top-10 sources of China's processing imports (Xing, 2011). Korea, for example, exported about US$60 billion worth of China's processing imports, while the processing exports of Thailand, the Philippines and Singapore were worth about US$12.5 billion, US$10 billion and US$8.8 billion, respectively.

[13] A typical example of processing trade is iPhone trade between the People's Republic of China (PRC) and the United States. This advanced mobile phone is assembled exclusively in China. All the components, however, are produced in Germany, Japan, Republic of Korea, Taipei, China and the United States. These components are shipped to and the final products are fully assembled in the PRC, before being exported to the rest of the world (Xing, 2011).

China has also been the largest exporter of labor-intensive goods to the rest of the world and a major competitor for a number of labor-abundant East and Southeast Asian economies examined here—namely, Indonesia, the Philippines and Thailand. Studies such as Thorbecke (2011) and Thorbecke and Zhang (2009) found labor-intensive exports from China and Association of South-East Asian Nations (ASEAN) countries to be very sensitive to exchange rates in both the exporting country and other countries exporting labor-intensive exports to third markets. Based on panel data analysis looking at about 30 countries over the 1987–2006 period, Thorbecke and Zhang (2009) reported that for China a 10 percent appreciation of the renminbi would reduce labor-intensive exports by about 17 percent, and a 10 percent depreciation among competing countries would decrease exports by about 9 percent. Similarly, analyzing an annual panel data set including exports to 25 countries over the 1983–2007 period, Thorbecke (2010) found that for ASEAN countries, a 10 percent appreciation in the exporting country would reduce that country's labor-intensive exports by about 20 percent, and a 10 percent depreciation among competing countries would decrease the ASEAN countries' exports by about 12 percent. These results support the claim that profit margins for these goods are thin, and that exchange rates play a critical role in the overall competitiveness of the labor-intensive export products of these economies.

Going forward, the influence of the Chinese renminbi and the exchange rate policy of China is likely to gain further momentum with the internationalization of its currency. As a result of the use of the renminbi for conducting trade and investment, coupled with the gradual movement of the renminbi towards greater exchange rate flexibility, there will be a pressing need to strengthen regional cooperation in the broad arena of trade and finance. For example, in order to ensure stability in trade and investment activities between and during the peak of the recent sub-prime GFC, the monetary authorities of Hong Kong, Indonesia, Malaysia, Korea and Singapore signed swap agreements, denominated in renminbi, with the central bank of China (Table 4). In fact, this swap arrangement has been widely extended by the Chinese central bank to other trading partners outside the region.[14]

[14] Since the onset of the GFC, China has also signed swap arrangements with Belarus, Argentina, Iceland, New Zealand and Uzbekistan.

Table 4. People's Bank of China's Swap Agreements with Asian Central Banks

Counterparty central bank	Date of announcement	Terms of agreements	Amount (RMB billion)	Stated purpose
Bank of Korea	12 December 2008	3	180.0	Address short-term liquidity in financial system and improve bilateral trade
Hong Kong Monetary Authority	20 January 2009	3	200.0	Extend short-term liquidity support to mainland operations of Hong Kong banks
Bank Negara Malaysia	8 February 2009	3	80.0	Bilateral trade and investment
Bank Indonesia	March 23, 2009	3	100.0	Bilateral trade and investment
Monetary Authority of Singapore	23 July 2010	3	150.0	Bilateral trade and investment

Source: Web site of the People's Bank of China.

6. Conclusion

There are still significant concerns in the Asian economies examined in this paper about allowing market forces to completely determine their exchange rates. To be more specific, these economies continue to be characterized by a great aversion to appreciation, or what is now known as 'fear of appreciation'. Our findings confirm those of earlier works. Our study, however, goes one step further by bringing to light the vital role of the Chinese renminbi in shaping the exchange rate behavior of these same five major Asian currencies. Whereas some of the previous studies continue to underscore the return of the soft US dollar pegging in Asia post crisis, our findings indicate that there is an even greater dimension to this story: the greater fear of appreciation against the renminbi than against the US dollar, especially prior to the GFC.

Our finding, therefore, lends further support to the claim that links the exchange rate policy of China to the overall fear of appreciation in Asia. Bergsten (2004), for instance, asserts that China continued to "strengthen its competitiveness" by "riding the dollar down", which in turn "severely truncated the adjustment process" because other Asian countries fear losing competitiveness against China and thus block their appreciation against the US dollar. This will preserve appreciation expectations among other Asian currencies and fuel further demand for emerging market currencies that foster a further need to intervene to prevent currency appreciation. This will likely derail the supposed global rebalancing process (Kiguel and Levy-Yeyati, 2009). This in turn implies that only if China allows the renminbi to rise, are other Asian countries likely to follow suit. Only then will Asia play its full part in the issue of global rebalancing.

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Appendix

Table A1a. Estimation Results of LSTR2 Models for East Asian Currencies *vis-à-vis* US Dollar (pre-GFC sample period, weekly data, January 2000 – December 2006)

	Indonesian rupiah	Korean won	Philippine peso	Singapore dollar	Thai baht
P	5	1	3	8	1
d	2	3	1	5	9
Linear part					
Intercept	0.037 (0.01)***	0.004 (0.00)	0.001 (0.00)	–0.000 (0.00)	–0.000 (0.00)
$\Delta\ln exr_{t-1}$	–0.478 (0.15)***	–0.708 (0.26)**	0.369 (0.06)***	0.365 (0.08)***	0.471 (0.07)***
$\Delta\ln exr_{t-2}$	–0.889 (0.38)**		0.170 (0.04)***	–0.005 (0.10)	
$\Delta\ln exr_{t-3}$	–0.579 (0.16)***		0.062 (0.05)	0.038 (0.09)	
$\Delta\ln exr_{t-4}$	0.123 (0.12)			–0.182 (0.10)*	
$\Delta\ln exr_{t-5}$	–0.271 (0.10)***			0.248 (0.15)*	
$\Delta\ln exr_{t-6}$				–0.027 (0.10)	
$\Delta\ln exr_{t-7}$				–0.091 (0.14)	
$\Delta\ln exr_{t-8}$				–0.222 (0.13)*	
Nonlinear part					
Intercept	–0.037 (0.01)***	–0.005 (0.00)	–0.096 (0.01)***	–0.000 (0.00)	0.001 (0.00)
$\Delta\ln exr_{t-1}$	0.893 (0.15)***	1.023 (0.27)***	–2.311 (0.23)***	–0.056 (0.18)	–0.319 (0.10)***
$\Delta\ln exr_{t-2}$	0.823 (0.39)**		–1.791 (0.29)***	–0.181 (0.17)	
$\Delta\ln exr_{t-3}$	0.827 (0.17)***		3.870 (0.76)***	–0.101 (0.16)	
$\Delta\ln exr_{t-4}$	–0.189 (0.13)			0.229 (0.19)	
$\Delta\ln exr_{t-5}$	0.187 (0.12)			–0.197 (0.19)	
$\Delta\ln exr_{t-6}$				–0.229 (0.17)	
$\Delta\ln exr_{t-7}$				0.425 (0.19)**	
$\Delta\ln exr_{t-8}$				0.412 (0.22)*	
LB-Q test	0.20	0.72	0.67	0.74	0.33

Note: p is the number of lags of the linear auto-regressive model; d is the optimal delay parameter; numbers in parentheses are standard errors, whereas numbers in the LB-Q test are p-values. Significance levels: * 10%; ** 5%; *** 1%.

Table A1b. Estimation Results of LSTR2 Models for East Asian Currencies *vis-à-vis* US Dollar (GFC sample period, weekly data, January 2007 – July 2009

	Indonesian rupiah	Korean won	Philippine peso	Singapore dollar	Thai baht
p	2	1	2	1	1
d	4	12	1	2	5
Linear part					
Intercept	0.000 (0.01)	0.002 (0.00)	–0.142 (0.08)*	–0.010 (0.00)**	0.007 (0.00)
$\Delta\ln exr_{t-1}$	0.206 (0.13)	–0.216 (0.12)*	–6.567 (3.74)*	–0.974 (0.50)**	1.704 (0.91)*
$\Delta\ln exr_{t-2}$	0.242 (0.13)**		–1.971 (0.86)**		
Nonlinear part					
Intercept	0.001 (0.00)	–0.002 (0.00)	0.143 (0.075)*	0.010 (0.00)**	–0.007 (0.00)
$\Delta\ln exr_{t-1}$	–0.358 (0.29)	0.911 (0.18)***	6.735 (3.73)*	1.310 (0.50)***	–1.679 (0.92)*
$\Delta\ln exr_{t-2}$	–0.839 (0.36)**		2.047 (0.87)**		
LB-*Q* test	0.57	0.58	0.62	0.13	0.16

Note: *p* is the number of lags of the linear auto-regressive model; *d* is the optimal delay parameter; numbers in parentheses are standard errors, whereas numbers in the LB-Q test are *p*-values. Significance levels: * 10%; ** 5%; ***1%.

Table A1c. Estimation Results of LSTR2 Models for East Asian Currencies *vis-à-vis* US Dollar (post-GFC sample period, weekly data, August 2009 – March 2011)

	Indonesian rupiah	Korean won	Philippine peso	Singapore dollar	Thai baht
p	1	1	1	1	1
d	2	2	1	7	11
Linear part					
Intercept	–0.002 (0.00)	–0.001 (0.00)	–0.010 (0.00)***	–0.014 (0.01)**	–0.001 (0.00)
$\Delta\ln exr_{t-1}$	–0.840 (0.35)**	0.607 (0.13)***	1.237 (0.37)***	–1.259 (0.86)	0.577 (0.12)***
Nonlinear part					
Intercept	0.001 (0.00)	0.006 (0.00)	0.009 (0.004)**	0.013 (0.00)***	0.003 (0.00)*
$\Delta\ln exr_{t-1}$	1.077 (0.37)***	–1.364 (0.26)***	–1.242 (0.42)***	1.398 (0.88)	–0.837 (0.28)***
LB-*Q* test	0.75	0.97	0.16	0.98	0.40

Note: *p* is the number of lags of the linear auto-regressive model; *d* is the optimal delay parameter; numbers in parentheses are standard errors, whereas numbers in the LB-Q test are *p*-values. Significance levels: * 10%; ** 5%; *** 1%.

Table A2a. Estimation Results of LSTR2 Models for East Asian Currencies *vis-à-vis* Chinese Renminbi (pre-GFC sample period, weekly data, January 2000 – December 2006)

	Indonesian rupiah	Korean won	Philippine peso	Singapore dollar	Thai baht
P	3	1	1	1	1
D	2	4	5	1	11
Linear part					
Intercept	0.003 (0.00)	0.004 (0.00)	0.017 (0.00)***	0.005 (0.00)**	0.004 (0.00)***
$\Delta\ln exr_{t-1}$	–0.528 (0.13)***	1.316 (0.23)***	–2.248 (0.16)***	–0.236 (0.29)	–0.180 (0.16)
$\Delta\ln exr_{t-2}$	0.166 (0.20)	0.297 (0.19)			
$\Delta\ln exr_{t-3}$	0.072 (0.11)				
Nonlinear part					
Intercept	–0.003 (0.00)	–0.005 (0.00)	–0.016 (0.00)***	–0.006 (0.00)***	–0.004 (0.00)***
$\Delta\ln exr_{t-1}$	0.976 (0.14)***	–1.099 (0.24)***	2.349 (0.17)***	0.496 (0.30)*	0.516 (0.17)***
$\Delta\ln exr_{t-2}$	–0.267 (0.21)	–0.316 (0.194)			
$\Delta\ln exr_{t-3}$	0.114 (0.12)				
LB-*Q* test	0.19	0.76	0.18	0.13	0.60

Note: *p* is the number of lags of the linear auto-regressive model; *d* is the optimal delay parameter; numbers in parentheses are standard errors, whereas numbers in the LB-Q test are *p*-values. Significance levels: * 10%; ** 5%; *** 1%.

Table A2b. Estimation Results of LSTR2 Models for East Asian Currencies *vis-à-vis* Chinese Renminbi (GFC sample period, weekly data, January 2007 – July 2009)

	Indonesian rupiah	Korean won	Philippine peso	Singapore dollar	Thai baht
P	2	5	1	1	3
D	6	2	9	1	8
Linear part					
Intercept	0.003 (0.00)	0.004 (0.00)**	–0.004 (0.00)	0.007 (0.00)**	0.002 (0.00)
$\Delta\ln exr_{t-1}$	0.255 (0.33)	0.253 (0.10)***	–0.350 (0.43)	1.299 (0.33)***	0.257 (0.12)**
$\Delta\ln exr_{t-2}$	0.819 (0.42)**	–0.229 (0.12)**			–0.171 (0.13)
$\Delta\ln exr_{t-3}$		–0.010 (0.09)			–0.157 (0.13)
$\Delta\ln exr_{t-4}$		–0.411 (0.085)***			
$\Delta\ln exr_{t-5}$		0.337 (0.09)***			
Nonlinear part					
Intercept	–0.002 (0.00)	0.006 (0.01)	0.006 (0.003)**	–0.006 (0.00)**	–0.001 (0.00)
$\Delta\ln exr_{t-1}$	–0.041 (0.38)	0.119 (0.47)	0.678 (0.44)	–1.054 (0.35)***	0.005 (0.19)
$\Delta\ln exr_{t-2}$	–0.921 (0.46)**	0.983 (0.24)***			0.530 (0.20)**
$\Delta\ln exr_{t-3}$		–0.546 (0.34)			0.523 (0.18)**
$\Delta\ln exr_{t-4}$		1.508 (0.40)***			
$\Delta\ln exr_{t-5}$		–0.392 (0.66)			
LB-*Q* test	0.55	0.14	0.73	0.17	0.47

Note: *p* is the number of lags of the linear auto-regressive model; *d* is the optimal delay parameter; numbers in parentheses are standard errors, whereas numbers in the LB-Q test are *p*-values. Significance levels: * 10%; ** 5%; *** 1%.

Table A2c. Estimation Results of LSTR2 Models for East Asian Currencies *vis-à-vis* Chinese Renminbi (post-GFC sample period, weekly data, August 2009 – March 2011)

	Indonesian rupiah	Korean won	Philippine peso	Singapore dollar	Thai baht
p	1	3	3	1	1
d	4	2	3	7	11
Linear part					
Intercept	–0.002 (0.00)	–0.004 (0.00)	–0.087 (0.06)	–0.003 (0.00)	–0.004 (0.00)
$\Delta\ln exr_{t-1}$	–0.982 (0.35)***	0.617 (0.15)***	–0.328 (0.73)	0.589 (0.32)*	1.526 (1.605)
$\Delta\ln exr_{t-2}$		–0.282 (0.14)***	0.189 (0.85)		
$\Delta\ln exr_{t-3}$		0.106 (0.137)	7.938 (5.00)		
Nonlinear part					
Intercept	0.002 (0.00)	0.008 (0.01)	0.086 (0.06)	0.002 (0.00)	0.003 (0.00)
$\Delta\ln exr_{t-1}$	1.180 (0.37)***	–1.628 (0.58)***	0.411 (0.74)	–0.549 (0.35)	–1.119 (1.62)
$\Delta\ln exr_{t-2}$		0.343 (0.24)	–0.384 (0.86)		
$\Delta\ln exr_{t-3}$		–0.162 (0.263)	–8.060 (5.01)		
LB-Q test	0.68	0.98	0.70	0.43	0.55

Note: p is the number of lags of the linear auto-regressive model; d is the optimal delay parameter; numbers in parentheses are standard errors, whereas numbers in the LB-Q test are p-values. Significance levels: * 10%; ** 5%; *** 1%.

CHAPTER 8

What Drives Some Countries to Hoard Foreign Reserves?

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Managing capital flows and liquidity demand has been a central issue for emerging-market countries. In an era of global imbalances, rapid accumulation of foreign exchange reserves by surplus countries is also an issue for the interntional system. In a well-functioning international financial system there would be no advantage to holding large reserves so this raises the question of whether surplus countries have a deliberate strategy of building reserves and why they would do this. This paper examines the motives for foreign reserve accumulation and analyzes the effects of financial development and capital flows on reserve accumulation in East Asian economies. We present a model in which a state holds reserves to supply foreign exchange liquidity in underdeveloped financial markets. Using annual data for 12 Asian economies between 1980 and 2009, our empirical results confirm the precautionary motives and financial stability motives in the region. We also find that financial development attenuates central banks' motivation to hoard reserves by reducing the impacts of capital flows on foreign reserve demand. The policy implications are that improving financial market development within developing countries will reduce the incentive to build surpluses and accumulate reserves, while improving the international financial system to reduce volatility would also help.

Keywords: foreign reserves, capital flows, financial development

JEL Classifications: F31, F32, E44

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1. Introduction

> The lack of a clear benchmark for the appropriate level of precautionary reserves, and for the appropriate use of reserves, is a problem, both at the country level and at global level.
>
> — Olivier Jeanne[3]

Over the past two decades, East Asian economies have accumulated a large amount of foreign reserves. The reserves in the region were merely US$0.7 trillion before the Asian crisis in 1997, but rose nine fold to about US$6 trillion in 2010. This amount is more than half of total global foreign reserves.

Four major motivations behind the rapid reserve build-up, as often suggested, are precautionary self-insurance against crisis (Aizenman and Lee, 2008), mercantilism to stimulate growth (Dooley et al., 2004), supporting the overall banking system and insuring against financial instability (Obstfeld et al., 2010), and managing exchange rate volatility (Levy-Yeyati and Sturzenegger, 2006). These four rationales become even stronger amid increasing global capital flows, which are often volatile and potentially destabilizing. Capital flows, for instance, increase output volatility (Mendoza and Terrones, 2008), cause real exchange rate appreciation and thus loss of competitiveness (Corden, 1993), and drive asset bubbles (Grenville, 2008).

Reserve build-up, however, involves some types of domestic risks and costs (Pineau et al., 2006). The most significant ones include inflationary pressure, asset bubbles, misallocation of domestic bank lending, complications in the management of monetary policies, sterilization costs, and potentially sizeable capital losses on central banks' balance sheets. Conflict between reserve accumulation (that is, as a result of intervention in foreign exchange markets) and inappropriate increases in money supply, for instance, could cause inflation and asset price bubbles. Sterilization costs—as another example—can be a considerable drain on a country's budget when the reserves are excessive (Rodrik, 2006).[4]

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[3] Jeane (2010).

[4] Sterilization cost is the spread between interest paid on external borrowing and the returns from investment of reserves. For such costs, Rodrik (2006) provides an estimate of 1 percent of GDP when the reserve level is 30 percent of GDP.

To dampen macroeconomic effects associated with reserve accumulation and capital inflows, countries have applied various policies such as modest capital controls, sterilized foreign exchange intervention, and fiscal tightening. As these policies have generally not proved to be effective in many cases, a satisfactory way of managing capital flows and reserve build-up remains to be discovered.

In this paper, we hypothesize that the development of a deep and active financial sector attenuates the impact of capital flows on the demand for reserves. Capital inflows influence reserve demand via their volatility, potential destabilizing effects, and the risks of sudden stop and reversal (Frankel, 2010; Jeanne, 2010; Kaminsky et al., 2004). Financial development, meanwhile, reduces the impacts of capital flows on real exchange rate appreciation (Saborowski 2009), and lowers output and macroeconomic volatility (Raddatz, 2006). The main reason is that a well-functioning financial market enables efficient utilization of capital inflows, mobilizes resources, facilitates risk diversification, and provides access to global liquidity during shocks (Beck and Levine, 2004; Beck et al., 1999; King and Levine, 1993).

We present a model in which the state holds reserves in order to supply foreign exchange liquidity in underdeveloped financial markets. Our theoretical argument is that with the low capacity of the private sector to meet liquidity demand when financial markets are underdeveloped, the state plays a role in supplying additional liquidity. Thus, in our model, the development of the financial system reduces the monetary authority's motivation to hoard reserves for liquidity provision.

Using annual data for 12 East Asian economies between 1980 and 2009, we empirically examine the motives for foreign reserve accumulation and analyze the effects of capital flows and financial development on reserve demand. Fixed effects and alternative measures of financial development are also introduced to check the robustness of the estimations. We confirm the precautionary motives and financial stability motives for reserve demand in Asia. Our results also consistently suggest that financial sector development reduces the impacts of capital flows on the demand for reserves.

This paper contains three innovations. First, our analysis concentrates on East Asian economies that attract a large share of global capital flows. Second, we formally take into account the level of financial development in discussing foreign reserve

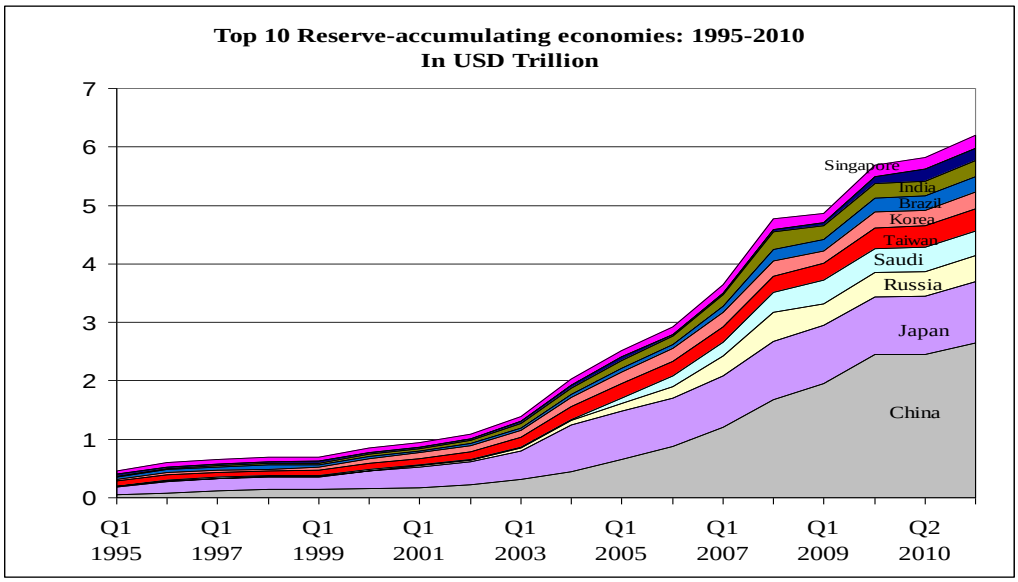
demand and capital flows. Third, we introduce a "rationalized" monetary policy reaction and the concept of private and public liquidity provision—first analyzed by Holmström and Tirole (1998)—into the framework set up by Obtsfeld et al. (2010).

The next section describes the recent trends in foreign reserve accumulation among Asian emerging-market economies. Section 3 provides a short review of the current state of understanding on foreign reserve accumulation and its nexus with capital flows and financial development. Section 4 introduces the theoretical underpinnings of the analysis. The formal model is presented in Appendix A. Section 5 presents the empirical investigation. Section 6 discusses the results. Section 7 concludes and sheds some light on policy implications in reserve accumulation. An appendix presents a model explaining the motives for reserve accumulation and the role of the private sector in liquidity provision.

2. Recent Trends in Foreign Reserve Accumulation Among Asian Economies

As can be seen in Figure 1, there are three features in the trend of reserve accumulation over the past two decades. First, reserves grew rapidly in 2002–07, at a pace three times more than that in 1999–2001. Second, central banks in East Asia, particularly China, accounted for the bulk of the build-up. Among the reserve accumulators, Asian economies are among the 10 largest reserve holders: China, Japan, Taiwan, Korea, India, Hong Kong, Singapore and Malaysia. The share of foreign reserves held by Asian economies increased from 45 percent in 1995 to 66 percent in 2010. Third, few monetary authorities held an increasingly larger share of the reserve holding. China and Japan accounted for more than half the total world reserve accumulation.

Figure 1. Top-10 Reserve-Accumulating Economies: 1995–2010 (in US$ trillion)

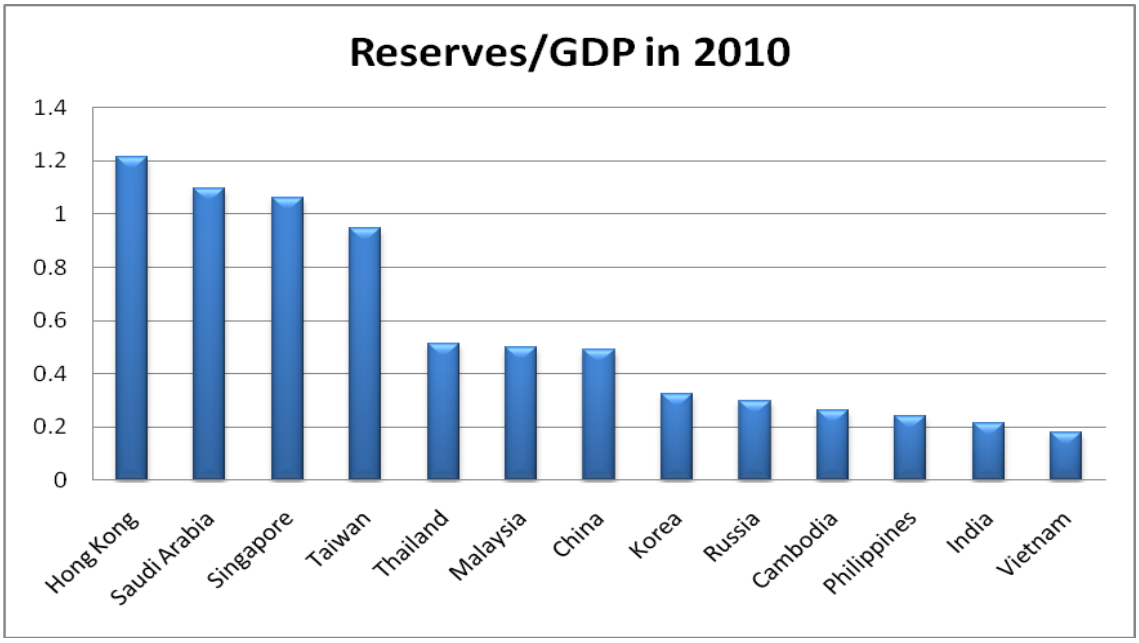


Source: Foreign exchange (series code:…1D.DZF), International Financial Statistics, IMF, (accessed 19 December 2010); Central Bank of the Republic of China (Taiwan).

As shown in Figure 2, Hong Kong accumulates the highest percentage of reserves to GDP (121 percent), followed by Singapore (106 percent), Taiwan (94 percent), Malaysia (50 percent), and China (49 percent).

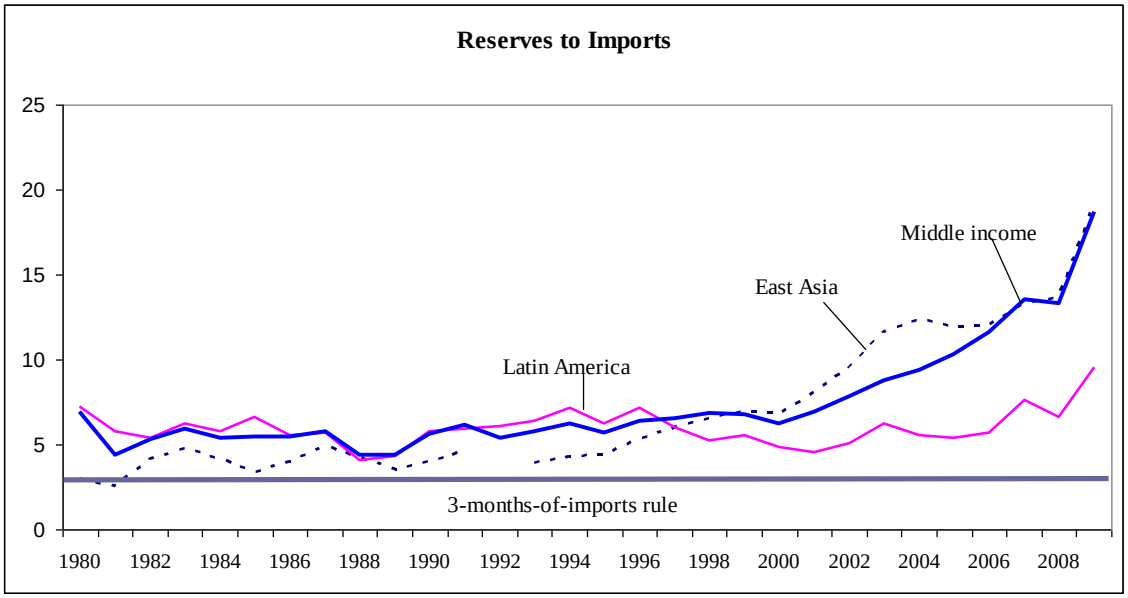
As shown in Figures 3, 4 and 5, ratios of reserves to imports for many Asian economies are far above the traditional rule of thumb, which is three to four months' coverage. Taiwan, for example, would be able to finance its imports for about two years with its reserves. Similarly, as can be seen in Figure 6, China's ratio of reserves to short-term external debt reaches a value of about 10, which is much higher than 1, suggested by the Greenspan–Guidotti rule. In addition, as shown in Figures 7 and 8, the reserves to broad money ratios in many Asian economies have increased significantly above the threshold values, which are suggested to be between 5 and 20 percent. In Singapore, for example, the ratio is about 90 percent.

Figure 2. Reserves/GDP in 2010



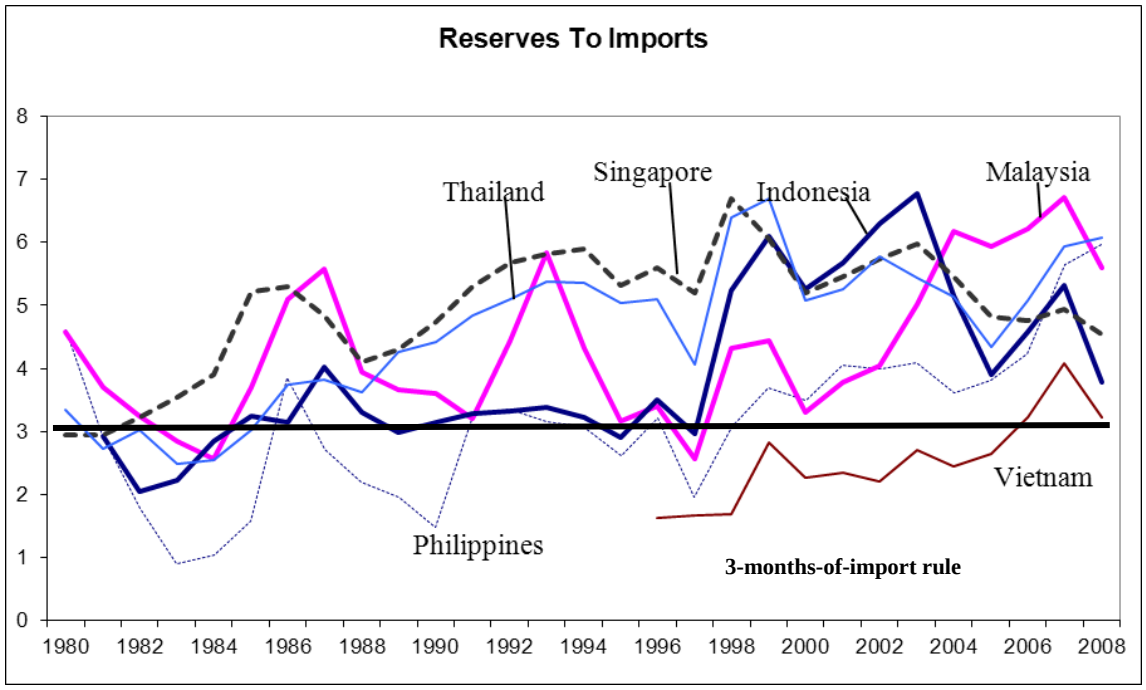
Source: International Financial Statistics, IMF. GDP from World Economic Outlook, IMF, (accessed 23 December 2010); Central Bank of the Republic of China (Taiwan).

Figure 3. Reserves to Imports



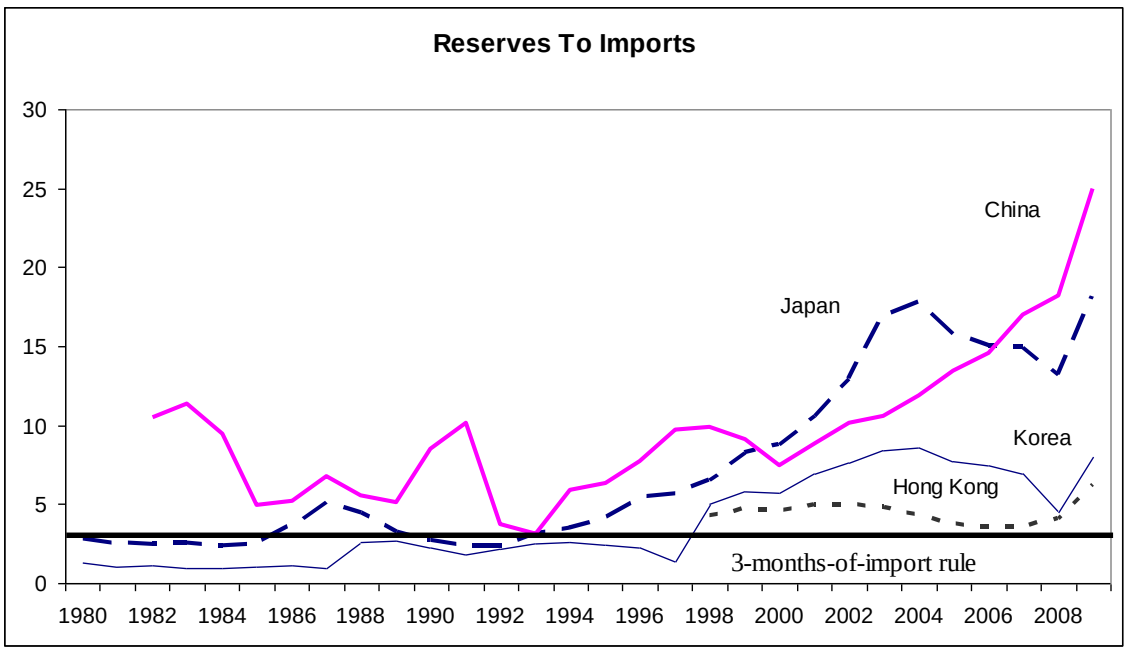
Source: World Development Indicators, World Bank (accessed 28 December 2010); Central Bank of the Republic of China (Taiwan).

Figure 4. Reserves to Imports



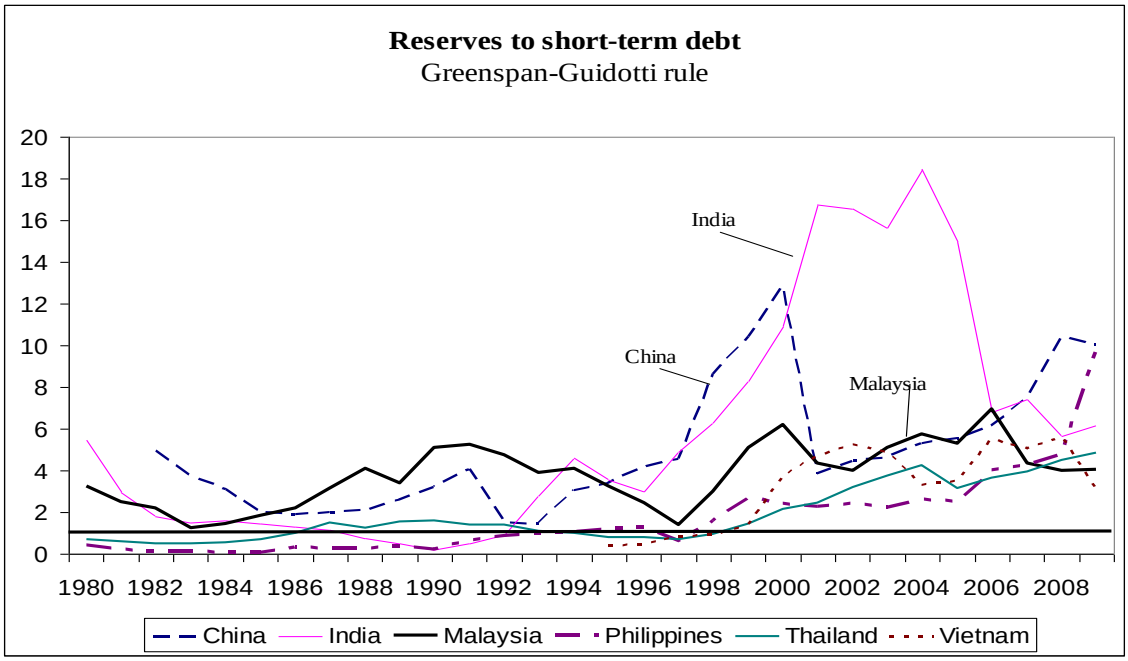
Source: World Development Indicators, World Bank (accessed 28 December 2010); Central Bank of the Republic of China (Taiwan).

Figure 5. Reserves to Imports



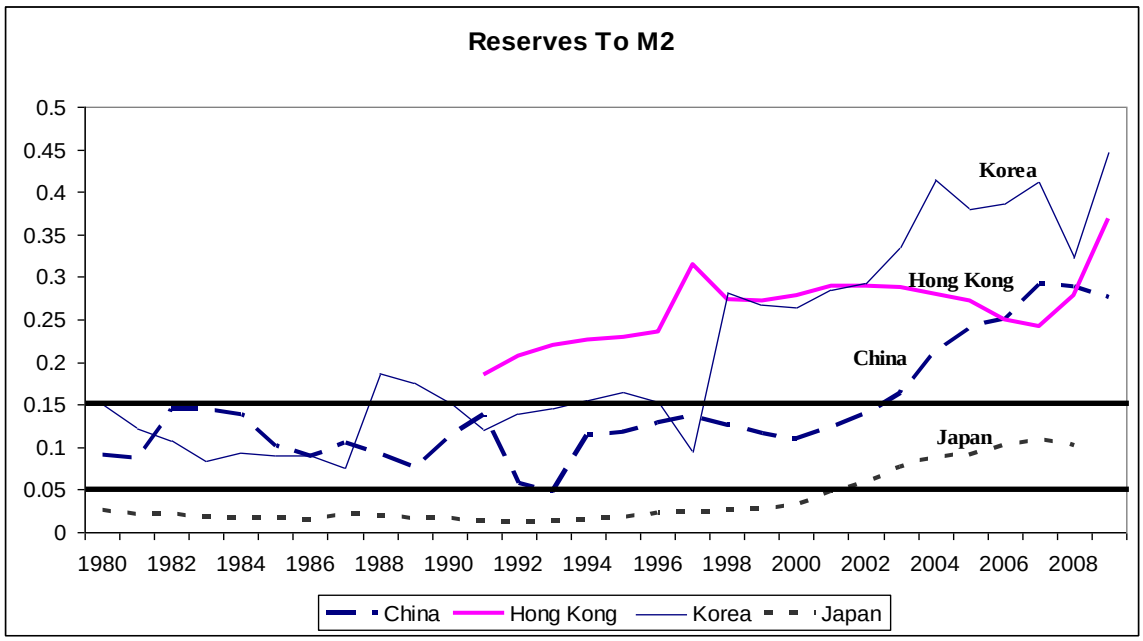
Source: World Development Indicators, World Bank (accessed 28 December 2010); Central Bank of the Republic of China (Taiwan).

Figure 6. Reserves to Short-Term Debt (Greenspan–Guidotti Rule)



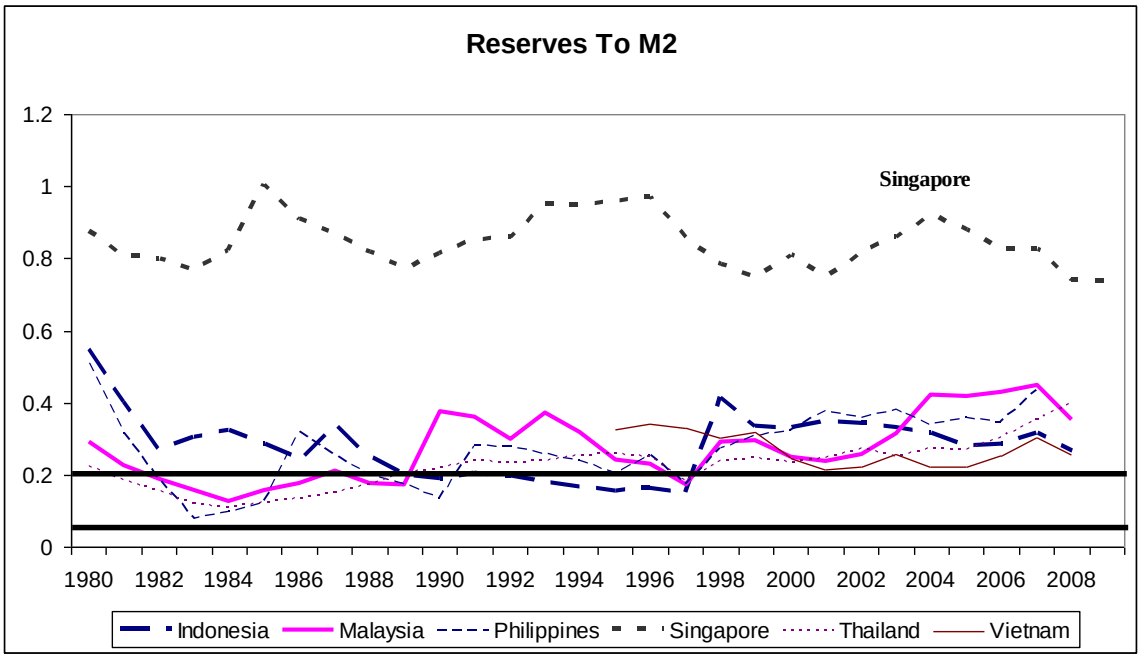
Source: Authors' calculation; World Development Indicators, World Bank (accessed 28 December 2010); Central Bank of the Republic of China (Taiwan).

Figure 7. Reserves to M2



Source: Authors' calculation; World Development Indicators, World Bank (accessed 28 December 2010); Central Bank of the Republic of China (Taiwan).

Figure 8. Reserves to M8



Source: Authors' calculation; World Development Indicators, World Bank (accessed 28 December 2010); Central Bank of the Republic of China (Taiwan).

Traditional indicators (see Box 1) for reserve adequacy suggest that in emerging Asian economies the stock of foreign reserves might be substantially in excess. The unprecedented accumulation in several key Asian economies indicates that factors other than purely precautionary motives might be driving the rapid build-up of international reserves (Aizenman and Lee, 2008). The evidence also suggests that limiting vulnerability has probably not been the primary motive for recent reserve build-ups in most economies. Nonetheless, determining the optimal level of foreign reserves is not straightforward as it is subject to uncertainty and institutional factors such as the degree of capital mobility, financial liberalization, or the weakness of the domestic banking system. Under financial globalization, the high volatility of capital flows complicates the conduct of monetary policy and exchange rate policy, and has impacts on an economy's ability—particularly those with underdeveloped financial markets—to deal with sudden capital inflows and outflows. This environment indeed influences the desired stock of foreign reserves (see Box 2 for the case of South Korea during the 2008 crisis).

Wijnholds and Kapteyn (2001) argue that the old rule of thumb that reserves should be equivalent to three months of imports is obsolete and a new benchmark that takes into account capital flows is needed. They argue that the new benchmark should consist of the sum of short-term debt (external drain) and an allowance for possible capital flight by domestic residents (internal drain), taking into account differences in country risk and the exchange rate regime.

Box 1. Traditional Indicators for Reserve Adequacy

Ratio	Value	Notes
Reserves to imports	3 to 4	This ratio represents the number of months for which an economy could support its current level of imports if all other revenues were to stop. As a rule of thumb, countries should hold foreign reserves in order to cover their imports for three to four months.
Reserves to short-term external debt	1	This ratio, known as the Greenspan–Guidotti rule, reflects an economy's ability to service its existing short-term external debt (debt maturing within a year) in the case of a sharp deterioration in the external financing conditions. Typically, the country is prudent if the ratio is equal to 1 (Garcia and Soto, 2006; Rodrik and Velasco, 1999).
Reserves to broad money (M2)	0.05 to 0.2	This ratio reflects the potential for resident-based capital flight from the domestic currency because broad money indicates a country's exposure to the withdrawal of assets. If the ratio is close to zero, broad money largely exceeds foreign reserves. In the case of an exchange rate peg regime, the lower the ratio, the higher is the potential for capital flight in the event of negative money demand shocks. This ratio has indeed increased in most Asian economies since the 1997 Asian crisis (see Wijnholds and Kapteyn, 2001)

3. Literature Review

3.1. Reserve Demand

Three major theoretical explanations stand out in the literature on reserve demand: precautionary motives, mercantilist motives, and financial stability motives. In the precautionary view, countries accumulate foreign reserves as self-insurance to avoid costly liquidation of long-term projects (Aizenman and Lee, 2008), and to smooth domestic absorption as a cushion against sudden stops in capital inflows (Jeanne and Rancière, 2006) when the economy is susceptible to sudden stops. In addition, countries can use international reserves to smooth the impact of capital-flow volatility, to manage an adjustable-peg or managed-floating exchange rate regime (Frankel, 1983), and to stabilize output (Aizenman et al., 2004; Garcia and Soto, 2006; Jeanne and Ranciere, 2006). Similarly, foreign reserves can be used to stabilize fiscal expenditure in countries with limited taxation capacity and sovereign risk, and limited access to the global capital market (Aizenman and Marion, 2004).

In the mercantile view, reserve accumulation is the result of a growth strategy by keeping exchange rates undervalued to stimulate export growth and competitiveness (Dooley et al., 2004). Moreover, foreign reserves can serve as "collateral" for encouraging foreign direct investment (FDI). Similarly, foreign reserve accumulation can occur in the aftermath of a growth strategy that combines export promotion and credit subsidization—known as "financial mercantilism" (Aizenman and Lee, 2008). The development experience of East Asia suggests the prevalence of export promotion by preferential financing, which effectively subsidizes investment in targeted sectors (Aizenman and Lee, 2008). The promotion was achieved in several ways, including through direct subsidies funded by state banks; by means of financial repression where favored sectors enjoyed preferential access to cheaper external debt; or through 'moral suasion' where private banks were encouraged to provide favorable financing.

In the financial stability view, a major motivation for central banks to hold foreign reserves is to support the overall banking system and to insure against financial instability (Obstfeld et al., 2010). In this view, financial shock is not simply a "sudden stop", in which case countries would need to hold reserves only in proportion to their

short-term external debt (Greenspan–Guidotti rule). Given such motivation and the desire for exchange rate stability and vulnerability to portfolio shifts by domestic residents, the monetary authority needs to hold reserves proportional to the size of its banking system.

3.2. Capital Flows, Reserve Accumulation and Financial Development

In this section, we connect the link among capital flows, reserve accumulation and financial development. Despite the benefits of capital flows on investment and growth (Bosworth and Collins, 1999; Mileva, 2008; Mody and Murshid, 2005), capital flows can have a direct impact on macroeconomic stability and then affect reserve demand through at least three channels, as can be seen in Box 3.

First, capital flows affect reserve demand through increased output volatility as they are more often pro-cyclical than countercyclical (Kaminsky et al., 2004; Mendoza and Terrones, 2008; Reinhart and Reinhart, 2008). Sudden changes in the direction of capital flows, for instance, tend to induce or exacerbate boom–bust cycles in economies that lack a deep and well-functioning financial sector (Aghion et al., 2005). This relation implies that increases in capital flows tend to increase output volatility, which motivates more precautionary demand for foreign reserves.

Second, capital inflows influence reserve demand through their appreciation impacts on the real exchange rate and thus have negative effects on the external competiveness of recipient economies (Athukorala and Rajapatirana, 2003; Corden, 1993). As Asian economies are fearful of appreciation (Pontines and Yongqiang, 2010), central banks are induced to intervene in foreign exchange markets by buying reserves to "lean against the wind" when there is upward pressure on exchange rates. The reasons for such intervention could be that a fixed or relatively rigid exchange rate can provide benefits in terms of macroeconomic stability, particularly to developing countries where financial development is limited and the capital market is closed (Aghion et al., 2009). On the contrary, real exchange rate volatility reduces growth in countries with relatively weak financial development (Aghion et al., 2009). In such cases, reserve accumulation is a result of intervening in foreign exchange markets or stabilizing the real exchange rate in the presence of volatile terms-of-trade shocks and potentially destabilizing capital flows.

Third, capital inflows motivate reserve demand when they drive up equity and asset prices (Grenville, 2008; Schadler, 2008), reduce the quality of assets, and adversely affect the maturity and currency composition of the balance sheets of the private sector. This contributes to greater financial fragility, which increases the odds of a currency crisis (Kaminsky and Reinhart, 1999). Real estate booms and asset price bubbles can amplify financial fragility and crisis risks, thus making the economy particularly vulnerable to financial shocks and crises (Reinhart and Rogoff, 2008). In such cases, a reserve build-up can also be associated with growing fragility of a country's banking system because concerns about financial stability lead countries to hoard foreign reserves for liquidity provision to mitigate the possible transmission of a banking crisis to a currency crisis during shocks.

Analysis of the three transmission types implies that the development of the financial sector can attenuate the reserve demand by weakening the impacts of capital flows on output volatility, the real exchange rate and financial fragility. First, a more developed financial system is associated with lower output volatility across countries (Beck et al., 1999). Second, a deep and active financial sector can provide broad investment opportunities, direct capital inflows towards their most productive use, mitigate investment demand constraints (Ötker-Robe et al., 2007), and thus reduce real exchange rate appreciation (Saborowski, 2009). Third, financial development has a large causal effect in the reduction of macroeconomic volatility as a result of liquidity provision by the financial sector (Raddatz, 2006), which then requires less liquidity provision by the government.

Different strands of the literature discussed above underline: i) the motivation to accumulate reserves; ii) the potentially adverse impacts of capital inflows on the recipient economies and thus on the reserve build-up; and iii) the importance of the financial market in mobilizing and allocating resources efficiently to attenuate the impacts. These findings shape our hypothesis that the impacts of capital flows on reserve demand could be attenuated by the development of deep financial markets and institutions.

4. Theoretical Motivation Based on Liquidity View

The theoretical framework underpinning our analysis rests on three important strands of the literature: foreign reserve accumulation, liquidity provision and financial development. We take into account the concept of liquidity in the model as it plays an essential role in the literature of financial crisis. Higher liquidity can significantly decrease countries' vulnerability to external shock in the face of weak domestic fundamentals (Mulder and Bussière, 1999). Similarly, in the model of amplification mechanism of financial shock, liquidity provision by the central bank can alleviate the crisis (Krishnamurthy, 2010).

Drawing on the work of Holmström and Tirole (1998), we introduce the concept of private versus public supply of liquidity (domestic versus international liquidity) into the framework in Obstfeld et al. (2010). In the case of liquidity demand shock, domestic residents or firms can meet liquidity by issuing claims on their productive assets or by using a credit line (Holmström and Tirole, 1998). When financial markets are not developed well enough to provide these options, however, the government might need to step in to supply additional liquidity. The underdeveloped financial markets could be caused by collateral constraints (Caballero and Panageas, 2005). In these circumstances, the build-up of foreign reserves is motivated by the government's role in supplying additional liquidity to domestic economic agents during a liquidity shock—that is, a sudden stop or capital outflows, with the presence of an underdeveloped capital market that fails to fully meet liquidity demand. This relation implies that the development of a deep and active financial market could bring about two benefits. First, it could promote resource mobilization for more private liquidity provision. Second, it can reduce the impacts of capital flows on macroeconomic and exchange rate volatility, and vulnerability to financial crisis. These two benefits, therefore, can attenuate the state's motivation to hoard reserves.

The theoretical reasoning outlined above motivates our simple modeling of the relationship between the demand for liquidity, the level of financial sector development and an economy's international reserve accumulation. In the model outlined in the Appendix, we follow Obstfeld et al. (2010) in deriving the liquidity demand in a

domestic economy. Unlike the framework set out in Obtseld et al. (2010), however, in which the central bank sells foreign reserves passively, we introduce a monetary reaction function based on optimizing behavior to motivate its intervention. Furthermore, as noted earlier, our model also introduces concepts of private versus public liquidity provision and the level of capital market development.

5. Empirical Approach

We turn to an empirical investigation on the liquidity demand, financial development and reserve accumulation. Based on the theoretical motivation outlined in the previous section and Appendix A, the reduced form for our empirical study can be simplified as:

$$\text{Re}serves = \alpha_1 + \alpha_2 Capflows_{it} + \alpha_3 Findev_{it} + \alpha_4 CapFin_{it} + \alpha_5 X_{it} + \eta_{it} + \varepsilon_{it}, \qquad (12)$$

where *Reserves* is the amount of foreign reserves, *Capflows* is capital inflows, *Findev* is financial development, and *Capfin* is the interaction terms between capital flows and financial development. X_{it} is a vector of control variables including GDP per capita, broad money, trade, exchange rate stability, and financial openness, which are often included in the literature. η is the fixed effect and ε is the error term. We also include a dummy for the post–Asian crisis period, POST, in order to capture potential differences in reserve accumulation patterns across countries between the pre and post Asian crisis periods.

The parameters of main interest are α_3 and α_4, which capture the effects of financial development and the interaction of capital flows and financial development on reserve accumulation, respectively. If financial development can attenuate the impact of capital flows on reserve accumulation then α_4 should be negative and statistically significant. Meanwhile, we expect the coefficient of capital flows, α_2, to be positive and that of financial development, α_3, to be negative.

For potential liquidity demand, we use broad money over GDP. Using broad money as a proxy for possible liquidity demand is motivated by (Wijnholds and Kapteyn, 2001), the Early Warning System literature, and the financial stability model presented by Obstfeld et al. (2010). Short-term external debt can also be a good proxy for liquidity demand. Given data availability, however, broad money (M2) is preferred in this analysis.

Financial development is a broad economic concept, within which there is a large literature on the measurement of financial development (see, for example, Beck et al., 1999). Among all measures, the sum of total external equity liability and debt liability is used as an indicator of a country's level of financial development in terms of access to external financial resources. The measure of financial market development as the extent of external liabilities is based on the assumption that countries with less developed domestic financial markets also have fewer external liabilities. Thus, this measure will be used for our main regressions and analysis. Besides, the total stock value traded measures financial market liquidity while stock-market capitalization reflects the size and depth of the market. These alternative measures will be used for a robustness check in the next section.

For financial openness, the Chinn–Ito Index (2008) is used. This index is based on the binary dummy variables that codify the restriction on cross-border financial transactions reported in the International Monetary Fund's *Annual Report on Exchange Arrangements and Exchange Restriction* (*AREAER*). A higher value signals a higher degree of openness to financial transaction.

For capital flows, we follow Mendoza (2010) by using the sum of the current account and net FDI inflows scaled by GDP. This measure captures more of the short-term component of capital flows (hot money)—considered to be volatile and potentially destabilizing in the literature. A negative value indicates the level of short-term flows needed to finance a current account deficit. A positive value might reflect a current account surplus and positive net FDI inflows. This indicator could be construed as a possible inducement for appreciation pressure on the currency, in which there would be a positive link to reserve accumulation.

Our annual data sample covers 30 years from 1980 to 2009 and includes 12 Asian economies.[5] (See Box 3 for an explanation of each variable and the Appendix for data sources.)

Box 3. List of Explanatory Variables for Reserve Build-Up

Variables	Sign	Notes
GDP per capita	+/–	GDP per capita can reflect the stage of economic development. It is expected to be positively/negatively linked to reserve accumulation according to the stage of the economy.
Capital flows (Hot money)	+	A potential indicator of hot money flows to a country is the sum of the current account and net FDI inflows scaled by GDP. A negative value indicates the level of short-term flows needed to finance a current account deficit. A positive value might reflect a current account surplus and positive net FDI inflows. This indicator could be construed as a possible inducement for appreciation pressure on the currency, in which there would be a positive link to reserve accumulation.
Broad money	+	Broad money often indicates a country's exposure to the withdrawal of assets or resident-based capital flight from the domestic currency. Thus, it is used as a proxy for potential liquidity demand. Broad money is expected to be positively linked to reserve accumulation.
Trade	+	Trade openness might require foreign reserve demand for transaction. Also, a conventional rule of thumb suggests that a country should hold reserves enough to finance three or four months of imports without income flows. For this reason, as a precautionary demand, a country can hold more for self-insurance. Thus, imports/GDP is expected to be positively linked to reserve accumulation (*source*: WDI, the World Bank).
Financial development	–	A high level of financial sector development could mobilize resources more efficiently and would be less vulnerable to crises. Thus, it is expected to reduce demand for a reserve build-up. A country's total equity and debt liability is used as an indicator of capital market development and as a proxy for the country's access to the international financial market.
Interaction term (Capital flows* financial development)	–	The interaction term captures the marginal effect of capital flows on reserve demand. It is expected to take a negative sign given the hypothesis that increases in financial development could help attenuate the impact of capital flows on reserve demand.
Financial openness (Chinn–Ito)	+	We adopt the Chinn–Ito Index. Higher financial openness suggests vulnerability to external financial shocks, and is expected to increase precautionary demand for reserves.
Exchange rate fluctuation	+/–	On the one hand, exchange rate fluctuation within a certain range would result in less government intervention in the foreign exchange market, thus less reserve build-up. On the other hand, greater real exchange rate volatility is empirically linked to lower growth and financial instability—notably, in financially underdeveloped countries. Also, a higher level of reserves is empirically linked to reduced exchange rate volatility (Hviding et al., 2004). This variable is expected to be positively linked to reserve holding.

[5] China, Hong Kong, India, Indonesia, Japan, Korea, Malaysia, the Philippines, Singapore, Taiwan, Thailand and Vietnam.

6. Regression Results and Analysis

Table 1 reports the results of regressions with a log of reserve accumulation over GDP as the dependent variable. Column 1 shows the result of regression with a country fixed effect while column 2 includes country and year fixed effect. In columns 3 and 4, we add capital flows, financial development and the interaction terms with country fixed effect and country and year fixed effect, respectively.

We observe that broad money and trade are positive and significant in all regressions while the post-crisis period is positive and significant in columns 1 and 3 (country fixed effect). These results confirm the precautionary motives and financial stability motives for reserve accumulation among Asian economies. Based on the results, a 10 percent increase in broad money over GDP leads to about a 5 percent increase in reserves over GDP. Similarly, when trade over GDP increases by 10 percent, the reserves over GDP ratio would increase by about 7 percent.

In columns 3 and 4, we find that the coefficient of capital flows is positive and significant. This finding implies that a 10 percentage point increase in the capital flows ratio would lead to about a 26 percent increase in the reserves-to-GDP ratio. This effect is fairly high, but is evidenced by some Asian economies' behavior. In our sample, an average capital inflow is 4 percent while the average increase in reserves-to-GDP ratio is 14 percentage points.

We also find that the interaction terms between capital flows and financial development have the expected sign and are significant. The results confirm our hypothesis that financial development attenuates the impacts of capital flows on reserve accumulation. The implication here is that although capital inflows could motivate reserve accumulation, a well-functioning financial system could help reduce the impacts of capital flows on reserve hoarding. In other words, the magnitude of the impacts of capital flows on reserve demand decreases with a higher level of financial development due to the efficient absorption of capital inflows.

More interestingly, if financial development increases by 10 percentage points, the impact of capital flows on reserve demand will be reduced by 11 percent. Based on the results of our empirical analysis, we can also determine the threshold level of financial

development around which the effects of capital flows on reserve accumulation are neutralized. To do this, we differentiate the model in equation 10 (in column 4) with respect to capital flows.

$$\frac{\Delta Reserves}{\Delta CapFlows} = 2.72 - 1.044 * FinDev$$

The threshold level of financial development is about 2.6, which is equivalent to 260 percent of GDP in terms of access to international financial resources. This is indeed a high level of financial development. In our data, only Hong Kong and Singapore have such financial size and depth. Nonetheless, the threshold itself is not important. Rather, an essential implication is that the high level of financial sector development attenuates the impacts of capital flows on reserve accumulation.

6.1. Robustness Check

To conduct a robustness check, we use domestic credit and market capitalization over GDP (DCMCAP) and domestic market liquidity (total stock value traded over GDP, SVT) as alternative proxies of financial development and resource mobilization for liquidity provision by the private sector. The results are presented in Table 2. We observe that the results are not quantitatively much different from our earlier findings. The coefficients of broad money, trade and the post–Asian crisis period dummy remain positive and significant. The interaction terms between capital flows and financial development are all negative and remain statistically significant. The results confirm our hypothesis that financial development attenuates the impact of capital flows on reserve accumulation. Based on the results, a 10 percent increase in financial development reduces the impacts of capital flows on reserve accumulation by between 6 and 10 percent.

7. Conclusion

This paper has examined the motives for foreign reserve accumulation and analyzed the effects of capital flows and financial development on reserve demand in the Asian region. We have presented a model in which a state holds reserves to supply foreign exchange liquidity in underdeveloped financial markets. Our theoretical argument is that with the low capacity of the private sector to meet liquidity demand due to underdeveloped financial markets, the state plays a role in supplying additional liquidity. Thus, in our model, the development of the financial system weakens the monetary authority's motivation to hoard reserves for liquidity provision.

Using annual data for 12 East Asian economies between 1980 and 2009, our results confirm the presence of a precautionary motive and a financial stability motive in hoarding reserves. By using various measures of financial development, we also consistently found that financial sector development reduces the impacts of capital flows on reserve demand.

Table 1. Regression Result with log(Foreign Reserves/GDP) as Dependent Variable

	(1)	(2)	(3)	(4)
logGDPPC	0.153	–0.099	0.175	–0.1
	(0.12)	(0.053)*	(0.10)	(0.042)**
logM2	0.542	0.485	0.528	0.427
	(0.242)**	(0.162)**	(0.210)**	(0.126)***
lnTrade	0.73	0.758	0.683	0.774
	(0.239)**	(0.110)***	(0.217)***	(0.128)***
Evol	–1.604	–3.631	–1.446	–3.979
	(1.03)	(2.21)	(1.14)	(2.29)
Kaopen	0.137	0.022	0.19	0.04
	(0.08)	(0.06)	(0.081)**	(0.05)
Post crisis	0.469		0.471	
	(0.237)*		(0.217)*	
Capital inflows			2.057	2.721
			(1.091)*	(1.009)**
Financial development			–0.009	–0.08
			(0.06)	(0.06)
Cap*Fin			–1.094	–1.044
			(0.361)**	(0.298)***
Observations	326	327	322	322
Country fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	No	Yes	No	Yes
R-squared	0.9	0.85	0.91	0.87

Note: Robust standard errors in parentheses. Significance levels: * 10%; ** 5%; *** 1%.

Financial Development 1 (Fin.Dev1) is the sum of total external equity liability and debt liability.

Table 2. Robustness Check with Access to International Market (External Access)

	(1)	(2)
logGDPPC	–0.114	–0.126
	(0.036)***	(0.048)**
logM2	0.633	0.505
	(0.238)**	(0.172)**
lnTrade	0.683	0.636
	(0.084)***	(0.091)***
Evol	–4.506	–4.089
	(2.328)*	(2.34)
Kaopen	0.00	–0.02
	(0.04)	(0.05)
Capital inflows	2.523	1.79
	(0.692)***	(0.668)**
DCMCAP	–0.051	
	(0.09)	
Cap*DCMCAP	–0.59	
	(0.214)**	
SVT		0.186
		(0.100)*
Cap*SVT		–0.989
		(0.331)**
Observations	242	247
Country fixed effect	Yes	Yes
Year fixed effect	Yes	Yes
R-squared	0.88	0.87

Note: Robust standard errors in parentheses. Significance levels: * 10%; ** 5%; *** 1%.

DCMCAP is domestic credit and market capitalization over GDP while SVT is total stock value trade over GDP.

It is widely believed that a deep financial sector helps allocate resources efficiently. In extending this concept to precautionary reserve holdings to provide liquidity provision against shock, an important implication is that financial development could help reduce reserve demand due to capital flows and their macroeconomic consequences. Our finding in this paper suggests that an important part of a long-term policy in dealing with capital flows is the development of a deep and active financial sector. Also, as capital flows can be volatile and potentially have destabilizing effects on macroeconomic management, the policy recommendation in favor of financial sector development becomes even stronger.

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Appendix A. The Analytical Model of Reserve Demand

A.1. The Private Sector

The economy in the model consists of two typical periods: t and t+1. The exchange rate on date t+1 is expressed as follows:

$$e_{t+1} = e(\theta) = \alpha\theta, \tag{1}$$

where e is the foreign currency price of the domestic currency, and θ reflects the future state of the economy. Higher values of θ indicate more favorable states of the economy. Economic agents in the domestic economy have divergent views of the fundamental that will materialize in period t+1. For a given θ, agents i expect that the fundamental will be $\theta+\varepsilon$, where the noise, ε_i , is uniformly distributed over the interval $[-\bar{\varepsilon}, \bar{\varepsilon}]$ and $\theta - \varepsilon_i > 0$. $i \in [0, 1]$ indexes domestic agents who are all risk neutral.

Assume that there is a liquidity shock—in other words, a sudden stop or capital flow reversal—which increases the demand for foreign currency and, for simplicity, that foreigners are not willing to hold the home currency at any price. In this case, the exchange rate will be determined by the exchange market involving only domestic residents, domestic financial institutions and the home monetary authority. We also assume that the monetary authority can prevent domestic interest rates from fully offsetting expected exchange rate changes, or that the increase in interest rate *per se* is so damaging to financial stability that home residents discount it. Transaction costs and interest gains that could potentially be earned from the currency position are ignored for simplicity here. In such circumstances, people fundamentally care about the exchange rate in period t+1, compared with the exchange rate in period t. If θ is very low and the economic consequence from a liquidity shock is expected to continue when the financial market cannot function to fully offset the liquidity demand then the average market forecast is for continuing home currency weakness. Domestic agents, however, hold divergent views on how weak the currency will be.

Assume that domestic agents hold a domestic liquid asset (that is, a bank deposit), the size of which is proportional to total liquid asset l_t at period t claimed by all domestic agents, and which can be sold for foreign exchange. Banks' asset, however,

are illiquid. Thus, if domestic agents liquidate their liquid asset, financial institutions can repay domestic residents only if they can mobilize resources domestically or internationally to fully meet liquidity demands or the domestic monetary authority intervenes to supply additional liquidity.

Given the assumptions, domestic agent i would trade the home currency for foreign exchange if the home currency is expected to fall from its current level, or

$$E_t\{e_{t+1}/(\theta+\varepsilon_i)\} = \alpha(\theta+\varepsilon_i) \le e_t . \tag{2}$$

For a given date, t, and exchange rate, e_t, the measure of agents such that

$$\alpha(\theta+\varepsilon_i) \le e_t, \text{ or } \varepsilon_i \le (e_t/\alpha) - \theta, \text{ is } \frac{1}{2\bar{\varepsilon}} \int_{-\bar{\varepsilon}}^{(\frac{e_t}{\alpha})-\theta} dx = \frac{1}{2\bar{\varepsilon}}(\bar{\varepsilon} + \frac{e_t}{\alpha} - \theta) \tag{3}$$

.

Therefore, at date t, the demand for foreign exchange in terms of the home currency as a result of liquidity demand shock is

$$l_t^d = \frac{l_t}{2\bar{\varepsilon}}(\bar{\varepsilon} + \frac{e_t}{\alpha} - \theta), \tag{4}$$

where l_t^d is the total demand for foreign exchange liquidity.

A.2. Private Liquidity Supply

From here, we depart from Obstfeld's framework by introducing private liquidity supply. The financial institutions will coordinate to supply liquidity, the amount of which depends on the capacity of the financial sector to mobilize resources domestically or internationally to meet the liquidity demand. In this regard, the net liquidity demand is

$$l_t^d - l_t^s, \tag{5}$$

where l_t^s is the liquidity supply coordinated by all private financial institutions. If λ_t, for which $0 < \lambda < 1$ captures the level of the financial sector's ability to coordinate liquidity supply, $l_t^s = \lambda_t l_t^d$. Equation 5 can be rewritten as:

$$(1-\lambda_t)\frac{l_t}{2\bar{\varepsilon}}(\bar{\varepsilon}+\frac{e_t}{\alpha}-\theta). \quad (6)$$

Equation 6 implies that the level of financial development partly determines the net liquidity demand. Higher capacity to coordinate resources for liquidity supply would help offset the liquidity demand.

A.3. Public Liquidity Provision and Central Banks' Reaction Function

The central bank is assumed to intervene in the foreign exchange market to minimize the following intertemporal criterion:

$$\min_{R_{t+1}} E_t\{L_t + \delta L_{t+1}\},$$

where δ is the discount factor and L_t is the loss function at period t. In specifying the function, we follow Surico (2008) and specifically Srinivasan et al. (2009) whose function captures the asymmetric preference on exchange rate stability. This is supported by the argument that emerging economies "fear floating" (see, for example, Calvo Guillermo and Reinhart, 2002). Levy-Yeyati and Sturzenegger (2006) conjectured that exchange rate policy has evolved towards an apparent "fear of floating in reverse" or "fear of appreciation" whereby interventions have been aimed at limiting appreciation rather than depreciations. Pontines and Rajan (2011) confirm the existence of the asymmetry in central bank foreign exchange intervention responses to currency appreciation versus depreciation in India, Korea, the Philippines, Singapore, Thailand and Indonesia. In this regard, the monetary reaction function is:

$$L_{t+1} = \frac{1}{2}(R_{t+1} - R^*)^2 + \frac{\beta}{2}\left\{(e_{t+1} - e^*)^2 + \frac{\gamma}{3}(e_{t+1} - e^*)^3\right\}, \quad (7)$$

where $\beta > 0$ is the relative weight and γ is the asymmetric preference parameter on exchange rate stability. Here, $\mathbf{R^*}$ and $\mathbf{e^*}$ are the optimal level of foreign reserves and the target exchange rate, respectively. We express the reaction function in period t+1 because we will later assume that the exchange rate at period *t* is the central bank's

target rate. The loss function departs from the standard quadratic form in that policymakers are allowed to treat differently the rate of appreciating and depreciating pressure. It should be noticed that if $\gamma = 0$, the loss function becomes symmetric. If $\gamma > 0$, equation 13 implies that the rate of appreciation is weighted more heavily than the rate of depreciation. In other words, if , the exchange rate appreciation would increase the policymaker's loss.

$$\frac{\partial L_{t+1}}{\partial e_{t+1}} = \beta\left[[(e]_{t+1} - e^*) + \left(\frac{\gamma}{2}\right)(e_{t+1} - e^*)^2\right] > 0$$

Furthermore, since we take into account the central bank's motives for foreign exchange market intervention, it is assumed that the exchange rate depreciation/appreciation can be reduced by the central bank's intervention. That is,

$$e_{t+1} - e^* = a_0 + a_1 R_{t+1} + \epsilon_{t+1}, \tag{8}$$

where $a_1 > 0$ and ϵ_{t+1} are the error terms with zero mean and variance σ_ϵ^2. Minimizing equation 7 subject to equation 8 leads to the following intervention reaction function of the central bank:

$$0 = R_{t+1} - R^* + \frac{\beta}{2} E_t\{2a_1(e_{t+1} - e^*) + \gamma a_1(e_{t+1} - e^*)^2\}. \tag{9}$$

Suppose that a central bank's optimal level of reserves is equal to the net liquidity demand in period *t* as expressed in equation 6. In other words, given the economic fundamentals and with the underdeveloped financial market, the central bank would hold the necessary precautionary reserves to supply additional liquidity by selling *R* in foreign reserves, which is measured in foreign currency. Indeed, for emerging economies with a thin domestic bond market and shallow financial system, there might be no practical short-run means of managing the exchange rate other than reserve sales. The optimal level of reserves for the economy's central bank in period *t* is then given by

$$\frac{R^*}{e_t} = (1-\lambda_t)\frac{L}{2\bar{\varepsilon}}(\bar{\varepsilon} + \frac{e_t}{\alpha} - \theta). \tag{10}$$

Also, we assume that exchange rate at period t is the target exchange rate aimed for by the central bank—that is, $e_t = e^*$. Thus, equation 15 can be transformed as the following:

$$R_{t+1} = (1 - \lambda_t)\frac{L_t}{2\bar{\epsilon}} e_t \left(\bar{\epsilon} + \frac{e_t}{\alpha} - \theta\right) + \frac{\beta}{2} E_t\{2a_1(\Delta e_t) + \gamma a_1 (\Delta e_t)^2\}. \quad (11)$$

Equation 11 indicates that the reserve accumulation is influenced by the expected liquidity demand, the fundamentals of the economy, the central bank's target exchange rate, its preference on exchange rate fluctuation, and the level of financial development. If the capacity of the financial market is high (high value of λ) then pressure on the currency would be smaller (small net liquidity demand), which requires less intervention by the government. Equation 11 could also partly explain why reserve levels in countries with preference on exchange rate stability can be rather high.

Suppose there is a bad realization of θ, which causes a liquidity shock, and therefore pressure on the home currency as people liquidate their assets to speculate in foreign exchange. With the underdeveloped financial market, which cannot fully coordinate to meet the full liquidity demand, the monetary authority will then exercise its 'lender of last resort' role by using its reserves to moderate the exchange rate fall. This is motivated by the central bank's desire to limit exchange rate volatility and to avoid a currency crisis. Nevertheless, with a huge liquidity demand shock, the pressure on the exchange rate will be greater and will require a bigger intervention if the economy's financial development is low.

Similarly, suppose there is upward pressure on the exchange rate as a result of capital inflows. The monetary authority with a preference on exchange rate stability would intervene by buying foreign currency and end up with reserve accumulation. If the financial sector is developed enough to efficiently allocate resources to productive investment rather than consumption, or to efficiently intermediate capital outflows to offset inflows, the intervention in the foreign exchange market by the central bank is less necessary. Less intervention should partly reduce the central bank's motivation to hoard reserves.

The model provides implications not only for the central bank's liquidity provision, but also for the active management of liquidity by the central bank that values

macroeconomic and financial stability. Put simply, the role of states in easing illiquidity and providing liquidity increases when financial markets are underdeveloped and cannot fully guarantee liquidity during shocks. In other words, an open economy with less developed financial markets is expected to accumulate more reserves to ensure liquidity while limiting exchange rate and macroeconomic volatility. This implies that the motivation to hoard reserves could be mitigated partly by developing a deep financial sector. This theoretical framework provides the basis for the following empirical investigation.

Appendix B

B.1. List of Economies in the Sample

China, Hong Kong, India, Indonesia, Japan, Korea, Malaysia, Singapore, the Philippines, Taiwan, Thailand, Vietnam.

Table B.1. List of Variables, Definition and Data Source

Variables	Definition	Source
Log(GDPPC)	GDP per capita	World Development Indicators
Log(M2/GDP)	M2 over GDP	World Development Indicators
Log(trade/GDP)	Export plus import over GDP	World Development Indicators
Exchange rate volatility	Annual standard deviation of monthly change in exchange rate	Authors' calculation based on exchange rates from IFS, IMF.
Capital inflows (Hot money)	The sum of current account and net FDI inflows over GDP	Calculation based on data from IFS, IMF.
Financial development	Total equity liability plus total debt liability over GDP	(Lane and Milesi-Ferretti, 2007). Updated until 2009
DCMCAP	Domestic credit and market capitalization over GDP	World Development Indicators
SVT	Total stock value traded over GDP	World Development Indicators
Financial openness	Chinn–Ito index (2008)	http://web.pdx.edu/~ito/Chinn-Ito_website.htm

Table B.2. Summary Statistics

Variable	Obs	Mean	Std Dev.	Min.	Max.
Log(Reserves/GDP)	334	2.673	1.150	–0.724	4.799
logGDPPC	359	7.914	1.574	4.576	10.645
Log(M2/GDP)	339	4.302	0.670	2.065	5.490
Log(Trade/GDP)	353	4.336	0.882	2.514	6.082
FX volatility	359	0.025	0.070	0.000	0.835
Financial openness	355	0.691	1.605	–1.844	2.478
Capital inflows	358	0.051	0.095	–0.086	0.469
Financial development	340	0.775	0.975	0.000	5.299
DCMCAP	242	2.099	1.346	0.289	7.416
SVT	252	0.623	0.868	0.000	7.558

CHAPTER 9

The Real/Financial Dimensions to Measuring Regional Economic Integration in ASEAN and East Asia

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No single measure of real or financial integration sufficiently captures all of the salient characteristics of the extent of integration between economies and of economies within particular regional groups. As a way of addressing this issue, this paper employs various measures of bilateral and regional real and financial integration for Association of South-East Asian Nations Plus Three (ASEAN + 3) countries for the period 2000–09. By using many measures, one should be able to, first, capture many of the main attributes of integration and, second, investigate the extent to which individual measures drive the overall level of integration. In addition to gaining insights about the nature of integration in the region, this study develops indexes of integration using principal components methods that show which countries are most closely integrated with which others and in what sphere. This allows us to draw some significant policy implications about how to best target liberalization policies of both trade and financial markets as well as informing the ongoing debate about optimal currency areas (OCAs) and a possible monetary union in Asia.

Key Words: Economic Integration, ASEAN + 3, Regionalism

JEL Classifications: F30 F40 F36

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1. Introduction

A commonly asked question in the area of international trade and finance is what is the extent of economic integration in East and Southeast Asia? The reasons for asking this question are many and various. There is increasing evidence that real and financial integration (as subsets of "economic" integration more generally) are closely connected; it is plausible to consider a situation where trade integration is associated with more synchronous business cycles and together produces spill-overs that facilitate monetary integration (see Frankel and Rose, 1998). Monetary integration itself is rooted in the optimal currency area (OCA) literature. Furthermore, there are political-economy considerations that can lead to or are caused by the extent of real and financial integration.

No single measure of real or financial integration sufficiently captures all of the salient characteristics of the extent of integration between the economies in East and Southeast Asia. Furthermore, no single measure is able to explain what particular or individual aspects of integration drive the overall degree of closeness between economies and of economies within particular regional groups.

This paper seeks to employ many and various measures of bilateral real and financial integration for the Association of South-East Asian Nations Plus Three (ASEAN + 3) countries. Measuring the extent of integration through individual metrics is not new and, as is well known, there are many methods that have been employed to measure the degree of real and financial integration (see Cavoli and Rajan, 2009; and for a recent treatment, Kim and Lee, 2010). Real integration measures include, among others, business-cycle synchronization (see Imbs, 2006), trade openness, and relative purchasing power parity (PPP) (see Alba and Papell, 2007; Barumshah et al., 2007; Kim et al., 2009; and Liew et al., 2009 for recent contributions to measuring PPP).

Financial integration measures are many and can be divided into arbitrage conditions such as uncovered interest parity (UIP) (see, for instance, Alper et al., 2009; Chinn, 2006; Goh et al., 2006), asset market correlations (see, for example, Chi et al., 2006), quantity measures using flow data (Lane and Milesi-Ferretti, 2001), macroeconomic measures such as savings/investment correlations and consumption

correlations (Kim and Lee, 2008), and many more. Attempts have been made to find a multivariate measure of integration. Takagi and Hirose (2001) and de Brouwer (1999) have employed techniques to combine various measures of financial integration and reduce them to one measure. Chinn and Ito (2008) have also created what is now a very well-known index of capital mobility/financial openness. The advantage of these techniques is that, first, they capture the breadth of available measures of integration—information is not simply lost by virtue of the non-employment of a measure. Second, the index and all the information contained within can be assessed over time.

Moreover, this paper seeks to calculate the extent of "overall" integration in the region. The objective here is to employ data that are readily available and to construct several measures of integration taking in the real and financial dimensions. By using many measures, one should be able to investigate which individual measure drives the overall level of integration. While each measure might not be perfect (after all, this is why there is such a large literature on each individual measure of real or financial integration), and while the list of measures adopted here might not be exhaustive, there is much value to gaining information about the stylized facts of integration in Asia and to provide insights into the nature of integration in the region. This has significant policy implications about how to best target policies of liberalization of both trade and finance. The paper also intends to measure the extent of integration between a country and a set of other countries (cluster or region). The questions that we can seek to answer here are: which countries are 'closest' to each other in terms of economic integration? Do different measures of integration produce different results in relation to these clusters or groups?

The measures presented in this paper are, in essence, summaries relating to a particular characteristic of economic integration. By and large, the measures fall into two categories: real integration and financial integration. Perhaps surprisingly, there appears to be very little work of this type in this area[2]—researchers seemingly selecting to pursue the option of refining individual measures rather than examining the interaction of individual measures in an attempt to ascertain a broader perspective of integration in the Asian region.

[2] With the exception of the work mentioned above in this section.

The policy implications of this work include, but are not limited to, the following: information about which individual measures might drive overall integration possibly has some useful policy implications. It might provide insights into the suitability of a number of political instruments of integration (trade agreements versus investment accords; removal of controls over foreign direct investment flows versus portfolio versus bank flows, and so on). Information about the different dimensions of integration will inform the ongoing debate about OCAs and a possible monetary union in Asia. As is very well known, OCAs are heavily reliant on integration. Is the region sufficiently close to justify a currency union? What would be the optimum in terms of the countries in a possible union? Where would the central bank be?

This paper is structured as follows: the following section outlines the data sources, defines each of the measures of integration employed in this study and sets out the methodology under which integration is calculated. Section 3 presents the results for bilateral levels of integration as well as each country's level of integration against regional groups. Two methods deriving an overall integration metric are also presented. Section 4 offers some concluding remarks.

2. Data and Methodology

The measures proposed are as follows.

The first is a measure of business-cycle correlations (BCS).[3] These are given by $\rho_{GDPi,GDPj}$, where *GDPi* is the annual growth rate of GDP for country *i*. The correlation coefficient is calculated from 12 monthly observations. A higher value implies greater integration, as it would suggest that the pair of countries for which the correlation is taken can be subject to, and react in the same way to, common shocks.

Deviations from relative PPP (RPPD): this is given by $ABS(\Delta e_t^{d/f} + \pi_t^f - \pi_t^d)$, where e_t is the nominal exchange rate at time t and π_t^f(π_t^d) refers to the foreign (domestic) inflation rate at time t. A smaller value implies greater integration as the law of one price with respect to goods prices is more likely to hold.

[3] "S" for synchronicity.

Trade openness or intensity (TI): this is given by T_{ij}/T_{ALL}, where T_{ij} is the trade (exports plus imports) between countries *i* and *j*, and T_{ALL} is all trade recorded for each country pair within the sample examined (not double counted). A higher value means greater integration as it implies that the country pair examined occupies a greater share of total trade in the region.

Deviations from uncovered (money-market rates) interest parity (UID): this is measured by $ABS(i_t^d - i_t^f - \Delta e_{t+1}^{d/f})$, where i_t^d and i_t^f refer to domestic and foreign interest rates respectively. A lower value implies greater integration between two countries, as the law of one price with respect to financial assets is more likely to apply.

Equity market correlations (EQ): these are given by $\rho_{Ri,Rj}$, where *Ri* is the annual return for the main stock-market index for country *i*. The correlation coefficient is calculated from 12 monthly observations. A higher value implies two countries' stock-markets are more closely aligned, hence indicating a higher level of integration.

Foreign direct investment (FDI) openness or intensity (FI): this is given by $(FD_{ij}+FD_{ji})/FD_{ALL}$. The definitions for the bilateral FDI flows and for FD_{ALL} are as per the trade-intensity measure. Portfolio investment intensity (PI) is given by $(PF_{ij}+PF_{ji})/PF_{ALL}$. The definitions for the bilateral portfolio (PF) flows and for PF_{ALL} are as per the trade-intensity measure. For both FI and PI, a higher value is taken to imply higher integration, as a higher value suggests that the country pair examined occupies a greater share of total financial flows in the region.

These measures lend themselves appropriately as ways to ascertain the degree of integration between countries for the following reasons:

a) they are simple and easy to comprehend;

b) data are readily available for all countries sampled;

c) they are underpinned by economic intuition about agent behavior.[4]

The objective is to use data that are readily and publicly available so as to show the ease with which the overall measures can be calculated. The main data source is the international integration statistics database of the Asia Recovery Integration Center of the Asian Development Bank (ADB) (http://aric.adb.org/), except the data used to calculate the UID and RPPP measures, which were from the International Monetary

[4] This is especially the case for RPPD and UID.

Fund's *International Financial Statistics.* The sample selected for this features data from 2000–09. It is crucial that the measures are bilateral. This way, integration can be assessed between country pairs as well as between countries and predetermined groups. The groups that one might initially consider would be ASEAN5 (Indonesia, Malaysia, the Philippines, Singapore, Thailand), the more recent members, New ASEAN (Brunei, Cambodia, Lao PDR, Myanmar, Vietnam), and the larger regional economies, Plus3 (China, Japan, Korea). The availability of data is such that all countries in the sample are represented in four of the seven measures—namely, BCS, RPPD, UID and TI. All seven measures are presented for the ASEAN5 and the Plus3 nations. This, in itself, is quite instructive in revealing something about the possible extent of integration: the more established nations in terms of development are able to report more comprehensively on integration.

We use the measures as follows—for example, we can measure the extent of Indonesia's integration with, say, Malaysia by observing each measure *individually* between the two countries. We can also measure Indonesia's integration with the Plus3 countries by calculating each measure with China, with Japan and with Korea. For these calculations, we take the average of each bilateral measure, so Indonesia's level of integration, say UID, with the Plus3 equals the average of the UIDs between Indonesia and China plus the UID between Indonesia and Japan plus the UID between Indonesia and Korea. To derive the level of integration between a particular country and the region of which it is a member, the country is left out of the member's group.

Once we have analyzed the individual measures of integration, we can create a measure of "overall" integration. We do this in two ways: the first is to impose cumulative normal distributions to all of the measures such that they all map on to the same distribution. The normalized individual measures are then summed to create an overall measure.[5] The second is to take the raw individual measures of integration and employ principal components analysis to reduce them to a single measure. Given the data considerations outlined above, two composite measures of integration are presented for the normalized metric and the principle components score—one using the four

[5] One can take averages rather than sums, but the effect is much the same.

individual measures for the whole sample, and the other using all seven measures for the ASEAN5 and Plus3 sample. The next section presents the results.

3. Results

3.1. Bilateral Integration and Regional Groupings

This section is divided broadly into two parts. The first examines the extent of (or level of) bilateral integration by calculating the level of integration under each individual measure. The second part examines how each country is integrated to a number of regional groupings.

Table 1 presents the extent of bilateral integration for each measure; the highlighted numbers show some potentially interesting results. From Table 1a, we can see that the level of business-cycle synchronization is high for Malaysia and the Philippines, Singapore and Thailand. The BCS for Japan/Philippines and Japan/Thailand are also high. The RPPDs in Table 1b also reveal a high level of integration (low RPPD) for pairings involving Malaysia and the Philippines. The same is found for the UIDs in Table 1e and, albeit to a lesser extent, the equity correlations in Table 1d.

Table 1. Bilateral Integration Measures by Type

Table 1a. Business-Cycle Synchronization

	BR	CA	PRC	ID	JP	KR	LAO	MA	MY	PH	SG	TH	VT
BR	1.00												
CA	- 0.08	1.00											
PRC	- 0.16	0.62	1.00										
ID	- 0.60	0.41	0.78	1.00									
JP	0.23	0.66	0.38	0.33	1.00								
KR	0.51	- 0.06	0.01	0.07	0.71	1.00							
LAO	- 0.11	0.38	0.79	0.77	0.21	- 0.04	1.00						
MA	- 0.14	0.40	0.57	0.60	0.85	0.64	0.78	1.00					
MY	- 0.11	0.42	- 0.03	0.33	0.66	- 0.01	0.17	0.63	1.00				
PH	- 0.10	0.48	0.59	0.65	0.86	0.61	0.60	0.94	0.49	1.00			
SG	0.06	0.64	0.55	0.61	0.84	0.63	0.58	0.88	0.63	0.95	1.00		
TH	0.33	0.33	0.32	0.25	0.89	0.58	0.32	0.91	0.68	0.82	0.75	1.00	
VT	0.05	0.89	0.74	0.47	0.83	0.40	0.56	0.78	0.13	0.76	0.76	0.74	1.00

Table 1b. RPPP Deviations

	BR	CA	CH	ID	IN	JP	KR	LA	MA	MY	PH	SG	TH	VT
BR	0													
CA	0.092	0												
CH	0.132	0.417	0											
ID	0.332	0.007	0.798	0										
IN	0.246	0.041	0.455	0.034	0									
JP	0.236	0.321	0.251	0.313	0.279	0								
KR	0.366	0.0215	0.558	0.207	0.174	0.105	0							
LA	0.285	0.179	0.462	0.139	0.221	0.675	0.263	0						
MA	0.124	0.11	0.304	0.107	0.074	0.205	0.069	0.271	0					
MY	1.685	1.382	0.275	1.504	1.464	1.677	1.699	1.278	1.512	0				
PH	0.014	0.091	0.485	0.084	0.05	0.229	0.123	0.287	0.023	1.515	0			
SG	0.035	0.131	0.255	0.123	0.089	0.189	0.084	0.305	0.015	1.524	0.039	0		
TH	0.029	0.062	0.272	0.054	0.02	0.258	0.118	0.223	0.049	1.512	0.029	0.069	0	
VT	0.131	0.074	0.513	0.126	0.088	0.317	0.345	0.198	0.171	1.345	0.135	0.177	0.122	0

Table 1c. Trade Intensity

	BR	CA	PRC	ID	JP	KR	LAO	MA	MY	PH	SG	TH	VT
BR													
CA	0.016%												
PRC	0.035%	0.041%											
ID	0.119%	0.012%	1.880%										
JP	0.320%	0.015%	23.079%	3.738%									
KR	0.113%	0.014%	12.762%	1.425%	9.073%								
LAO	0.000%	0.017%	0.023%	0.000%	0.005%	0.005%							
MA	0.054%	0.010%	3.343%	0.962%	4.116%	1.434%	0.002%						
MY	0.000%	-0.002%	0.188%	0.020%	0.047%	0.037%	0.000%	0.046%					
PH	0.002%	0.002%	1.447%	0.201%	2.155%	0.697%	0.000%	0.584%	0.001%				
SG	0.077%	0.069%	3.258%	1.513%	4.300%	1.312%	0.076%	3.161%	0.216%	0.707%			
TH	0.049%	0.070%	2.650%	0.747%	4.911%	0.832%	0.151%	1.623%	0.314%	0.457%	0.832%		
VT	0.000%	0.050%	1.181%	0.185%	1.090%	0.614%	0.029%	0.306%	0.007%	0.128%	0.640%	0.403%	

Table 1d. Equity Market Correlation

	PRC	ID	JP	KR	MA	PH	SG	TH
PRC								
ID	0.19							
JP	0.25	0.28						
KR	0.21	0.56	0.67					
MA	0.29	0.78	0.37	0.56				
PH	0.37	0.6	0.41	0.26	0.5			
SG	0.41	0.62	0.55	0.59	0.67	0.65		
TH	0.27	0.69	0.54	0.77	0.62	0.44	0.61	

Table 1e. UID Deviations

	BR	CA	CH	ID	IN	JP	KR	LA	MA	MY	PH	SG	TH	VT
BR	0													
CA	0.149	0												
CH	0.299	0.279	0											
ID	0.108	0.233	0.046	0										
IN	0.524	0.535	0.152	0.603	0									
JP	0.073	0.092	0.347	0.326	0.321	0								
KR	0.111	0.044	0.181	0.188	1.325	0.166	0							
LA	1.326	1.545	1.247	1.159	0.555	1.703	1.238	0						
MA	0.084	0.147	0.136	0.06	0.458	0.155	0.114	1.3	0					
MY	0.699	0.766	0.484	0.603	0.326	0.848	0.795	0.678	0.647	0				
PH	0.599	0.319	0.04	0.086	0.071	0.412	0.275	1.149	0.193	0.448	0			
SG	0.086	0.092	0.162	0.14	0.373	0.185	0.018	1.333	0.039	0.685	0.227	0		
TH	0.196	0.144	0.163	0.138	0.189	0.184	0.018	1.387	0.035	0.676	0.224	0.001	0	
VT	0.131	0.007	0.117	0.011	0.283	0.204	0.222	1.401	0.015	0.593	0.163	0.082	0.091	0

Table 1f. FDI Intensity

	PRC	ID	JP	KR	MA	PH	SG
PRC							
ID	0.611%						
JP	22.619%	-0.006%					
KR	18.523%	0.001%	4.543%				
MA	1.491%	0.089%	4.690%	1.071%			
PH	0.911%	0.003%	0.903%	0.009%	0.116%		
SG	10.304%	0.022%	11.253%	0.805%	5.415%	0.499%	
TH	0.867%	0.022%	9.744%	0.230%	0.258%	0.152%	4.702%

Table 1g. Portfolio Intensity

	PRC	ID	JP	KR	MA	PH	SG
PRC							
ID	0.041%						
JP	15.805%	1.628%					
KR	8.881%	0.453%	29.307%				
MA	0.098%	0.313%	5.868%	1.904%			
PH	0.054%	0.044%	4.323%	0.299%	0.482%		
SG	0.043%	0.521%	14.074%	3.961%	2.970%	0.722%	
TH	0.043%	0.134%	3.054%	2.829%	0.339%	0.046%	0.697%

When one observes the quantity-based measures, such as trade, FDI and portfolio investment intensity, the higher levels of integration occur in the larger economies of Japan, China and Korea. This possibly emphasizes the importance of size for trade and finance flows. We can see this effect most emphatically in the case of TI in Table 1c for the Japan–China, Japan–Korea and China–Korea pairings. The results for FI and PI

also show that these pairs are significant but, additionally, they reveal Singapore as an important source of openness when paired with the larger economies—notably Japan.

Figure 1 presents the extent of integration (by each measure) of each country with a predetermined grouping of countries. For BCS, RPPD, UID and TI, these groupings are ASEAN5, the New ASEAN, Plus3 and the entire sample as specified above. For the others—equity, FD and PF—the groupings are ASEAN5, Plus3 and ASEAN5+3. The results here confirm the patterns mentioned above—that Malaysia, Singapore and Thailand are among the most integrated when one observes the price-based measures (RPPD, UID and EQ as given in Figures 1b, 1d and 1e), but the larger regional economies exhibit higher integration when one observes the quantity measures (TI, FI and PI given in Figures 1c, 1f and 1g respectively). Furthermore, Figure 1 shows that, across all measures, the New ASEAN nations are among the least integrated generally, in terms of both the extent of integration with each other and with the other groupings in the sample.

Figure 1. Regional Integration by Type

Figure 1a. Business-Cycle Correlation

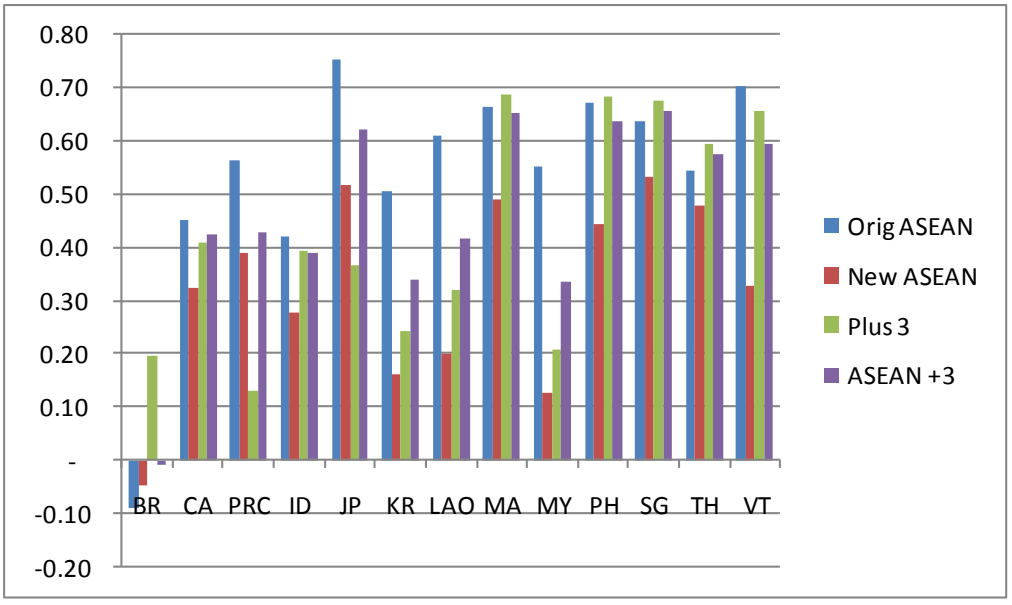


Figure 1b. RPPD Deviations

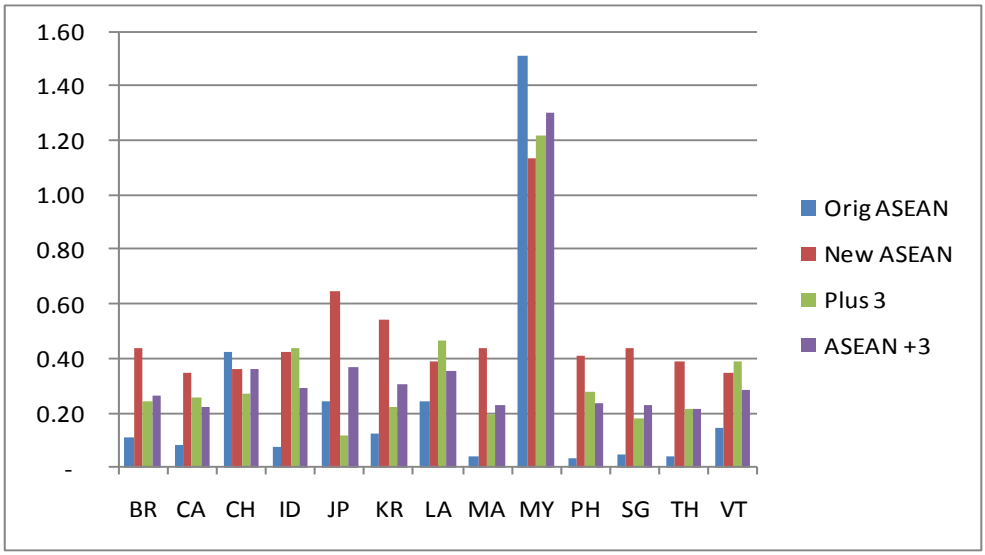


Figure 1c. Trade Intensity

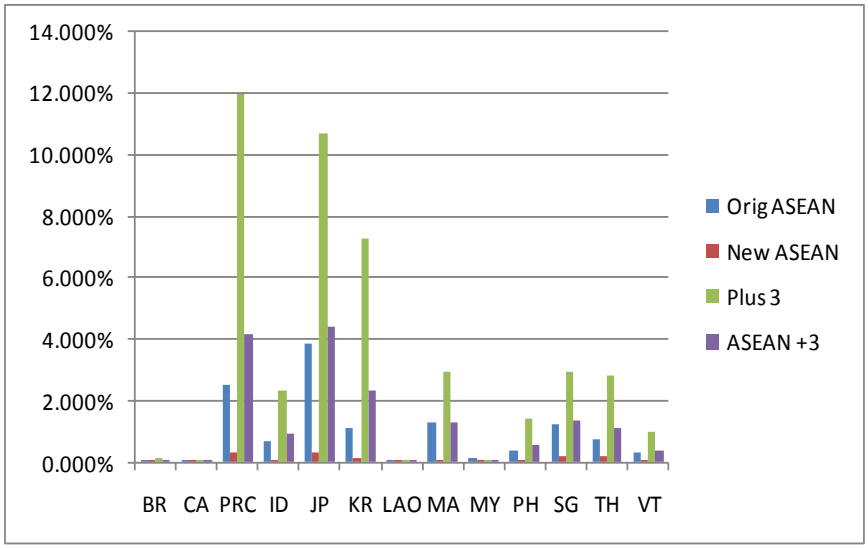


Figure 1d. Equity Market Correlation

Figure 1e. UID Deviations

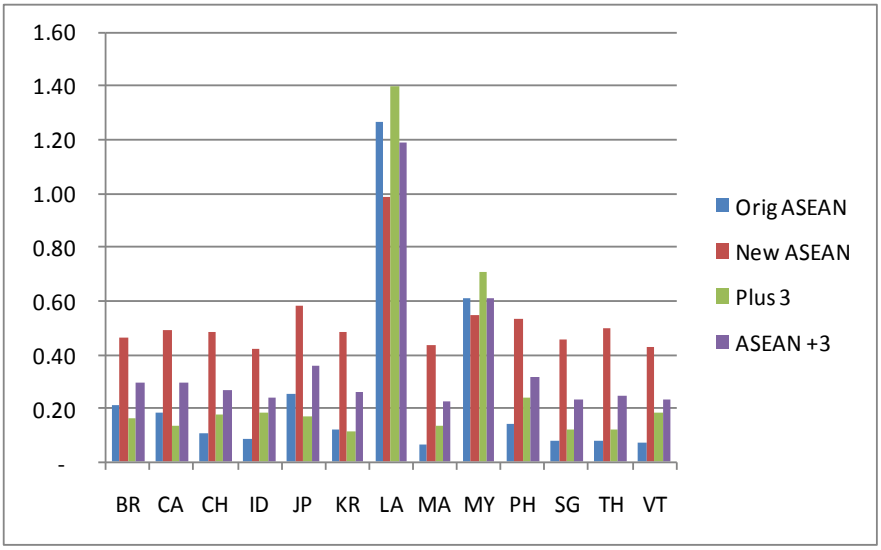


Figure 1f. FDI Intensity

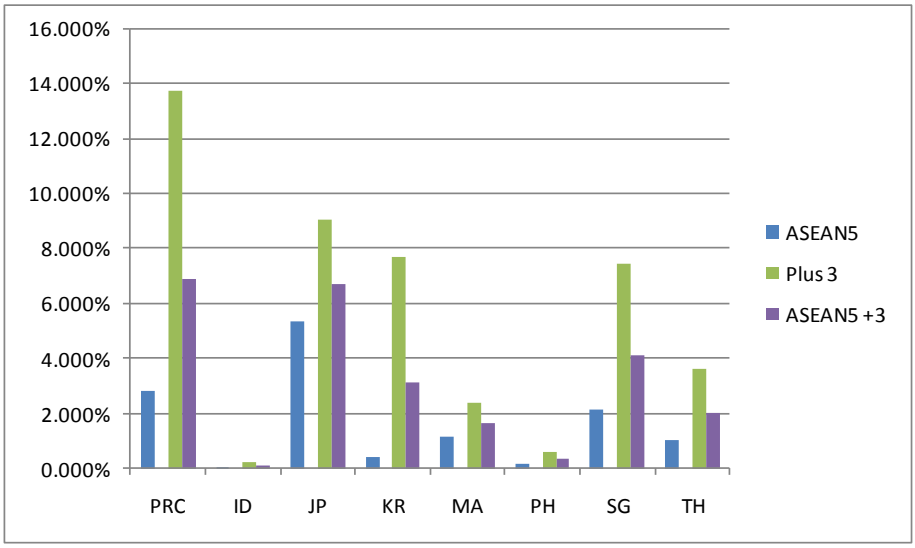
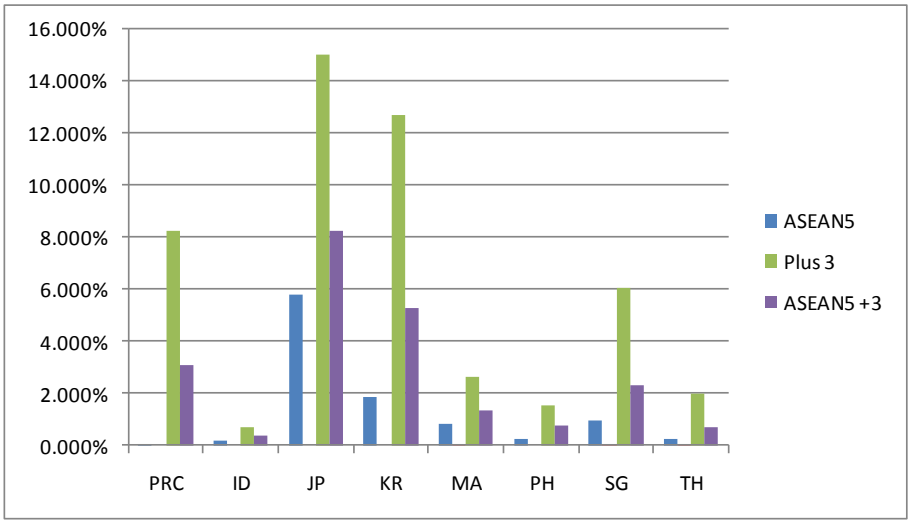


Figure 1g. Portfolio Intensity



3.2. Normalised Overall Measure of Integration

The next set of results attempts to use all of the available measures to return an overall measure of integration that captures both real and financial dimensions. This facilitates the investigation of which individual measure might possibly drive the overall level of integration and, in doing so, addresses the question of what might be the possible sources of integration between countries in the region. Each measure of integration against the defined regional groupings as defined above has been normalized to return a value between 0 and 1 where 0 = least integrated and 1 = most integrated.

Prior to making these transformations, the UID and RPPD are inverted such that a larger value now implies more integration. Each value is then simply summed to present an overall measure of integration for each country against the regional groupings. The benefit of this exercise is that it removes any issue of the scaling of individual measures as each metric is scaled from 0 to 1. As such, we can examine where each individual measure is in a cumulative normal distribution—thus facilitating comparisons.

Figures 2 and 3 present the results. Figure 2 presents the overall integration where all seven measures are used, and therefore omits the New ASEAN sample of countries. Figure 3 presents the overall integration where four measures (BCS, RPPD, UID and TI) are employed, thus utilizing all 13 countries in our sample. By construction, each normalized individual measure of integration shows what position it assumes in the distribution. As such, the larger the segment in each column graph relating to a particular measure, the more that measure contributes to the total.

Figure 2. Overall Integration: Seven measures

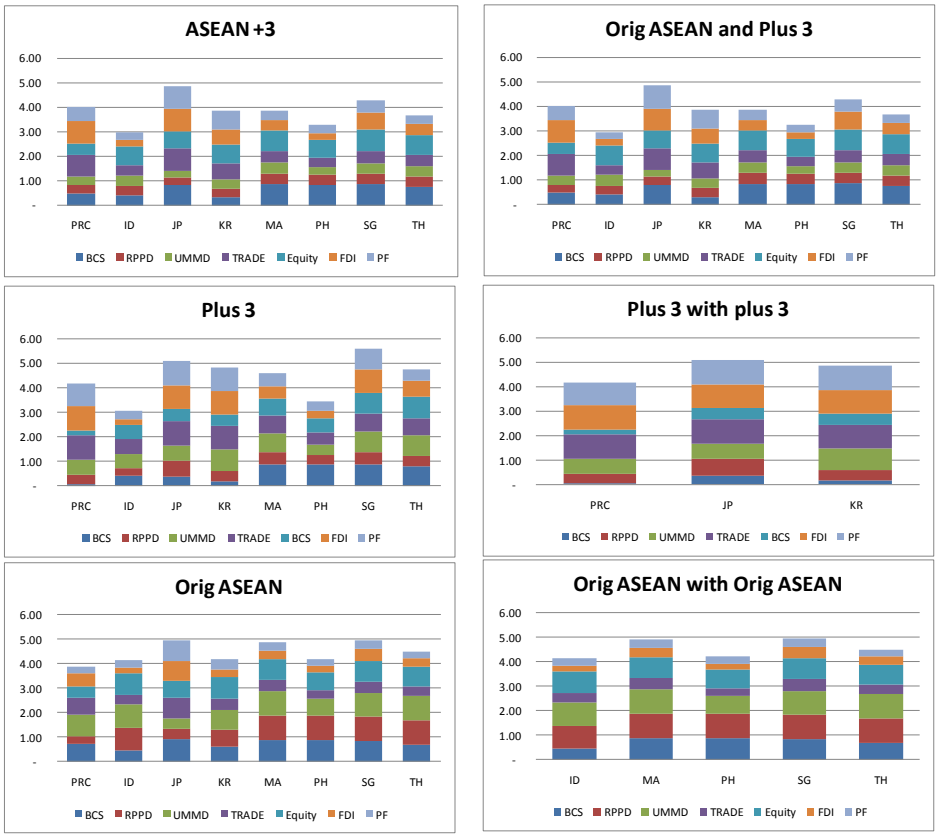
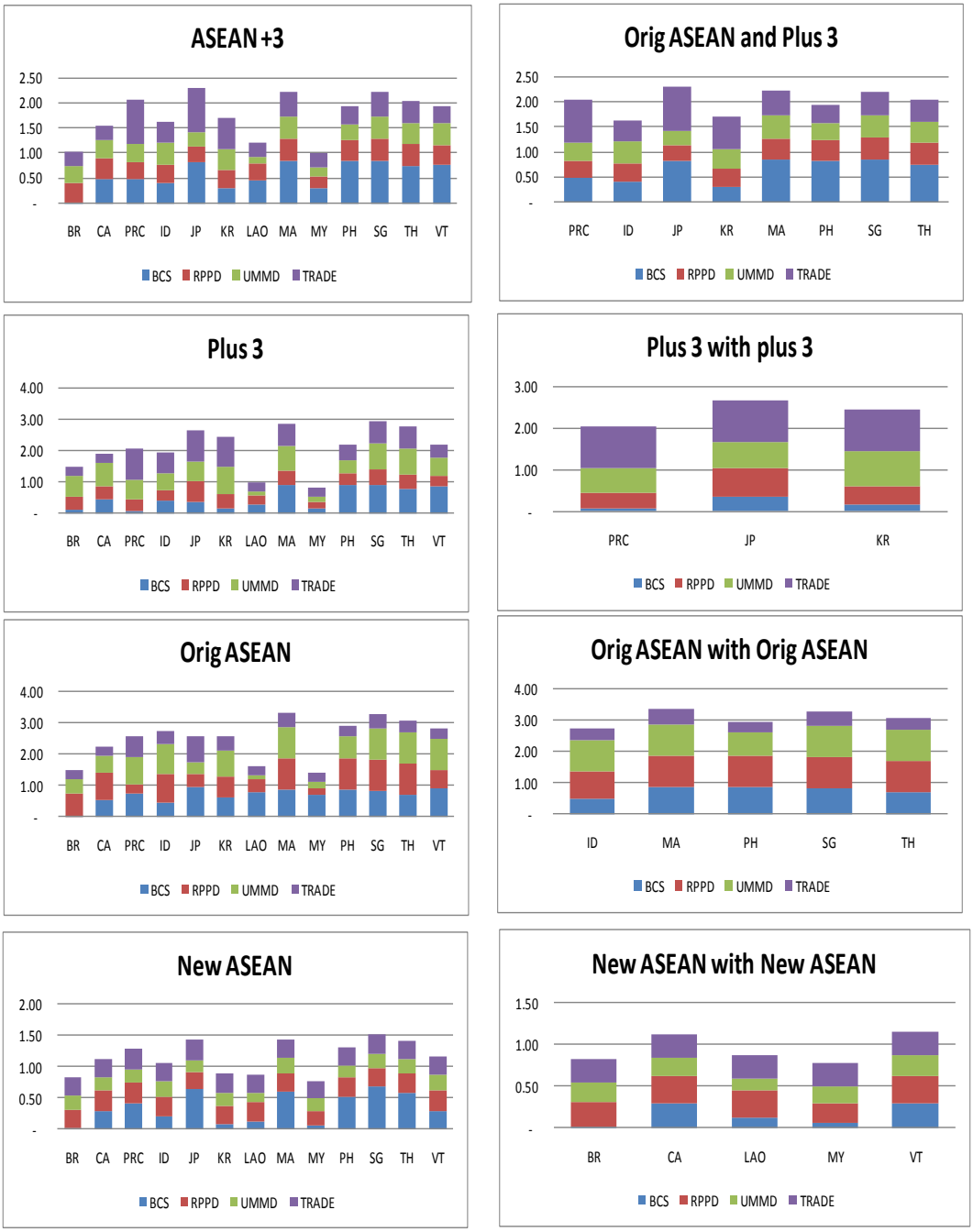


Figure 3. Overall Integration: Four measures



Generally speaking, if one observes the components of each measure, one sees that no one individual measure dominates the total measure. We see that equity market correlation and business-cycle synchronization are quite influential for the original ASEAN nations. We also see that the effect of UID seems generally greater than RPPD. From Figure 2, it can be seen that Singapore and Japan remain the most

integrated economies in the sample—and that this result occurs irrespective of which groupings these countries are measured against. Figure 3 presents a couple of interesting results. The first is that Malaysia's level of overall integration is higher under this measure—highlighting possibly the importance of BCS, RPPD, UID and TI for that country. The second interesting result is from the newer ASEAN nations. It can be seen that Vietnam and Cambodia are the most integrated from this group of countries but these levels are significantly lower than the ASEAN5 and Plus3 countries.

3.3. Principle Components Analysis

We also present some results of the application of principal components analysis to our measures of integration. The reasons for this are twofold. First, we can use the method to act as a robustness test for the above measures of (normalized) integration. The second is to augment the above measures, as they are not subject to any formal statistical testing. Principal components analysis is a method that is often used to reduce the number of variables into a single one for the purposes of estimation. It models the variance structure of a set of observed variables using linear combinations of the variables. These linear combinations, or components, might be used in subsequent analysis, and the combination coefficients, or loadings, might be used in interpreting the components. It is essentially an optimization algorithm that selects the optimal weights in a linear combination such that the variance of the linear combination is maximized. See Johnson and Wichern (1992) for more information.

We compute the principal components of the estimated (Spearman rank-order) correlation matrix of our series of measures, and display our results in Tables 2 and 3 and in Figures 4 and 5.

Table 2 presents the output for the seven-variable case for the ASEAN5 and the Plus3 countries. We can see from the first panel that the first principal component explains 39 percent of the variation in the measures of integration. The second panel shows the weights of each measure in constructing the components. We see that there is a difference in the price versus the quantity-based measures in that the price measures return a positive coefficient. The data are able to clearly differentiate between these broad types of measures—suggesting that each type can explain different aspects of the data.

Table 2. Principal Components Analysis (using BCS, UID, RPPP, Trade, Equity, FD, PF)

Eigen values: (sum = 7, average = 1)					
Number	**Value**	**Diff.**	**Prop.**	**Cum. value**	**Cum. prop.**
1.00	2.74	0.94	0.39	2.74	0.39
2.00	1.80	0.71	0.26	4.53	0.65
3.00	1.09	0.35	0.16	5.63	0.80
4.00	0.74	0.43	0.11	6.37	0.91
5.00	0.31	0.09	0.04	6.68	0.95
6.00	0.22	0.11	0.03	6.89	0.98
7.00	0.11	---	0.02	7.00	1.00

Eigen vectors (loadings):							
Variable	**PC 1**	**PC 2**	**PC 3**	**PC 4**	**PC 5**	**PC 6**	**PC 7**
BCS	0.21	0.46	–0.31	0.66	0.45	0.04	–0.07
EQ	0.44	0.31	0.23	–0.44	0.16	0.54	–0.38
FD	–0.37	0.43	0.28	0.31	–0.61	0.14	–0.34
PF	–0.22	0.58	–0.15	–0.47	0.14	–0.59	–0.08
RPP	0.49	0.33	–0.16	–0.05	–0.51	0.01	0.60
TR	–0.52	0.24	0.16	–0.10	0.30	0.46	0.58
UID	0.24	0.07	0.84	0.19	0.20	–0.36	0.18

The first panel of Table 3 shows that the first principal component explains 48 percent of the total variation in the data. The second panel shows that each variable is (reasonably) similarly weighted in the first component but the component shows some differences between the price measures, UID and RPPD and the others in explaining the variation in the second component.

Table 3. Principal Components Analysis (using BCS, UID, RPPP, Trade)

Eigen values: (sum = 4, average = 1)					
Number	**Value**	**Difference**	**Proportion**	**Cum. value**	**Cum. prop.**
1.00	1.95	0.95	0.49	1.95	0.49
2.00	1.00	0.33	0.25	2.95	0.74
3.00	0.67	0.28	0.17	3.61	0.90
4.00	0.39	---	0.10	4.00	1.00

Eigen vectors (loadings):				
Variable	**PC 1**	**PC 2**	**PC 3**	**PC 4**
BCS	0.43	0.58	0.65	–0.25
RPP	0.44	–0.65	0.45	0.43
TR	0.54	0.39	–0.49	0.56
UID	0.58	–0.30	–0.37	–0.66

Figure 4 presents the output of the principal components analysis for the seven-variable case for the ASEAN5 and the Plus3 countries. As with the normalized results, a larger number implies higher integration. This is configured in the same way as Figure 1 in that it shows the level of integration (but this time the level of overall

integration) of each nation against country groupings. What is quite obvious from these results is that the Plus3 nations are much less integrated than the ASEAN5 countries and much less integrated than what was being suggested in the earlier tests.

Figure 4. Overall Integration Using Principal Components (seven measures: BCS, UID, RPPP, Trade, Equity, FD, PF)

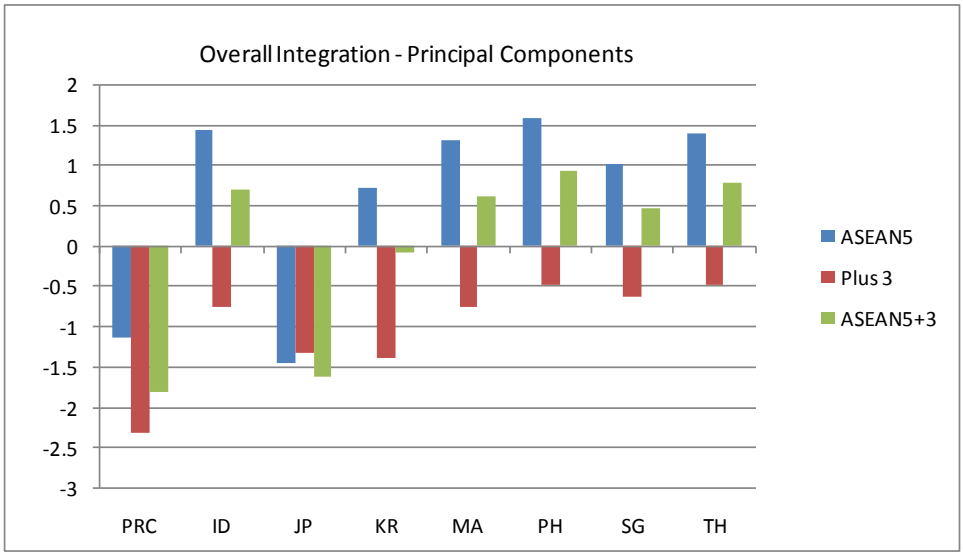
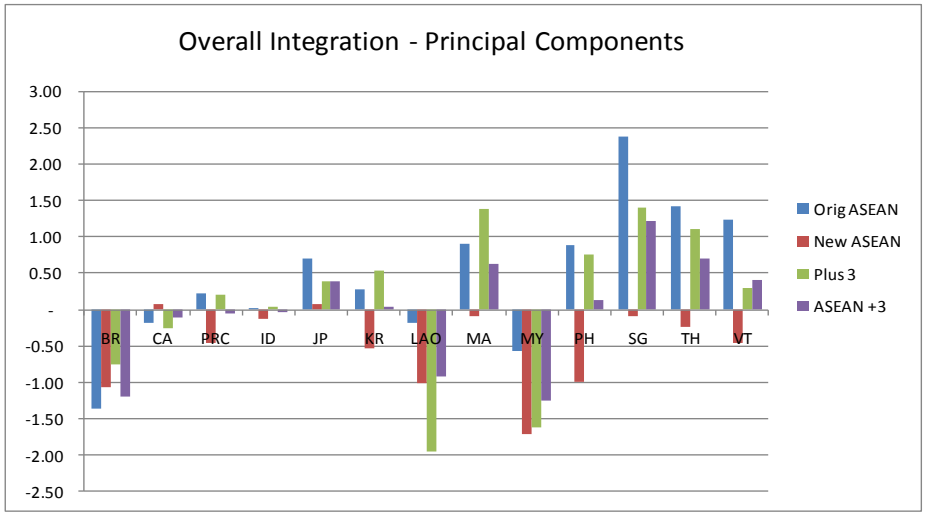


Figure 5 shows the principal components score for the four-variables case. It can easily be seen from Figure 5 that the newer ASEAN countries are much less integrated overall. This is the case in terms of their integration with others and with others' integration with these countries. The original ASEAN countries exhibit higher integration than all the others. Perhaps surprisingly (but consistent with Figure 4), the Plus3 nations are not as strongly integrated as the previous measures suggest.

Figure 5. Overall Integration Using Principal Components (four measures: BCS, UID, RPPP, Trade)



4. Some Conclusions

The three East Asian financial centers and high-income economies of Hong Kong,[6] Japan and Singapore are fairly highly integrated with global capital markets. The recent pace of liberalization in Korea post crisis is also intensifying the country's extent of international financial integration. The lower middle-income Southeast Asian countries, Thailand and Indonesia as well as the Philippines, are relatively less financially integrated, but still more integrated, in general, when one compares them with the less-developed ASEAN countries of Brunei, Cambodia, Laos, Myanmar and Vietnam.

Our analysis of the extent of real versus financial market integration finds that, overall, the original ASEAN nations—Indonesia, Malaysia, the Philippines, Singapore and Thailand—seem to be more integrated with the rest of Asia than other groups. This is the case for broad measures of both real and financial integration. They tend also to be especially well integrated with each other. Of these, Singapore and Malaysia appear to be the most connected generally. The newer ASEAN members are the least

[6] Not examined in the empirical section in this work.

integrated across all measures by a considerable margin—although the exception here is a possible exception itself.

The original ASEAN countries also seem to be more integrated when measured by the price-based measures—namely, UID, RPPD, equity-market correlations and business-cycle measures. The quantity measures show that Japan, Korea and China are highly integrated when measuring both the real (trade intensity) and the financial (FDI and portfolio intensity).

The principal components scores and the normalized scores for overall integration are reasonably consistent in that Singapore and Malaysia emerge as those countries with the highest levels. The scores do differ for China, Japan and Korea, with the principal component scores seemingly picking up more of a large-country effect.

There are several interesting policy implications arising from this work. First, it would appear that the financial aspects of integration are more persuasive in the smaller economies of ASEAN and that real integration is more prominently defined in the larger Plus3 countries. Thus, in terms of those aspects of integration that might more easily be reached by liberalization, it would appear that finance-based liberalization is more accessible. Second, there are still quite well-defined clusters, or regions, in the sample. This has implications for the design of trade or investment accords, and most certainly has implications for the outlook for monetary regionalism. While the larger economies are quite well integrated with the smaller ones, they are not as well integrated with each other. For this reason, the data suggest there is a considerable distance to travel before any regional bloc or monetary union involving the three major countries could be achieved.

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CHAPTER 10

Choosing Partners for Integration: Maximising Benefits from Risk Sharing

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This chapter estimates the risk reduction and welfare improvement from optimal pools of nine countries in East Asia plus the addition of the United Kingdom and the United States. Our results confirm that the welfare gains can be significant—under some assumptions, up to 5 percent of annual consumption for some countries. We show that the bulk of gains comes from pairs (that is, pools of two) with relatively little additional risk reduction added by larger pools. For most countries, the best pair is a developed country with a different business-cycle pattern. Though subject to change depending on the assumptions Australia could be the preferred pair partner for most countries in the region. There is no evidence that the current Association of South-East Asian Nations Five (ASEAN 5) grouping is optimal in terms of risk reduction, or that there are gains from a grouping of China–Japan–Korea. The policy implication is that the welfare benefits of risk sharing are large enough that they should form an additional part of the policy dialogue on regional integration. The results of such discussions might change the perspective on which partners should begin the process of closer financial cooperation.

Keywords: Risk sharing, financial Integration, East Asia
JEL Classifications: E32, F33

1. Introduction

Initiatives towards regional integration have traditionally been based on political definitions of national and regional boundaries. Even if the move to integration is primarily trade driven, as it is in East Asia, rather than politically motivated, as it has arguably been in Europe, the definition of the region and the identity of the nation-states within the region are the result of political history. The choice of partners within an integrating region can therefore be somewhat arbitrary. When there are conditions on entry—as, for example, the Maastricht conditions in Europe—existing members of a region have some control over who joins. But it is rare that these conditions are set on the basis of which countries will contribute most to the economic welfare of the integrated group. Nor do individual countries usually pick their partners on the basis of careful, welfare-maximizing conditions. Outcomes might be better if they did. The conditions for optimal currency unions are now well recognized and it is clear that currency unions that are very far from those conditions can face convulsions and disintegration.

In this chapter, we apply recently developed methods to show which groups of countries in the East Asian region will benefit most from closer financial integration. The benefits come both from improved stability of income and consumption streams and from the calculable welfare gains that these deliver. Section 2 of the chapter sets out the research question in more detail in the context of the relevant literature. Section 3 describes the research methodology. Section 4 describes the results and Section 5 presents our conclusions.

2. Research Questions

If it were possible to perfectly smooth consumption streams (which would in theory maximize welfare), a given country would consume a fixed fraction of aggregate world income regardless of the state of its economy. This situation is known in the literature as full diversification risk. If a country experiences an unusually positive outcome in its

economy, it would pay some fraction of its increased income to countries with negative outcomes and vice versa. That ideal situation can be achieved only when countries have access to perfect and complete financial markets and they have perfect ability to monitor and enforce contractual arrangements across borders. The absence of these conditions in the real world raises important research and policy questions: what second-best outcomes can be achieved by integrating with well-chosen partners?

In our context, this gives rise to the two questions we address in this chapter.

1. Which pool of countries is most attractive for regional risk-sharing opportunities in East Asia?
2. How large is the welfare gain from the optimal regional risk-sharing pool for countries in East Asia?

3. Literature Review

3.1. Optimal Risk

There is an abundant literature on the benefits of international risk sharing, and most studies agree that most countries in the world are yet to achieve the condition of complete international sharing of risk.

The discussion of the measurement of countries' risk sharing began when Lucas (1987) estimated the welfare cost of consumption uncertainty in the US economy. By proposing a method that compared countries' levels of utility under financial autarky with the levels of utility when countries can trade on international financial markets, Lucas argued that the gain from eliminating consumption variability was relatively small—that is, less than 1 percent of lifetime consumption. Hence, the cost of business cycles for the United States is insignificant. In the same spirit as Lucas, Obstfeld (1994) carefully distinguished the effects of risk aversion and inter-temporal substitution on the gain from reducing consumption volatility. Though producing a higher figure for the gain of eliminating consumption variability than Lucas, Obstfeld's estimation was still low.

More recent work (Callen et al., 2009) produces much larger welfare gains by examining the optimal country groupings for risk-sharing arrangements. The novelty of this approach relies on the fact that the reduction in volatility can be maximized by choosing partners who provide the best offsetting pattern of output variance. This suggests using the variance–covariance matrix to run a systematic search of the ideal pool from a group of countries worldwide. Callen et al. (2009) calculate the output volatility across a group of 74 countries and compare it with the volatility of output of each country individually. If the former has a lower figure than the latter, they infer potential welfare gains from international risk sharing. Furthermore, they conclude that the largest gains from risk sharing are obtained in a group that consists of less than 10 countries, and these gains can be of significant magnitude. In practice, weak institutional quality of potential partners and a history of default on international obligations might hinder the creation of these first best risk-sharing pools.

3.2. Welfare Implications

Many studies have tried to estimate the welfare effects of business cycles and international risk sharing. Among these, Cole and Obstfeld (1991), Lucas (1987) and Tesar (1995) find low welfare gains (less than 0.5 percent), while studies by Kim and Sheen (2007), Kim et al. (2006), Obstfeld (1994) and van Wincoop (1994, 1999) give a higher result.

Cole and Obstfeld (1991) evaluate the gains from international risk sharing using a simple general equilibrium model that incorporates output uncertainty. In a model that mimics selected moments of US and Japanese data to approximate the gain from international risk sharing, the magnitude is about a 0.2 percent increase in annual output. This gain, however, disappears once assumptions on preferences and technologies are altered. Tesar (1995) introduces different sources of uncertainty—market structure, country size, technology and preferences—and finds that the size of gains from risk sharing range from 0 to 2 percent of lifetime consumption. Such low results for the potential benefit of risk sharing might explain why countries appear to have a strong bias towards domestic assets, low international consumption correlations, and high correlations between domestic saving and investment (that is, a low level of international risk sharing).

Van Wincoop (1999), estimating Organization for Economic Cooperation and Development (OECD) countries' potential welfare gain from risk sharing, points out that the gains are sensitive to the parameterization of representative agents' preferences and to the assumption about the stochastic process and measurement of endowment. The first is important since it relates to the implicit risk-free interest rate, the rate of relative risk aversion, and the elasticity of substitution between tradable and non-tradable goods. Using almost full information on the factors that determine the benefits of risk sharing, van Wincoop (1999) estimates the welfare gain from risk sharing in the range of a 1.1 percent to 7.4 a percent permanent increase in consumption over 50 and 100-year horizons.

Using the same framework as van Wincoop (1994, 1999), Kim et al. (2006) calculate the potential welfare gain for 10 Asian countries when they perfectly diversify idiosyncratic country-income shocks. For all these countries, they find that risk-sharing gains are an increase of between 1.4 percent and 7 percent in consumption. The gains are higher if the United States is included in the set of countries that is available as risk-sharing partners, and range from 2 percent to almost 10 percent. For the ASEAN 5 subgroup, Kim et al. (2006) estimate an increase in annual consumption of about 2–9.5 percent for 10 and 50-year horizons. The gain for this group is higher than for the groups of Northeast Asia, developed countries and greater China.

4. Research Methodology

This section of the chapter discusses the procedures that we follow to estimate the possible extent of risk sharing between different groups of countries. The standard theory of risk sharing between countries asserts that, with complete markets, each country within the group will consume a fixed amount of aggregate output but does not give any information on the appropriate measure of the welfare gain associated with risk sharing. The main objective of this chapter—as with the literature reviewed above—is to estimate the scale of welfare gains from risk sharing. We go beyond the standard results, however, by not only asking what are the gains from risk-sharing versus no risk-

sharing but also quantifying the effect of risk-sharing arrangements between different countries in East Asia.

The initial step is to calculate the variance of output growth rates for each country under autarky and within different risk-sharing pools and then to evaluate the welfare implications of the different pools.

We define a "pool" as any group of countries that engage in complete risk sharing with each other (Callen et al., 2009). While Callen et al. use a large group of countries, we choose to narrow our search for the optimal pool and consider 10 countries in the Asia-Pacific region plus the United Kingdom as our universe of countries. These countries are Australia, China, Indonesia, Japan, the Philippines, Malaysia, Singapore, South Korea, Thailand, the United States and the United Kingdom. Our data are real gross domestic product (GDP) in purchasing power parity (PPP) US dollars over the period 1980–2009, taken from the World Bank's *World Development Indicators* (World Bank, various years).[1]

4.1. Descriptive Results

Figures 1 and 2 show the dynamics of GDP growth rates in the sample of countries between 1981 and 2009. The ASEAN 5 countries had relatively more volatile income than their peers. All countries in the ASEAN 5 experienced major downturns in their economic performance in 1998 and again in 2001 and 2009. While the impact of the Asian Financial Crisis (AFC) of 1998 was restricted to East Asian countries (excluding China), the more recent wave of crisis was experienced not only in East Asia but also in developed countries such as the United Kingdom and the United States. The coefficients of variation in Table 1 support the evidence of the graphs. This makes clear that not only did levels of income fall, but also growth rates became significantly more volatile about the time of the AFC. The ability to smooth consumption in such circumstances could be very valuable to improve welfare. Table 2 further shows high correlations between domestic consumption and output[2] for the countries in our

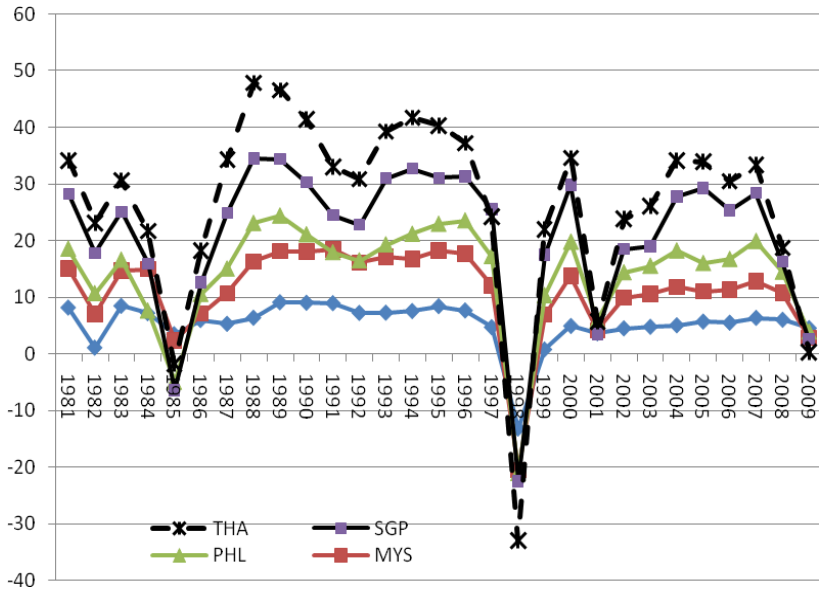
[1] Callen et al. (2009) note that the overall result of their analysis is similar when they use the Penn World Tables (PWT) dataset.

[2] With the curious exception of Indonesia, which might be the result not of high volatility in both series but of a difference in the timing of the volatility.

sample—consistent with a low ability to smooth consumption streams when income shocks occur.

Tesar (1995) explains that models of international risk sharing imply that, with high levels of risk sharing, countries' consumption streams should be highly correlated with each other. Since idiosyncratic shocks would be removed, the only remaining shocks would be system-wide ones and all countries' consumption would move together. She shows, however, that consumption in most countries had low correlation with global consumption while output had higher correlation with global output. This is inconsistent with any significant risk sharing. In Table 3, we report correlations between global and country output and consumption for selected East Asian countries for the period 1981–2009. The results confirm Tesar's findings and reiterate the findings in several previous studies (Corbett and Maulana, 2010; Kim et al. 2006) that risk-sharing activities are far from optimal for countries in the region. Correlations of consumption with global consumption are low in the region and are lower than for the developed-country benchmarks of the United States and the United Kingdom. Our data show—contrary to Tesar's—low correlations with global output, though other chapters in this study provide more information on the synchronization of business cycles and suggest a close synchronization with US real economic activity, though less close with other business cycles (for example, China's).

Figure 1. GDP Growth Across ASEAN 5 Countries, 1981–2009



Source: Data for all tables and charts are from World Bank's *World Development Indicators*, <http://data.worldbank.org/indicator>.

Figure 2. GDP Growth Across Non–ASEAN 5 Countries, 1981–2009

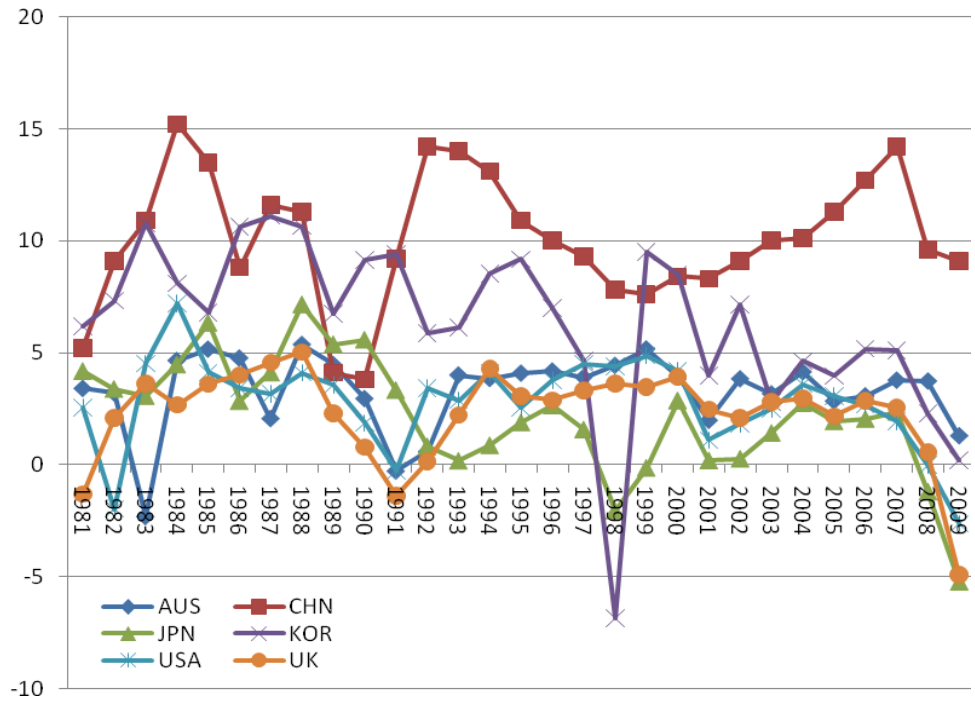


Table 1. Coefficients of Variation of GDP Growth Rates

Country	Coefficient variation					
	1981–85	1986–90	1991–95	1996–2000	2001–05	2006–09
Australia	107.44	34.40	86.65	11.58	26.33	38.86
China	34.79	46.47	16.73	11.30	11.06	20.41
Indonesia	56.28	24.04	9.28	1,234.36	15.53	13.65
Japan	29.21	31.78	86.67	215.78	83.67	–644.34
Korea	21.91	17.80	20.90	153.78	35.07	74.96
Malaysia	69.83	52.35	4.30	150.05	51.06	99.52
Philippines	–452.18	34.22	107.42	69.13	37.15	58.54
Singapore	70.42	42.49	28.49	70.38	107.24	112.91
Thailand	8.83	28.23	5.41	1,568.10	36.73	135.74
UK	96.26	52.56	137.94	10.90	14.92	1,734.54
USA	103.95	25.65	65.93	9.06	40.44	499.73

Table 2. Correlation of Growth of Domestic Consumption and Output, 1981–2008

Country	Coefficient
Australia	0.425
China	0.740
Indonesia	0.462
Japan	0.844
Korea	0.923
Malaysia	0.790
Philippines	0.846
Singapore	NA
Thailand	0.926
USA	0.851
UK	0.867

Note: Singapore's consumption data are available only for the three-year period 2003–05.

Table 3. Correlations with Global Consumption and Output

Correlation coefficient between growth of consumption and output in each country with world data

Country	Corr(c(i),c(w))	Corr(y(i),y(w))
Australia	0.46	0.18
China	0.25	0.16
Indonesia	0.09	–0.36
Japan	0.47	0.07
Korea	0.21	0.06
Malaysia	0.24	0.11
Philippines	0.26	0.16
Singapore	0.41	0.62
Thailand	0.21	0.02
USA	0.68	0.64
UK	0.69	0.57

4.3. Optimal Risk-Sharing Arrangements

Following the strategy of Callen et al. (2009), we use a (weighted) variance of the growth rate of output as a metric for output uncertainty. To estimate the covariance matrix, Callen et al. (2009) assume that the change in growth rates of GDP is identically distributed over windows of observations. This assumption allows them to decompose the resulting variance of country pools into the sum of each country's growth rate plus covariances between countries within the pool.[3]

[3] Callen et al. (2009) also test a different stochastic process for the growth rates of GDP and find that the main result of the analysis is largely unaffected.

We adapt Callen et al.'s (2009) criterion to select the "preferred" pool of countries by selecting the combination of countries that gives the minimum variance of the growth rate of GDP for the pool. Theoretically, if there is full integration and complete markets for a pool of countries then each country in the pool will consume a constant fraction of pool output. This implies that the percentage change in consumption for all countries in the pool will be equal to the percentage change in pool-wide output and will change only along with pool uninsurable risks. For this reason, we focus on the comparison of the volatility (variance) of pool-wide GDP with the volatility (variance) of each country's GDP (rather than using consumption variances).

Identifying the countries that give the minimum variance of the growth rate of pool-wide GDP is a not a trivial task, given the large number of possible combinations. To cover all combinations would take 2,047 calculations. Callen et al. (2009) used a binary traverse and window recursion computational algorithm but we devise a simpler, systematic enumerative strategy that keeps the number of calculations to a reasonably low quantity while at the same time logically identifying which group of countries has the lowest pool variances. Our procedure has one important difference from Callen et al (2009). We assume that the variance of the first pair identified as variance minimizing will always be in the set of larger best pools. With this approach, we reduce the number of variance calculations from 20 possible calculations to nine calculations for each country. This may result in overlooking best combinations of countries that do not include the initial pair.

We illustrate the enumerative processes using the Philippines.

1. Estimate the variance–covariance of the growth rate of output for the Philippines alone and with each country in the sample. The formula for group variance is

$$Var(g_p) = Var\left(\sum_{i=1}^{p} w_i g_i\right) = \sum_{i}^{p} w_i^2 Var(g_i) + \sum_{i=1}^{p}\sum_{j=i}^{p} w_i w_j \, Cov(g_i, g_j) \;\; for \; i \neq j \qquad (1)$$

where w_i represents the share of country i in the pool production, g_p is the growth of aggregate output for a pool of p countries and g_i is individual countries' growth rate. Using the formula, we can decompose the variance of the growth rate of group GDP into a weighted average of individual countries'

variances and the weighted sum of all bilateral covariances. In this way, we can characterize the group of countries that are optimal risk-sharing partners for a particular country.

2. Beginning with pools of two countries, the process gives variances of the Philippines and all two-country groups that have the Philippines as one of the members (pairing with each of our 10 countries). Theoretically, the variance of the groups will be smaller than the Philippines alone. The best two-country pool for the Philippines is the one that gives the lowest variance calculation. Using our results, China is the variance-minimizing best pair for the Philippines.
3. To search for the best pool for the Philippines in the case of three countries, we combine the Philippines–China group with the remaining nine countries and select the one that gives the lowest variance. With this approach, we reduce the number of variance calculations from 20 possible calculations to nine calculations. On the other hand, the approach assumes the variance of combinations with the 11 countries that we "skip" is higher than that of the nine combinations.
4. We repeat the above steps for the remaining countries' pooling.
5. We repeat these steps for each of the countries in the sample.[4]

We now turn to explaining the welfare implication of these best pools. The welfare gain is defined as the percentage increase in annual country consumption that would make the representative individual indifferent between autarky and pooling.

Thus, the welfare gain, δ , for country *j* at time *0* is defined as:

$$U(C_0^j(1+\delta), \mu_j\ \sigma_j^2) = U\left(\underline{C_0}, \underline{\mu}, \underline{\sigma}^2\right) \qquad (2)$$

where μ_j is the expected growth rate for one country and is assumed to be the same as the expected growth under pooling, $\underline{\mu}$, and σ_j^2, $\underline{\sigma}^2$ denote country *j* and pool-wide output variance; C_0^j is the individual country consumption level in the beginning period

[4] Our recursive procedure is not fully equivalent to Callen et al.'s (2009), with possible consequences that are noted in the conclusion.

and $\underline{C_0}$ is the pool-wide consumption level. Note the link between Equation (2) and the variances calculated in the previous pooling exercises.

Obstfeld (1994) argues that the "standard" constant relative risk aversion (CRRA) utility function cannot be used to specify (2) because CRRA fails to capture the offsetting effects of the inverse of inter-temporal substitution and relative risk-aversion coefficient. For this reason, the Epstein and Zin (1989) utility function is preferable. Assuming that C_t is log normally distributed then[5]

$$\log C_{t+1}^j = \log C_t^j + \mu_j - \frac{1}{2}\sigma_j^2 + \varepsilon_{t+1}^j \quad \text{where } \varepsilon_{t+1}^j \sim N\left(0, \sigma_j^2\right) \tag{3}$$

As we know, in the absence of risk-sharing arrangements, any single country's change in consumption equals the change in their individual output (income). That is, $C_t^j = Y_t^j$. The corresponding Epstein and Zin utility function at initial period *t = 0* for an individual country, *j*, is as follows:

$$U_0^j = U\left(C_0^j, \mu_j, \sigma_j^2\right) = C_0^j\left(1 - \beta exp\left[(1-\theta)\left(\mu_j - \frac{1}{2}\gamma\sigma_j^2\right)\right]\right)^{-\left(1/(1-\theta)\right)} \tag{4}$$

Likewise, the Epstein and Zin utility for the condition under a risk-sharing arrangement is given by

$$U_t = U\left(\underline{C_t}, \underline{\mu}, \underline{\sigma}\right) = \underline{C_t}\left(1 - \beta exp\left[(1-\theta)\left(\underline{\mu} - \frac{1}{2}\gamma\underline{\sigma^2}\right)\right]\right)^{-\left(1/(1-\theta)\right)} \tag{5}$$

The parameter θ is the inverse of the inter-temporal elasticity of substitution in consumption, γ is the parameter of relative risk aversion, β is the discount rate and $\sigma^2{}_j, \underline{\sigma^2}$ are individual and pool-wide variance, respectively. There are two points to be noted from (4) and (5). First, since $(\mu - 1/2\ [\gamma\sigma]\ ^{\uparrow}2$) positively affects the level of period *t* utility, we can see that the smaller the variance of pool-wide GDP, the bigger is the increase in the "certainty equivalent" utility. The scale of the effect is given by the size of the parameter for risk aversion, γ ; a higher risk-aversion coefficient will lead to greater welfare gains from a given reduction in variance. Second, as the term for the

[5] Limpert et al. (2001) point out that when a variable has low mean values, large variance and is non-negative then it is innocuous to assume the variable has a log normal distribution.

inverse of inter-temporal substitution, θ , increases, it reduces the welfare gain coming from a decrease in variance.

Having specified the measure for country welfare in (4) and (5), now we are ready to answer the question of how much is the welfare gain associated with moving from the autarky position to the risk-sharing arrangement. Full risk sharing within the pool ensures individual country *j*'s consumption grows with pool-wide output at rate $\underline{\mu}$ and fluctuates with pool-wide output variance, $\underline{\sigma^2}$. Substituting, we can calculate the welfare gain as:

$$\delta = \frac{C_0^j \left(1 - \beta exp\left[(1-\theta)\left(\mu_j - \frac{1}{2}\gamma\sigma j^2\right)\right]\right)^{-(1/(1-\theta))}}{\underline{C_j}\left(1 - \beta exp\left[(1-\theta)\left(\underline{\mu} - \frac{1}{2}\gamma\underline{\sigma^2}\right)\right]\right)^{-(1/(1-\theta))}} \qquad (6)$$

The welfare function (6) has three constituent parts: i) the difference between individual and pool-wide volatilities; ii) the expected difference between growth in country j in autarky and the growth of the pool; and iii) the ratio between the initial consumption of the individual country with no risk sharing and the initial consumption of pool-wide countries. In order to isolate the effects due directly to the diversification gain that country j will receive under risk sharing, we set $\mu_j = \underline{\mu}$ and $C_0^j = \underline{C_0}$, thus assuming that growth and consumption levels are equal in country j and the pool.[6] This approach also abstracts from the possibility of transfers on entry between countries in the pool. We therefore focus entirely on the welfare implications of the fall in volatility associated with international risk sharing and preserve the emphasis in Obstfeld (1994). From (6), we can deduce that the gain from international risk sharing will be small for a country that has volatility measures that are similar in the pooled and autarky situations. If volatility is related to size then countries' relative sizes matter in explaining the gain. Further, we assume that shocks to consumption follow a random walk (Callen et al., 2009, explain what happens if the random-walk assumption is relaxed), so we do not consider situations where certain countries are systematically subject to consumption shocks.

[6] Callen et al. (2009) extend the welfare calculation by allowing differential growth rates between countries and the pool and differentials in initial consumption levels. In the appendix, we show the effects of assuming different growth rates for all countries, but do not examine different growth rates for individual countries (see Note 8).

4. Results[7]

In this section, we present the variance and welfare calculations for each of the nine East Asian countries when paired with combinations of our group of 11 countries, and the optimal groupings between them.

We illustrate the intuition using the Philippines. We ask what pools of countries are optimal from the point of view of the Philippines. Figure 3 reports the variance of pool-wide GDP for the lowest variance combination of countries giving pools of different sizes, as the Philippines chooses partners from the set of all 11 countries to create ever larger pools. The bar graph against the right-hand scale is added to show the welfare effects of country pooling for the Philippines.

In this case, we observe an increasing trend of pool-wide variance as the pool size increases. The pool-wide variance reaches its peak when the Philippines pairs with 10 countries, at 1.142 percentage points, though this is still far below the 12.487 figure of the Philippines' own variance.

Using the pure diversification gains for the Philippines' consumption level as the measure of welfare, we show the gain from different-sized pools. We constrain the initial level of consumption for the Philippines to be identical to the aggregate pool consumption so that the gains come entirely from the reduction in variance of consumption, as noted above. The bar graph in Figure 3 shows the welfare gain for different pool sizes. To construct the figure, we adopt the values used by Callen et al. (2009)—namely, the discount rate $\beta = 0.95$, the inverse of the inter-temporal substitution rate $\theta = 2$ and the coefficient of relative risk aversion $\gamma = 5$. We use 3 percent as the common expected growth of the Philippines and pool-wide combinations.[8] These values are generally supported in the literature with values on risk aversion, γ, ranging between value 1 and 10 (Obstfeld (1994), Cole and Obstfeld,

[7] Our results depend heavily on the estimation of the variance–covariance matrices of GDP growth rates and these will be appropriate only if those series are statistically stable over time. Using the Augmented Dickey Fuller (ADF) test, unit roots are rejected in all countries' GDP growth rates excluding Japan, so we conclude that our estimator for the variance–covariance matrices is justifiable. The results of the ADF test for the unit root component for each country's growth of GDP are available upon request.

[8] Callen et al. (2009) use 3 percent growth as a reasonable global average. Since the East Asian region typically has higher growth than the world average, we tested the results with different values of expected growth and demonstrate a negative relationship between welfare gains for pooling and expected growth. The higher the expected growth, the lower is the gain that a country will receive under pooling.

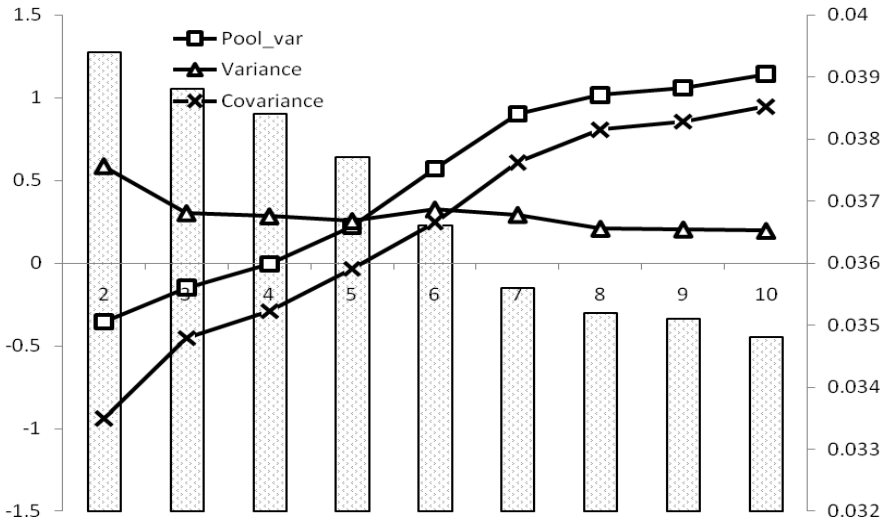
(1991) and Tesar (1995)). The literature suggests that a value for subjective time preference of 0.95 is relatively low. Obstfeld (1994) uses more conservative values of gamma=1, theta=4, and beta=0.95 to calculate gains for eliminating consumption variability for developing countries. We have kept close to Callen et al for comparability of results.

For the Philippines, the total gains are decreasing with pool size, and are at the maximum when the Philippines pools with just one other country. This best pair country is China, and the maximum welfare gain for the Philippines is about 4 percent of permanent increase in annual consumption when it pairs with China. Although these results take no direct account of the pattern of trade and are based entirely on the characteristics of growth volatility (so the outcome is the result of the negative co-movement of the growth of GDP between the two countries), there are, in fact, close trade links between China and the Philippines (EIU, various dates).

Interestingly, in view of the Philippines' participation in ASEAN, it turns out that the risk-minimizing combination of five countries for the Philippines would actually be achieved when it pairs with China, Australia, Singapore and Malaysia. This result shows that the optimal group of risk-sharing partners for the Philippines is not the current political group of ASEAN but a mix of some existing regional ties, China and a developed country, Australia (but see the Appendix for the effect of variations in assumptions).

Similar individual country results for other countries are shown in Appendix 1.

Figure 3. The Philippines' Risk-Sharing Indicator with its Best Pair and Welfare Implication



Note: Left-hand axis shows variance; right-hand axis shows welfare measure.

4.1. Pooling Risk Within Subgroups

4.1.1. ASEAN 5 Countries

Building on individual country results, we can draw out some suggestive conclusions for the process of integration in the East Asian region. We consider whether the current groupings, such as ASEAN, are optimal for risk-sharing partners and, if not, what are the optimal combinations for each country.

As the individual country results in Appendix 1 show, most countries in the region achieve their maximum gain from groupings of six or fewer countries (Singapore and Indonesia are exceptions). In Table 4, we show the optimal, GDP-growth-variance-minimizing combinations for each of the ASEAN 5 countries when combined with up to six countries, using the starting (1980) weights of each country in the region's GDP.[9]

[9] See the appendix for the effect of changing the weights.

Table 4. Ideal Risk-Sharing Partners for ASEAN 5 Countries and Welfare Implications

	Ideal partner				
Country	**2**	**3**	**4**	**5**	**6**
Indonesia	IDN-AUS	IDN-AUS-SGP	IDN-AUS-SGP-UK	IDN-AUS-SGP-UK-PHL	IDN-AUS-SGP-UK-PHL-CHN
Variance (17.11)	–0.4585	0.0776	0.3656	0.5296	0.6517
Welfare	[0.0548]	[0.0531]	[0.0522]	[0.0517]	[0.0509]
Philippines	PHL-CHN	PHL-CHN-AUS	PHL-CHN-AUS-SGP	PHL-CHN-AUS-SGP-MYS	PHL-CHN-AUS-SGP-MYS-JPN
Variance (12.49)	–0.3544	–0.1495	–0.0064	0.2215	0.5712
Welfare	[0.0394]	[0.0388]	[0.0384]	[0.0377]	[0.0366]
Singapore	SGP-AUS	SGP-AUS-IDN	SGP-AUS-IDN-UK	SGP-AUS-IDN-UK-PHL	SGP-AUS-IDN-UK-PHL-CHN
Variance (18.95)	0.3155	0.0776	0.3656	0.5296	0.6517
Welfare	[0.0584]	[0.0592]	[0.0583]	[0.0578]	[0.057]
Malaysia	MYS-AUS	MYS-AUS-CHN	MYS-AUS-CHN-PHL	MYS-AUS-CHN-PHL-SGP	MYS-AUS-CHN-PHL-SGP-JPN
Variance (16.82)	0.1814	0.3506	0.0457	0.2215	0.5712
Welfare	[0.0518]	[0.0513]	[0.0522]	[0.0517]	[0.0506]
Thailand	THA-AUS	THA-AUS-USA	THA-AUS-USA-PHL	THA-AUS-USA-PHL-IDN	THA-AUS-USA-PHL-IDN-SGP
Variance (21.24)	0.2915	0.5029	0.3496	0.3254	0.3564
Welfare	[0.0662]	[0.0655]	[0.066]	[0.0661]	[0.066]

Source: Authors' calculations. *Note*: In performing the above welfare calculations, we use the following assumptions: i) γ =5, θ =2, and β =0.95; ii) growth rates = 3 percent.

It is clear that pooling risk can significantly reduce the variance of GDP growth of ASEAN countries over the single-country variance (shown in Column 1). Furthermore, both the individual country figures in the Appendix and those in Figure 4 (showing just the welfare effects) indicate that each country achieves the bulk of its gains from the first pair. Adding more countries does not, in most cases, add significantly to the risk reduction and, even where some gain is achieved with more partners, the proportional

gain is small compared with the initial improvement. Only Singapore and Malaysia gain from additional partners, though most countries do not lose much from additional countries in their best pool. An important consequence is that Australia is the key risk-reducing partner for all ASEAN 5 countries except the Philippines. In general, a mix between developed and ASEAN partners is the ideal combination for income insurance for all ASEAN countries, rather than a pool of the current ASEAN 5 countries.

Figure 4. Welfare Implication of Different Pooling Size in ASEAN 5 Countries

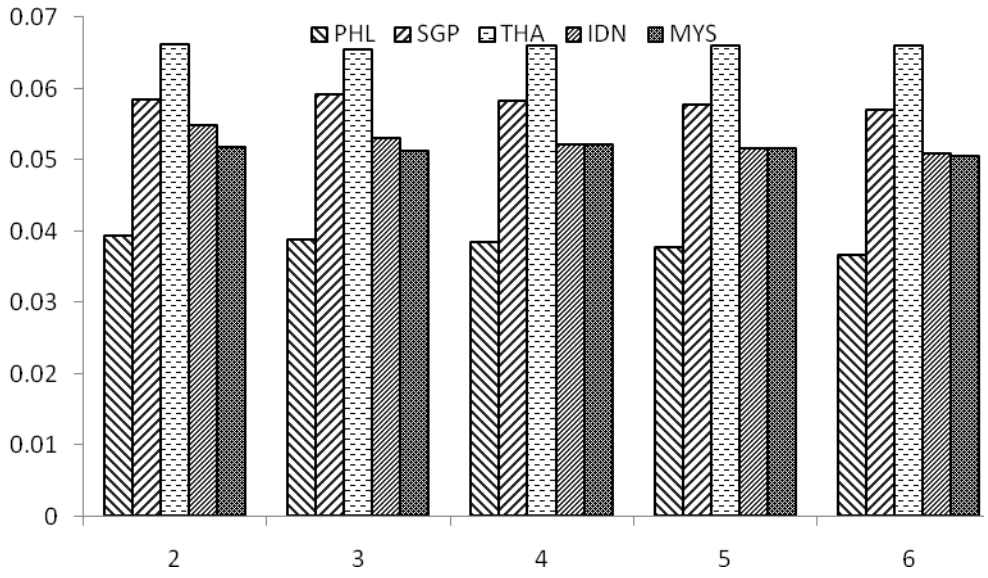


Figure 4 also shows two striking findings: on average, ASEAN countries have the possibility to gain close to 5 percent of annual consumption as a result of risk-sharing arrangements; and the more volatile is a country's income, the larger is the country's gain.

These findings for ASEAN 5 should not be surprising. Earlier research (Corbett and Maulana, 2010) showed that most East Asian countries smooth only about 25 percent of their GDP shocks via the standard international risk-sharing channels. The striking feature of the findings is that sequential risk-sharing agreements, starting with Australia as a partner, can bring a much larger gain than previous estimates suggest.

4.1.2. Non–ASEAN 5 Countries

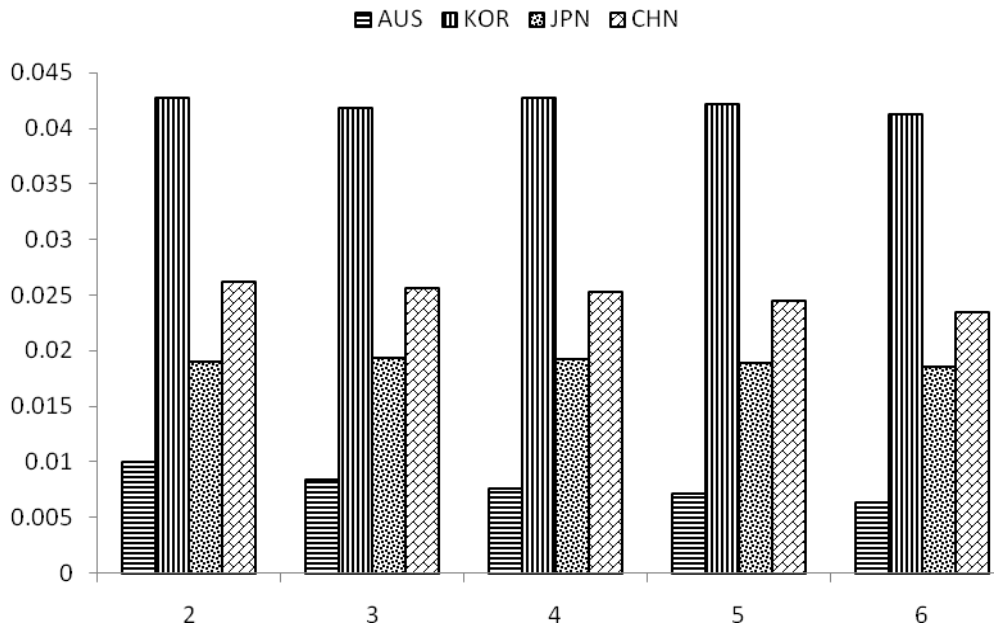
A similar calculation for non-ASEAN countries in the region is shown in Table 5. Interestingly, there is no evidence that a grouping of China–Japan–Korea is welfare improving for any of the partners. Only for Japan is China the best partner, while Korea gains most from links with Australia, and China gains most from links with the Philippines. Australia gains relatively little, in terms of stability, from risk-sharing links within the region, but contributes a lot. As in the case of the ASEAN 5, the bulk of gains come from the first pair and there is little gained or lost by adding members to the pools.

Table 5. Ideal Risk-Sharing Partner for Non–ASEAN 5 Countries and Its Welfare Implications

	Ideal partner				
Country	**2**	**3**	**4**	**5**	**6**
Australia	AUS-IDN	AUS-IDN-SGP	AUS-IDN-SGP-UK	AUS-IDN-SGP-UK-PHL	AUS-IDN-SGP-UK-PHL-CHN
Variance					
2.912	–0.4585	0.0776	0.3656	0.5296	0.6517
Welfare	[0.01]	[0.0084]	[0.0076]	[0.0071]	[0.0063]
Korea	KOR-AUS	KOR-AUS-CHN	KOR-AUS-CHN- PHL	KOR-AUS-CHN-PHL-SGP	KOR-AUS-CHN-PHL-SGP-MYS
Variance					
13.937	0.1048	0.3696	0.1046	0.2757	0.5856
Welfare	[0.0427]	[0.0418]	[0.0427]	[0.0421]	[0.0412]
Japan	JPN-CHN	JPN-CHN-PHL	JPN-CHN-PHL-AUS	JPN-CHN-PHL-AUS-SGP	JPN-CHN-PHL-AUS-SGP-MYS
Variance					
6.697	0.3922	0.2885	0.3411	0.4273	0.5712
Welfare	[0.019]	[0.0193]	[0.0192]	[0.0189]	[0.0185]
China	CHN-PHL	CHN-PHL-AUS	CHN-PHL-AUS-SGP	CHN-PHL-AUS-SGP-MYS	CHN-PHL-AUS-SGP-MYS-JPN
Variance					
8.298	–0.3544	–0.1495	–0.0064	0.2215	0.5712
Welfare	[0.0262]	[0.0256]	[0.0252]	[0.0245]	[0.0234]

Source: Authors' calculations. *Note*: In performing the above welfare calculations, we use the following assumptions: i) γ =5, θ =2, and β =0.95; ii) growth rates = 3 percent.

Figure 5. Welfare Effects for Non-ASEAN Countries



5. Conclusions

This chapter addresses the question of how much welfare could be gained by countries in the East Asian region from greater use of the risk-sharing opportunities that are presented by integration with countries that have different patterns of income variation. The relatively low level of international risk sharing globally has been widely noted. The low level of consumption smoothing and risk sharing amongst East Asian countries has also been previously noted. A frequent conclusion has been that the scale of the benefits is not large enough to overcome the home bias in investment that probably results from financial market friction and from a lack of confidence in institutional and legal structures to support cross-border financial transactions. More recent work, such as that of Callen et al. (2009), however, argues that the welfare gains are much more significant than previously estimated. We adapt the method of Callen et al. (2009) to estimate the risk reduction and welfare improvement from optimal pools of

nine countries in East Asia with each other plus the addition of the United Kingdom and the United States (to capture the possible benefits of links with highly developed countries well outside the region). Our results confirm that the welfare gains can be significant—at up to 5 percent of annual consumption for some countries. More strikingly, we show that for most countries in the region the bulk of gains comes from pairs (that is, pools of two), with relatively little additional risk reduction added by larger pools. For most countries, the best pair is a developed country with a different business-cycle pattern—often, Australia. There is no evidence that the current ASEAN 5 grouping is optimal in terms of risk reduction, or that there are gains from a grouping of China–Japan–Korea.

The method employed in the chapter has some limitations. It does not conduct a systematic search over all possible combinations of countries either within the region or across the globe. In order to keep computations simple, we developed a recursive technique that examines the effect of larger pools once the best small pool has been established. It is possible that this technique misses some better pool combinations that exclude the initial best partner, though the frequency of such combinations is likely to be low. We also show in the appendix that if actual growth is higher than the 3 percent we assumed, the scale of welfare gain is somewhat reduced. Importantly, changing the weights assigned to each country in the pool also changes the choice of best partner, with implications described below.

These limitations suggest important directions for future research. To draw solid and credible policy conclusions about the sensitive matter of the best choice of partners for integration gains, this research should be extended to use the full Callen et al. (2009), or similar, method to examine all possible combinations for East Asian countries. Further research is also needed to examine the appropriate parameter values for preferences, elasticities of inter-temporal substitution and risk aversion within the region, rather than using standard global norms. In addition, since optimal choices depend on the weights of countries in the possible pools (see Appendix 2), alternative calculations should explore the use of weights averaged over a plausible period to give a more representative value than the two extreme end-point weights we use in the text and the appendix. There would also be value in forecasting the change in partner

composition if differential growth rates result in foreseeable changes in the weights in the region (for example, the rise of China).

We have also focused exclusively on the welfare gains from the smoothing of income and consumption volatility. Our optimal pools do not, therefore, take account of trade gains that might arise from choosing the most trade-creating partnerships for free-trade agreements (which in any case we know would, optimally, be global rather than regional), nor do they say anything about the choice of partners to join in monetary agreements or common currency areas. Nonetheless, they demonstrate the possibility of deriving concrete information on another aspect of regional integration and one that should also become a standard part of the discussion of the benefits of closer financial integration to achieve risk diversification.

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Appendix 1. Effects of Pool Size for Individual Countries

Here we show the individual country welfare and variance changes with the "best" partners in each pool size. Note these calculations use the standard parameter values described in the text, our limited recursive method of calculation and the beginning-period weights in the variance–covariance matrix. As noted in Appendix 2, the best combinations, and the welfare values, will change with different weight and growth rate assumptions.

Figure A1.1. Dynamics of Singapore's Best Pool

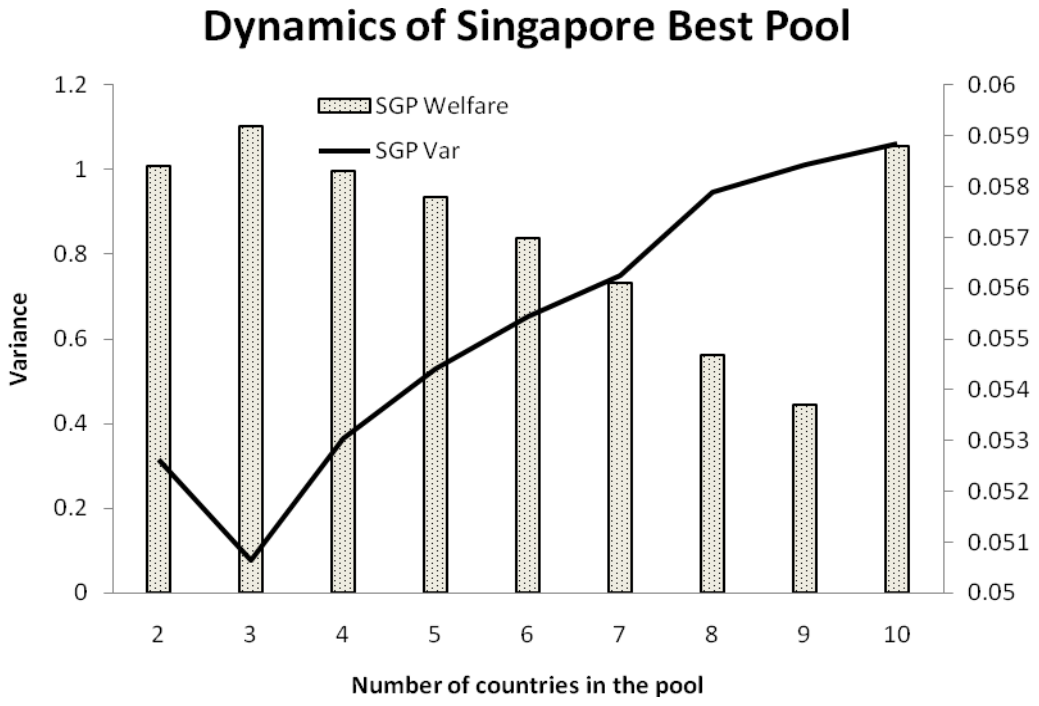


Figure A1.2. Dynamics of Indonesia's Best Pool

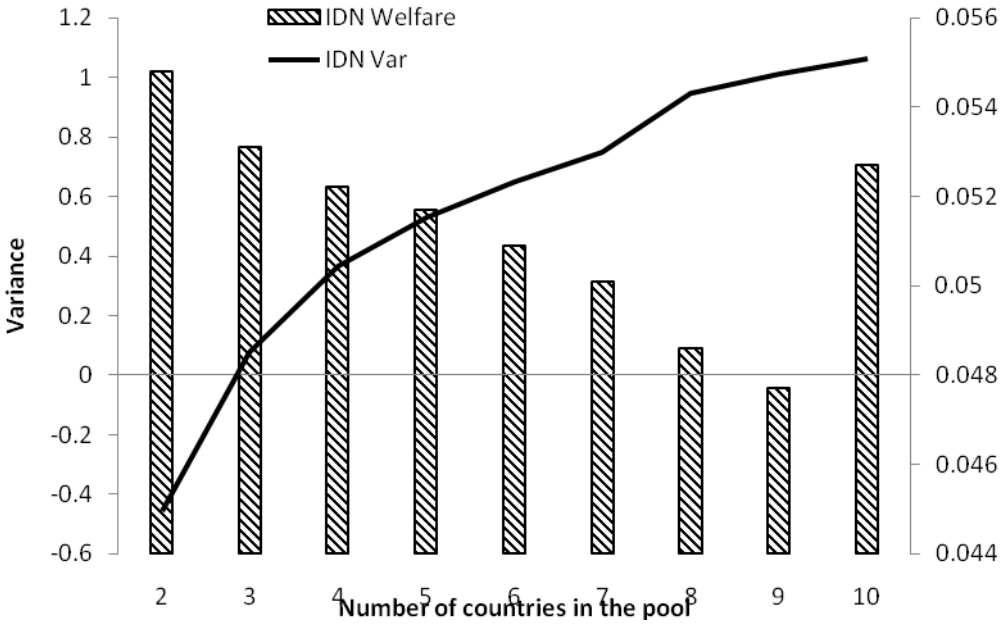


Figure A1.3. Dynamics of Korea's Best Pool

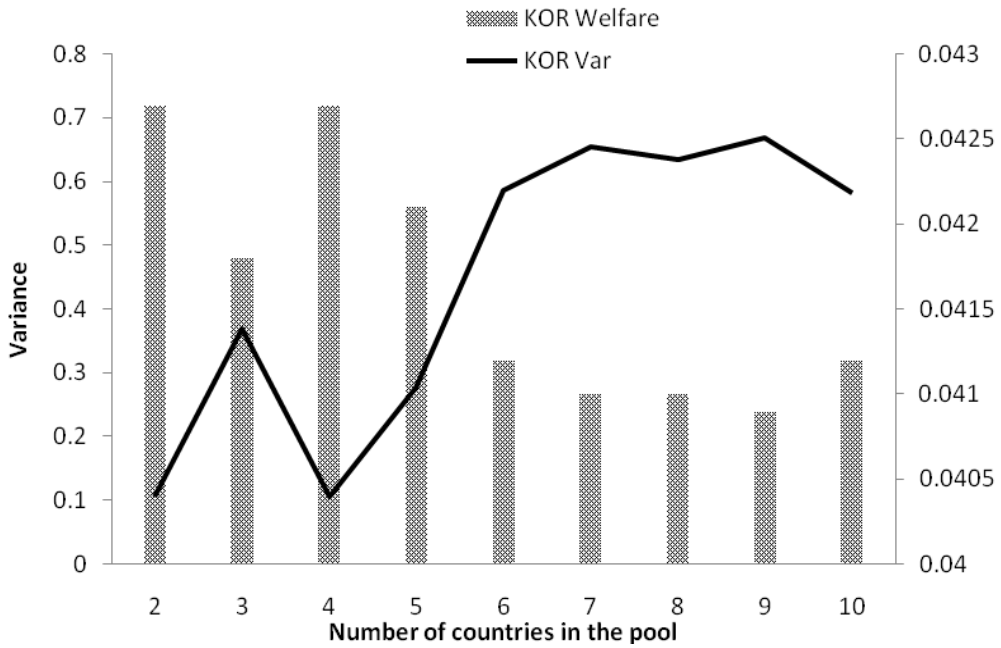


Figure A1.4. Dynamics of Malaysia's Best Pool

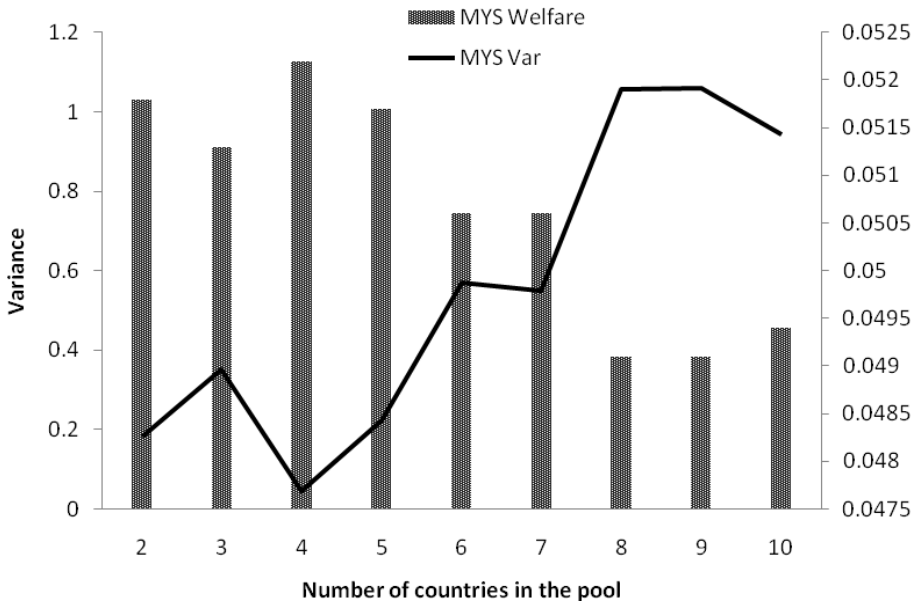


Figure A1.5. Dynamics of Japan's Best Pool

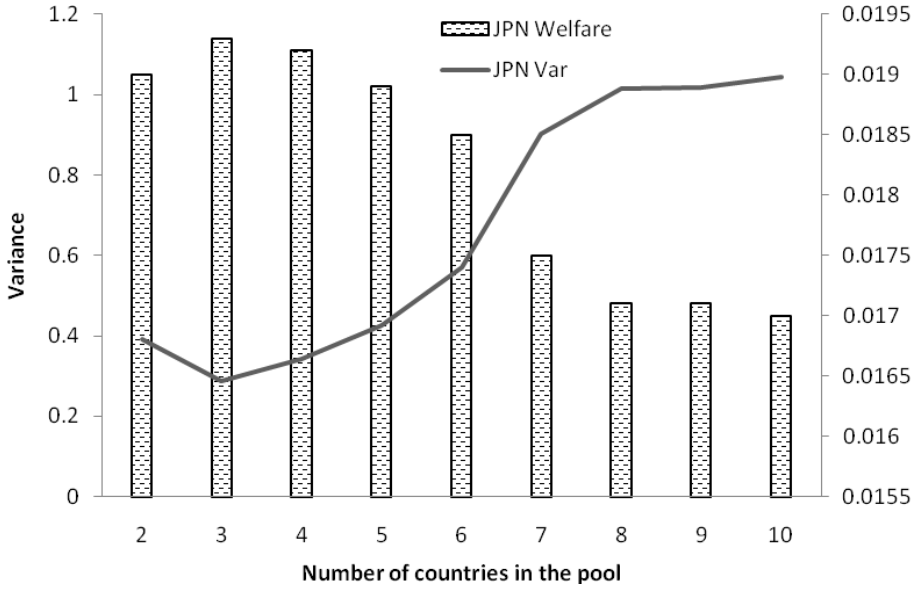


Figure A1.6. Dynamics of Thailand's Best Pool

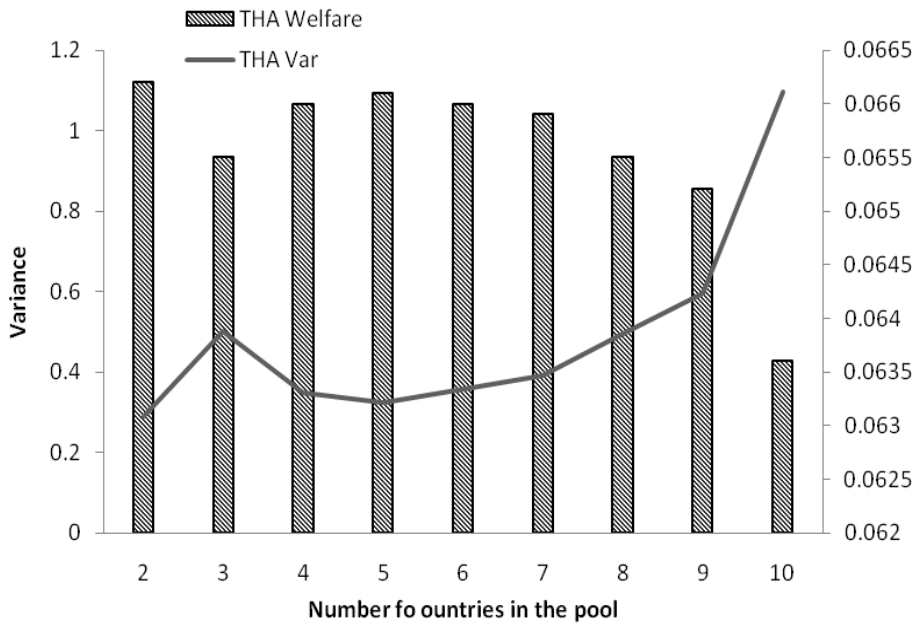


Figure A1.7. Dynamics of Australia's Best Pool

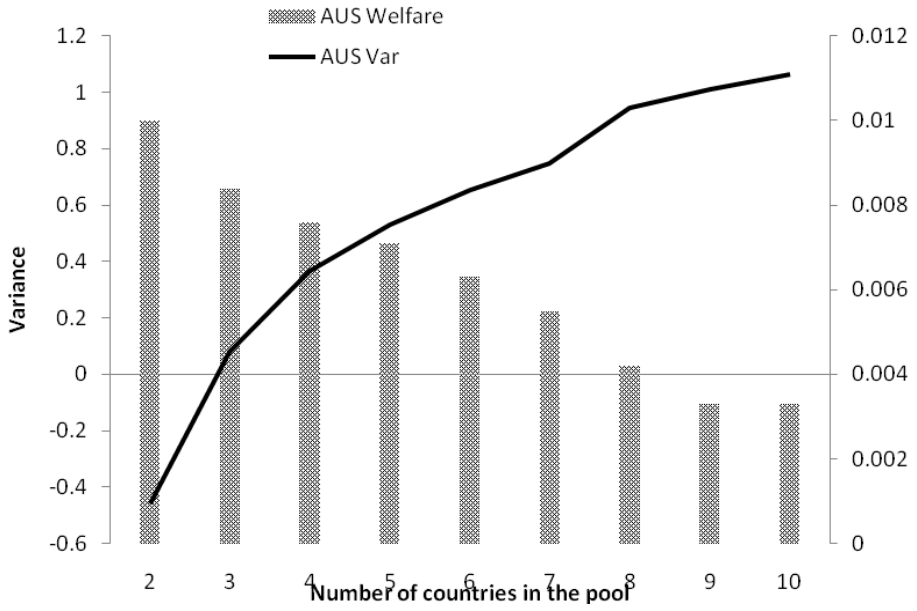
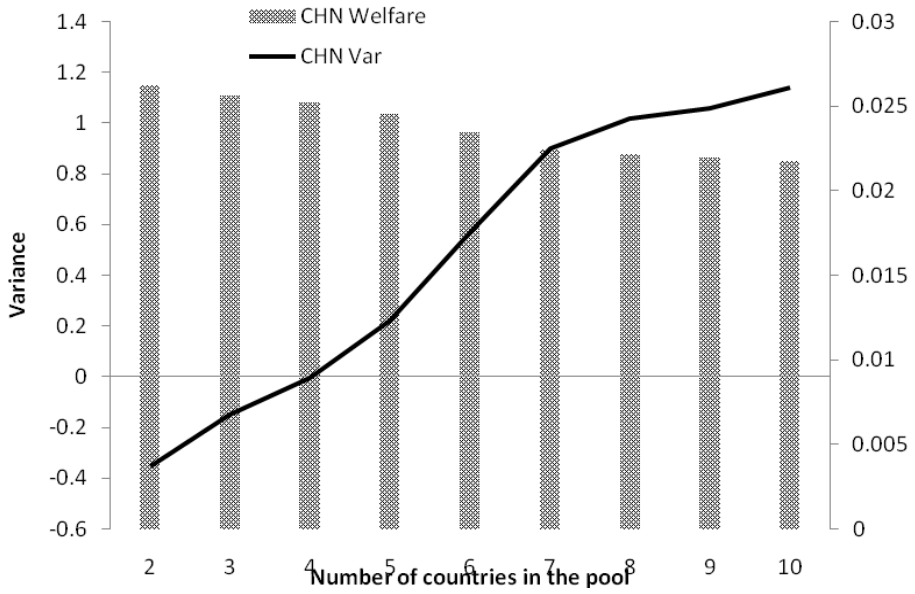


Figure A1.8. Dynamics of China's Best Pool



Appendix 2. Effect of Parameter Values Assumptions on Welfare Calculations

Altering the Assumptions

To compute the welfare implication of pooling, assumptions are needed for the following parameters: the discount rate, β , the coefficient of relative risk aversion, γ , and the inverse elasticity of inter-temporal substitution, θ . In addition to these parameters, an assumption is needed for the expected GDP growth rates for each country and for the pools. Given the scope of this chapter, we did not test the effects of different assumptions for all of these variables, but this appendix provides a simple sensitivity analysis of how the metric of welfare changes with different values of growth rates and how the ideal risk pooling between countries changes as we change the weights for covariance matrix estimation for GDP growth rates. We find that raising the growth rates to 5 percent (from the original assumption of 3 percent) decreases countries' gains from pooling. In addition, the method of calculating pool-wide variance is quite sensitive to changes in the variance weight of countries. We show this using countries' 2009 GDP as the weight for the covariance matrix estimations and find that the combinations of ideal risk-sharing partners for countries are sensitive to this assumption.

Growth Rate at 5 Percent Instead of 3 Percent

In the chapter, we assume that the expected growth rate is the same for the whole sample of countries and the various pools. To preserve comparability with Callen et al. (2009), we use the assumption of 3 percent expected growth rates and values of 2 for the coefficient of relative risk aversion, and 5 for the inverse elasticity of inter-temporal substitution. Using these values, Callen et al. (2009) find that (total income-weighted) welfare gains are monotonically increasing with pool size. In our results, in contrast, adding more countries to the ideal risk-sharing pool often causes the welfare for individual countries to decrease. Take Malaysia as an example. Malaysia's highest welfare gain is when paired with Australia. Malaysia experiences a 5.18 percent

increase in annual consumption and the figure drops when adding more countries to Malaysia's ideal-pool countries.

Table A 2.1. Risk Sharing Ideal partner for ASEAN 5 Countries and Its Welfare Implications with Growth at 5%

	Ideal Partner				
Country	**2**	**3**	**4**	**5**	**6**
Indonesia	IDN-AUS	IDN-AUS-SGP	IDN-AUS-SGP-UK	IDN-AUS-SGP-UK-PHL	IDN-AUS-SGP-UK-PHL-CHN
Poolwide variance	-0.4585	0.0776	0.3656	0.5296	0.6517
Welfare	[0.043]	[0.0417]	[0.041]	[0.0406]	[0.04]
Philippines	PHL-CHN	PHL-CHN-AUS	PHL-CHN-AUS-SGP	PHL-CHN-AUS-SGP-MYS	PHL-CHN-AUS-SGP-MYS-JPN
Poolwide variance	-0.3544	-0.1495	-0.0064	0.2215	0.5712
Welfare	[0.0311]	[0.0306]	[0.0302]	[0.0297]	[0.0288]
Singapore	SGP-AUS	SGP-AUS-IDN	SGP-AUS-IDN-UK	SGP-AUS-IDN-UK-PHL	SGP-AUS-IDN-UK-PHL-CHN
Poolwide variance	0.3155	0.0776	0.3656	0.5296	0.6517
Welfare	[0.0459]	[0.0464]	[0.0457]	[0.0453]	[0.0447]
Malaysia	MYS-AUS	MYS-AUS-CHN	MYS-AUS-CHN-PHL	MYS-AUS-CHN-PHL-SGP	MYS-AUS-CHN-PHL-SGP-JPN
Poolwide variance	0.1814	0.3506	0.0457	0.2215	0.5712
Welfare	[0.0407]	[0.0403]	[0.041]	[0.0406]	[0.0398]
Thailand	THA-AUS	THA-AUS-USA	THA-AUS-USA-PHL	THA-AUS-USA-PHL-IDN	THA-AUS-USA-PHL-IDN-SGP
Poolwide variance	0.2915	0.5029	0.3496	0.3254	0.3564
Welfare	[0.0518]	[0.0513]	[0.0517]	[0.0518]	[0.0517]

Source: Authors' calculation Notes: In performing the above welfare calculations we use the following assumptions. (i) γ =5, θ =2 , and β =0.95 (ii) growth rates= 5 %

Table A 2.2. Risk sharing ideal partner for Non ASEAN 5 Countries and Its Welfare Implications with Growth at 5%

	Ideal Partner				
Country	2	3	4	5	6
Australia	AUS-IDN	AUS-IDN-SGP	AUS-IDN-SGP- UK	AUS-IDN-SGP- UK-PHL	AUS-IDN-SGP- UK-PHL-CHN
Variance	-0.4585	0.0776	0.3656	0.5296	0.6517
Welfare	[0.008]	[0.0067]	[0.006]	[0.0056]	[0.005]
Korea	KOR-AUS	KOR-AUS-CHN	KOR-AUS-CHN- PHL	KOR-AUS-CHN- PHL-SGP	KOR-AUS-CHN- PHL-SGP-MYS
Variance	0.1048	0.3696	0.1046	0.2757	0.5856
Welfare	[0.0336]	[0.033]	[0.0336]	[0.0332]	[0.0324]
Japan	JPN-CHN	JPN-CHN-PHL	JPN-CHN-PHL- AUS	JPN-CHN-PHL- AUS-SGP	JPN-CHN-PHL- AUS-SGP-MYS
Variance	0.3922	0.2885	0.3411	0.4273	0.5712
Welfare	[0.015]	[0.0153]	[0.0152]	[0.015]	[0.0146]
China	CHN-PHL	CHN-PHL-AUS	CHN-PHL-AUS- SGP	CHN-PHL-AUS- SGP-MYS	CHN-PHL-AUS- SGP-MYS-JPN
Variance	-0.3544	-0.1495	-0.0064	0.2215	0.5712
Welfare	[0.0207]	[0.0202]	[0.0199]	[0.0193]	[0.0185]

Source: Authors' calculation Notes: In performing the above welfare calculations we use the following assumptions. (i) γ =5, θ =2 , and β =0.95 (ii) growth rates= 5 %

Changing the Weight to the End Period

Table A2.3 shows the effect of changing the weights for pool variance calculation. Callen et al. (2009) use the value of real GDP of each country in the first year of their observation to calculate the weights. In our case, using the beginning period values as country weights, we found that the ideal two-pair partner for Indonesia, Singapore, Malaysia and Thailand is Australia, while the ideal two-pair partner for the Philippines is China. Changing the weights has a significant effect, so that, when using the end of the period as countries' weight, we find that the ideal two-pair partner for Indonesia, Singapore, Malaysia and Thailand is the United Kingdom, while for the Philippines it is the United States of America. This suggests that further research is needed to track the changes in the economic structure of the region over the past 20 years and to examine the changes in optimal grouping as different countries rise in importance.

Table A2.3. Ideal Risk-Sharing Partners for ASEAN 5 Countries and their Welfare Implications (Using end year as weight)

Country	Ideal Partner				
	2	**3**	**4**	**5**	**6**
Indonesia	IDN-UK	IDN-UK-AUS	IDN-UK-AUS-PHL	IDN-UK-AUS-PHL-SGP	IDN-UK-AUS-PHL-SGP-USA
Pool-wide variance	–0.5798	0	–0.3038	0.2533	0.4767
Welfare	[0.0672]	[0.0663]	[0.0655]	[0.0646]	[0.0636]
Philippines	PHL-USA	PHL-USA-IDN	PHL-USA-IDN-THA	PHL-USA-IDN-THA-MYS	PHL-USA-IDN-THA-MYS-AUS
Pool-wide variance	0.2507	0.3183	0.1743	0.2245	0.2705
Welfare	[0.0419]	[0.0374]	[0.0421]	[0.0331]	[0.0418]
Singapore	SGP-UK	SGP-UK-IDN	SGP-UK-IDN-AUS	SGP-UK-IDN-AUS-PHL	SGP-UK-IDN-AUS-PHL-USA
Pool-wide variance	0.2098	–0.0569	0.014	0.2533	0.4767
Welfare	[0.0523]	[0.0532]	[0.0529]	[0.0522]	[0.0409]
Malaysia	MYS-UK	MYS-UK-SGP	MYS-UK-SGP-AUS	MYS-UK-SGP-AUS-JPN	MYS-UK-SGP-AUS-JPN-USA
Pool-wide variance	–0.1766	0.2037	0.3779	0.5071	0.4685
Welfare	[0.0558]	[0.0546]	[0.0541]	[0.0537]	[0.0538]
Thailand	THA-UKA	THA-UKA-IDN	THA-UKA-IDN-AUS	THA-UKA-IDN-AUS-SGP	THA-UKA-IDN-AUS-SGP-USA
Pool-wide variance	–0.04	0.4747	0.0085	0.4731	0.4801
Welfare	[0.0712]	[0.0514]	[0.0711]	[0.0656]	[0.0696]

Source: Authors' calculations.

Note: In performing the above welfare calculations, we use the following assumptions: i) γ =5, θ =2, and β =0.95; ii) growth rates = 3 percent.

Table A2.4. Ideal Risk-Sharing Partners for ASEAN 5 Countries and their Welfare Implications (Using end year as weight)

Country	Ideal Partner				
	2	3	4	5	6
Australia	AUS-IDN	AUS-IDN-UK	AUS-IDN-UK-PHL	AUS-IDN-UK-PHL SGP	AUS-IDN- UK-PHL SGP-USA
Poolwide Variance	-0.4272	-0.3038	-0.0516	0.2533	0.4767
Welfare	[0.0112]	[0.0109]	[0.0101]	[0.0092]	[0.0082]
Korea	KOR-AUS	KOR-AUS-CHN	KOR-AUS-CHN-JPN	KOR-AUS-CHN-JPN PHL	KOR-AUS-CHN-JPN PHL-SGP
Poolwide Variance	0.0537	0.3696	0.5306	0.3949	0.4419
Welfare	[0.0424]	[0.0418]	[0.0408]	[0.0413]	[0.0412]
Japan	JPN-UKA	JPN-UKA-PHL	JPN-UKA-PHL-AUS	JPN-UKA- PHL-AUS CHN	JPN-UKA- PHL-AUS CHN-SGP
Poolwide Variance	0.2262	0.2006	0.2822	0.2627	0.2889
Welfare	[0.0145]	[0.0146]	[0.0143]	[0.0144]	[0.0143]
China	CHN-JPN	CHN-JPN-PHL	CHN-JPN-PHL-AUS	CHN-JPN-PHL-AUS SGP	CHN-JPN- PHL-AUS SGP-MYS
Poolwide Variance	0.2387	0.0625	0.0456	0.0897	0.18
Welfare	[0.0262]	[0.0267]	[0.0268]	[0.0267]	[0.0264]

Source: Authors' calculations.

Note: In performing the above welfare calculations, we use the following assumptions: i) γ =5, θ =2, and β =0.95; ii) growth rates = 3 percent.

CHAPTER 11

Trends, Patterns and Dynamics of Capital Inflows in Asia

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An important dimension in the measurement of the extent of international financial integration is the literature on the trends in and determinants of capital flows. While the literature on this is sizeable, there do not appear to be many contributions that focus on the dynamics of the interactions between the various components of capital flows, viz. foreign direct investment (FDI), portfolio equity, portfolio debt and bank flows. This paper seeks to examine this issue—looking only at the inflows of capital—by asking the following questions: are the respective components of capital flows substitutes or complements? Does one type of capital flow enhance or inhibit the others? Do these notions of substitution and complementarity apply to the effect of the volatility of the components of flows on the level of each flow? The policy implications of this analysis can be viewed in terms of countries' financial liberalization policies. If two types of flows are substitutes then a policy of liberalizing, or indeed restricting, one type of flow might actually crowd out the other. This could well be an unintended consequence of a country's financial liberalization policy.

Keywords: Capital flows, financial integration, FDI
JEL Classifications: F31, F21, F36

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1. Introduction and Motivation

While there is a sizeable literature on the trends and determinants of capital flows, there do not appear to be many contributions focussing on the dynamics of the *interactions* between the components of capital flows. This paper seeks to examine this issue by asking the questions: are the respective components of capital flows substitutes or complements? Does one type of capital flow enhance or inhibit the others? We examine both the mean and the volatility of flows to establish whether high volatility in one type of flow might result in a substitution towards another type of flow. This study employs country-level total inflows of foreign direct investment (FDI), portfolio equity, portfolio debt and bank flows for Hong Kong, Indonesia, Japan, Korea, Malaysia, the Philippines and Thailand for the period 2000–09.

The recent literature is devoted mainly to gravity-type models on the determinants of capital flows[2] (for a brief survey of recent studies, see Hattari and Rajan, 2009; and also Rajan and Hattari, 2009), on the effect of capital flows on variables such as GDP growth (see, for example, Edison et al., 2002), or inflation. There is also a literature examining the effect of liberalization policies on flows (see the well-known paper by Montiel and Reinhart, 1999, or, for a recent piece, see Sompornserm, 2010), and the sequence of financial liberalization—particularly asking the question whether FDI should be promoted before, say, portfolio flows (as it is more stable).

There is also a reasonably recent literature on the variations in capital flows and its associated measurement issues. Becker and Noone (2009), Debelle and Galati (2005) and, very recently, Broto et al. (forthcoming) and Neumann et al. (2009) all present analyses containing the volatility of capital flows and what factors might determine it. Recent papers by Alfaro et al. (2004) in particular examine the effect of institutions on capital flow volatility. This paper differs by using the existing literature on the determinants of the level and volatility of capital flows as a baseline specification, and extends it by introducing the interaction of the various components of these flows. This paper is very much exploratory in nature and, as such, rather than employing a single measure, we employ a system-of-equations approach by using a VAR as well as

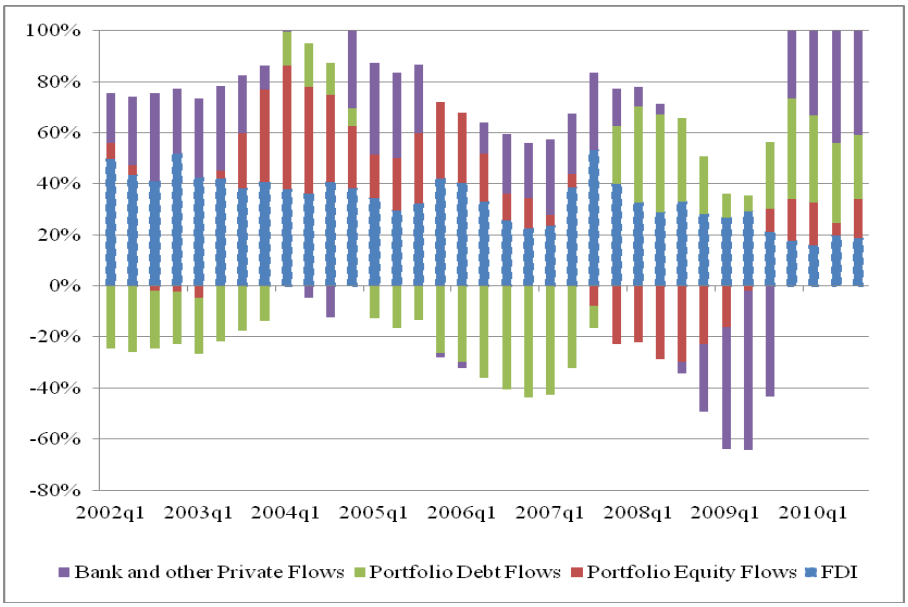
[2] For a cogent review of the traditional determinants of capital flows and some policy consequences, see Calvo et al. (1994).

analyzing a series of single-equation models based on a panel fixed-effects specification.

Essentially, as we wish to examine the interaction of the components of capital flow, this study is an investigation of the determinants of the composition of capital flows. While there is a significant policy literature on this, the scholarly literature is not large. Binici et al. (2010), for instance, present an empirical analysis of the role of capital controls on the composition of flows by direction but not necessarily by type. Much of the existing literature is over the empirical regularity that FDI is relatively more stable. For instance, Fernandez-Arias and Hausmann (2001) ask whether the composition of flows (and especially the possession of FDI) matters during crises. This issue is more recently taken up in Sula and Willett (2009). The issue of the relative stability of FDI is presented in Albuquerque (2003). An interesting paper dealing with the interaction of the types of flows is Smith and Valderamma (2009), who argue that the composition of flows is an important factor in that some substitutability exists, that it has a dynamic pattern and that this can be explained with the assistance of a general equilibrium model of a small, open economy.

Empirically, there is an important strand of the policy literature that assesses the stylized facts in relation to the composition of capital flows. In recent times, and with respect to Asian economies, the IMF (2011a) reports that composition is important in tracking the patterns of international capital flows. In recent times, portfolio debt investment inflows are stronger relative to other inflows for Indonesia, Korea and Malaysia, while bank inflows are stronger in Hong Kong. The IMF (2011b) reports that net debt flows were the least persistent (suggesting other determinants might play a stronger role here), FDI net flows are most persistent and FDI and, to a lesser extent, equity net flows are the most stable. Regarding the volatility of net flows, bank flows are the most variable. This can be seen in the net flows presented in Figure 1.

Figure 1. Net Capital Flows by Component



Source: IMF (2011a).

Quite clearly, FDI net flow (the line with the dashed effect) is the most stable component of capital flow. It can also be seen that bank net flows appear relatively less stable and suffered a dip in the period after the commencement of the Global Financial Crisis (GFC). This dip is preceded by similar reductions in the net flows of, first, portfolio debt and, then, portfolio equity investment. We can see that the patterns of each component of flow are not necessarily consistent with any other and that these flows appear to follow a dynamic pattern or sequence. Such a sequence is likely to be difficult to explain with any great precision but we can say that financial integration, as measured through capital flows, could well be subject to the ebbs and flows of the interactions of the types of flows. This is one important motivation for the work that follows.

At its core, this study measures the indirect effect of various determinants of capital flows by investigating directly the interaction between the components of those flows. In other words, if policymakers liberalize (by, say, removing capital controls on) portfolio flows, what effect does this have on FDI? Under this analysis, this would depend on whether they are substitutes or complements. If FDI and portfolio flows are substitutes then a policy of liberalizing portfolio flows will actually crowd out FDI flows. This could well be an unintended consequence of a country's financial

liberalization policy. This is naturally also true of the employment of capital controls. Let us consider an example.

Consider the case of equity versus debt flows; if controls are instituted on equity flows then the effect on debt flows depends crucially on the dynamic interaction between the two. By additionally presenting an analysis of the effect of the volatility of capital flows, we can examine whether the levels of inflows are augmented or diminished by the second moment—both of its own inflow (a mean-variance argument) and of other flows. As such, this study might represent a useful addendum to the literature that assesses the direct effect of liberalization policies on their respective capital flows.

Can we make any statements about what we might expect from the interactions of the components of capital flows? The general landscape of financial integration in developing economies generally and in Asia in particular is that flows increase alongside each other—that the banking system must improve in order to accommodate the consequences of increasing FDI and portfolio flows. This improvement makes banking more efficient and therefore more attractive for foreign funds. The data do not overwhelmingly support this. It could be conjectured from Figure 1 that the pattern that emerges from the graph, where waves of (non-FDI) flows tend to occur in sequence, implies that substitutability is the strongest factor. If this is the case, the components of each flow are decreasing in the other components. We can also form some conjectures regarding the relative stability of the flows—particularly FDI. Does FDI extract any benefit at all from being relatively stable? If so, we can conjecture that an increase in the variability in one (or more) of the other flows will increase the level of FDI flows, and investors choose this component due to its relative stability.

The paper is structured as follows: the following section presents the data and their sources, and details the estimation procedure for the VAR and the Panel LS tests used in this paper. Section 3 presents the results of the estimations and the relevant discussions. Section 4 concludes and presents some policy remarks.

2. Data and Methodology

We orient this study towards an analysis of the recent experience for a sample of Asian countries. This study will in the first instance employ country-level total flows of FDI, portfolio equity, portfolio debt and bank flows for Hong Kong, Indonesia, Japan, Korea, Malaysia, the Philippines and Thailand for the period 2000–09. Quarterly observations of the data are taken from the IMF *International Financial Statistics* database and from the Asian Development Bank database.[3] Specifics pertaining to data are found in the Appendix Table A1. Positive and negative flows (as a percentage of GDP) are employed in constructing the estimates. To ignore the other side of the flow would produce a highly discontinuous data set and would also remove a potentially important source of inquiry. We will analyze the inflow of capital in this instance. In addition to flow data, we also employ inflation, interest rate, exchange rate and output growth data as controls. The modeling approach involves two stages. The first will involve the specification of a basic VAR model. The second will employ a panel fixed-effects specification.

First, given that we intend to examine the interactions of the components of capital flows, system of equations through an unrestricted VAR will be employed.[4] Some pre-testing for the stationarity properties of the data (in panel form) being used revealed that most of the variables are *I(0)* processes, some are weakly *I(0)*—FDI flows mainly—whilst the interest rate data were weakly *I(1)*. Preliminary co-integration tests suggest the existence of some co-integrating relationships, but given the integration properties of most of the data, a VAR specification was selected for analysis. As such, the model to be tested will be based on the following: $AY_t = C + B(L)Y_{t-1} + GX_{t-1} + \xi_t$, (1)

where $Y_t = [FDI_t, PF_t^{EQTY}, PF_t^{DEBT}, BANK_t]'$; the component of capital inflows, X_t, is a vector of control variables and potential determinants of capital inflows; ξ_t is an error term; and A, B, G, (C) are each a matrix (vector) of coefficients. L is the polynomial lag operator.

[3] www.adb.org.

[4] A structural VAR is an option here; however, the unrestricted version is employed to establish some stylized facts around the interactions of the component inflows. For the impulse responses and variance decomposition results that follow, a Cholesky ordering (discussed below) offered sufficient identification of restrictions to suffice for this analysis.

Testing will involve the usual time-series techniques including the assessment of the directionality of the relationships between the capital flows by observing the coefficient values for the effect of lagged flows on current flows as well as impulse response functions. Variance decompositions are also employed. Model identification through coefficient restriction of *A* is performed by Cholesky decomposition. The estimates are quite robust to different orderings. The ordering presented here reflects the possibility that FDI is the slowest to move (that is, shocks to equity, bank and debt flows do not influence FDI contemporaneously). The impulse response functions and variance decompositions presented are calculated over 12 periods.

Lag length selected for all estimates is four quarters. This is (for the most part) the most appropriate model under SBC model selection. The X variables are lagged one period in the model to assist with addressing the issue of endogeneity.

In order to further evaluate the interactive effects of the components of capital flows, we employ a panel fixed-effects model to our data. The modelling strategy will follow an auto-regressive distributed lag (ARDL) approach as follows:

$$FLOWj_{it} = \alpha_0 + \alpha_1 FDI_{it-1} + \alpha_2 DEBT_{it-1} + \alpha_3 EQUITY_{it-1} + \alpha_4 BANK_{it-1} + \alpha_5 Z_{it} + \alpha_6 X_{it-1} + \varepsilon_{it}, \qquad (2)$$

where j = [*FDI, DEBT, EQUITY, BANK*] and, as above, X is a vector of controls. In other words, we will have an equation for each flow to assess the effect on that flow of lagged flows. Lagged dependent variables were used to pick up the time-series characteristics as well as to avoid the problem of endogeneity. Furthermore, we examine any contemporaneous relationships between the flows by including the remaining flows (Z_{it}) as regressors. In order to address the question of the effect of the variability of flows in determining the level of a particular flow, we augment the model as follows:

$$FLOWj_{it} = \alpha_0 + \alpha_1 FDI_{it-1} + \alpha_2 DEBT_{it-1} + \alpha_3 EQUITY_{it-1} + \alpha_4 BANK_{it-1} + \alpha_5 Z_{it} + \alpha_6 X_{it-1} + \beta_1 SD(FDI_{it-1}) + \beta_2 SD(DEBT_{it-1}) + \beta_3 SD(EQUITY_{it-1}) + \beta_4 SD(BANK_{it-1}) + \varepsilon_{it}, \qquad (3)$$

where SD represents the rolling 12 (previous) period standard deviation of each respective flow.[5] The model was estimated with two-way (country, time) fixed effects. All models were estimated with all controls and the statistically insignificant ones were removed.

3. Results and Discussion

This section presents the results for the VAR specification and the fixed-effects model as detailed above. Table 1 presents the coefficients to the lagged variables in the model. As mentioned in Section 1, what we are looking for here are negative values that might be interpreted as possible evidence of substitution or positive values that might be evidence of complementarity. From Table 1, the most notable result is that a shock to lagged bank inflows has a strong positive effect on FDI inflows. This effect is also persistent—a possible indication that it is not simply an auto-regressive effect that diminishes over time. From this table, we can also see that FDI is quite persistent—consistent with the empirical evidence for the Asian region in general. That said, in contrast with the same empirical observations, debt and bank flows as measured here are also quite persistent. Moreover, there is some evidence—albeit quite weak—of a negative influence of lagged FDI on debt inflows.

Table 1. Unrestricted VAR Coefficients for Lagged Terms: Inflows

	BNINGDP	DBINGDP	EQINGDP	FDINGDP
BNINGDP(-1)	0.555410 [8.10112]	0.016228 [0.57546]	–0.018206 [–0.87856]	0.101149 [6.05380]
BNINGDP(-2)	0.170820 [2.19360]	0.051862 [1.61914]	0.115769 [4.91858]	0.076587 [4.03559]
BNINGDP(-3)	–0.309294 [–3.95885]	–0.180105 [–5.60449]	0.009805 [0.41523]	0.061916 [3.25189]
BNINGDP(-4)	0.134328 [1.83356]	0.115356 [3.82810]	–0.001592 [–0.07190]	–0.035155 [–1.96903]

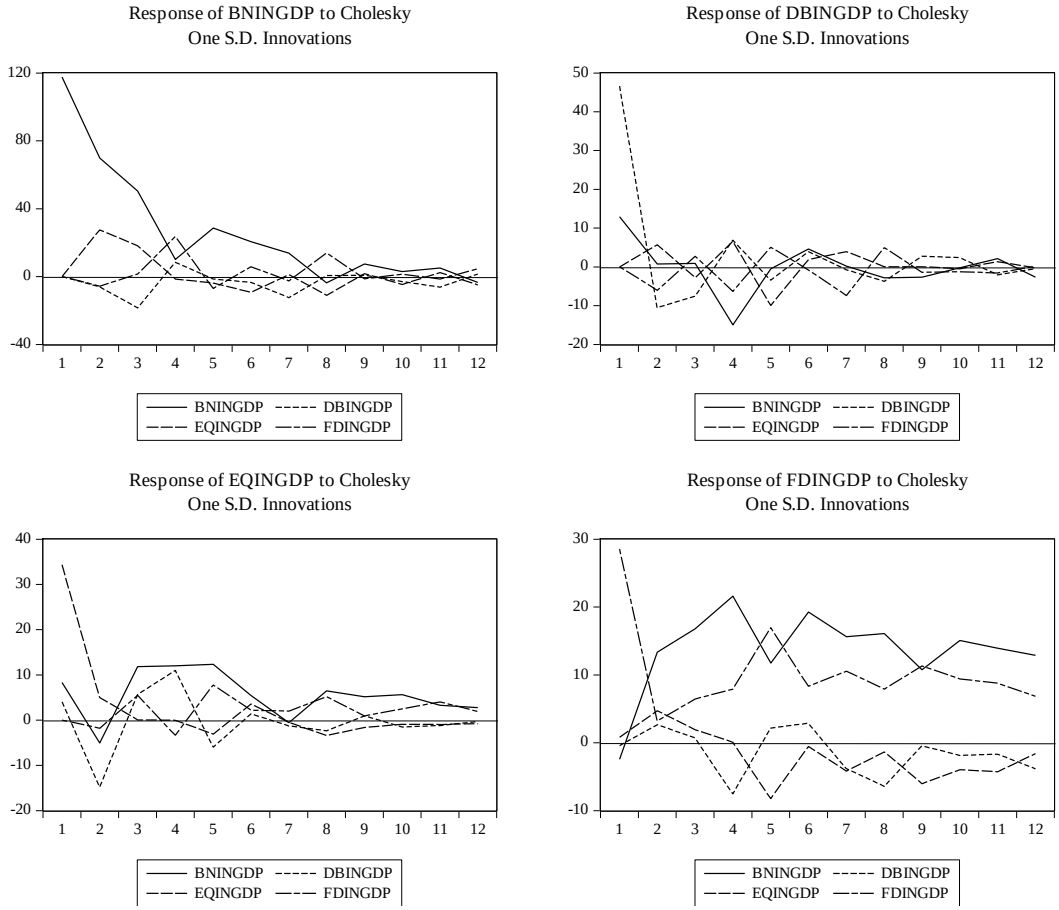
[5] Obviously, a balance is needed between the size of the rolling window and the degrees of freedom remaining for the fixed-effects estimates. Robustness checking was performed with windows of varying sizes for broadly similar results.

Table 1. ***(Continued)***

	BNINGDP	DBINGDP	EQINGDP	FDINGDP
DBINGDP(-1)	–0.204212 [–1.25693]	–0.242541 [–3.62934]	–0.330811 [–6.73654]	0.046436 [1.17278]
DBINGDP(-2)	–0.102862 [–0.58395]	–0.143290 [–1.97765]	0.091751 [1.72328]	0.083938 [1.95530]
DBINGDP(-3)	0.316841 [1.86755]	0.034543 [0.49500]	0.215932 [4.21093]	–0.125038 [–3.02418]
DBINGDP(-4)	–0.459617 [–2.60043]	–0.051372 [–0.70663]	–0.050788 [–0.95070]	0.007333 [0.17023]
EQINGDP(-1)	0.806515 [3.94876]	0.170770 [2.03269]	0.147322 [2.38640]	0.134956 [2.71128]
EQINGDP(-2)	0.021572 [0.11212]	–0.052305 [–0.66091]	0.054173 [0.93153]	–0.074494 [–1.58870]
EQINGDP(-3)	–0.509328 [–2.72723]	0.159409 [2.07516]	–0.148959 [–2.63888]	–0.158382 [–3.47989]
EQINGDP(-4)	0.036508 [0.21936]	–0.144712 [–2.11391]	–0.105873 [–2.10466]	–0.335827 [–8.27975]
FDINGDP(-1)	–0.199776 [–0.92473]	–0.212605 [–2.39253]	–0.063923 [–0.97894]	0.112404 [2.13493]
FDINGDP(-2)	0.193786 [0.98284]	0.083008 [1.02352]	0.134578 [2.25822]	0.251328 [5.23043]
FDINGDP(-3)	0.700376 [3.56580]	–0.215989 [–2.67345]	–0.066519 [–1.12047]	0.215125 [4.49417]
FDINGDP(-4)	–0.753423 [–4.07793]	0.197299 [2.59621]	0.238200 [4.26552]	0.402193 [8.93244]

Figure 2 presents the impulse response functions. These show the effect on the inflows of a shock to each inflow. We would expect some consistency between these and the results presented in Table 1. There are many results embedded in the impulse response functions; we will focus our attention on some pertinent ones.

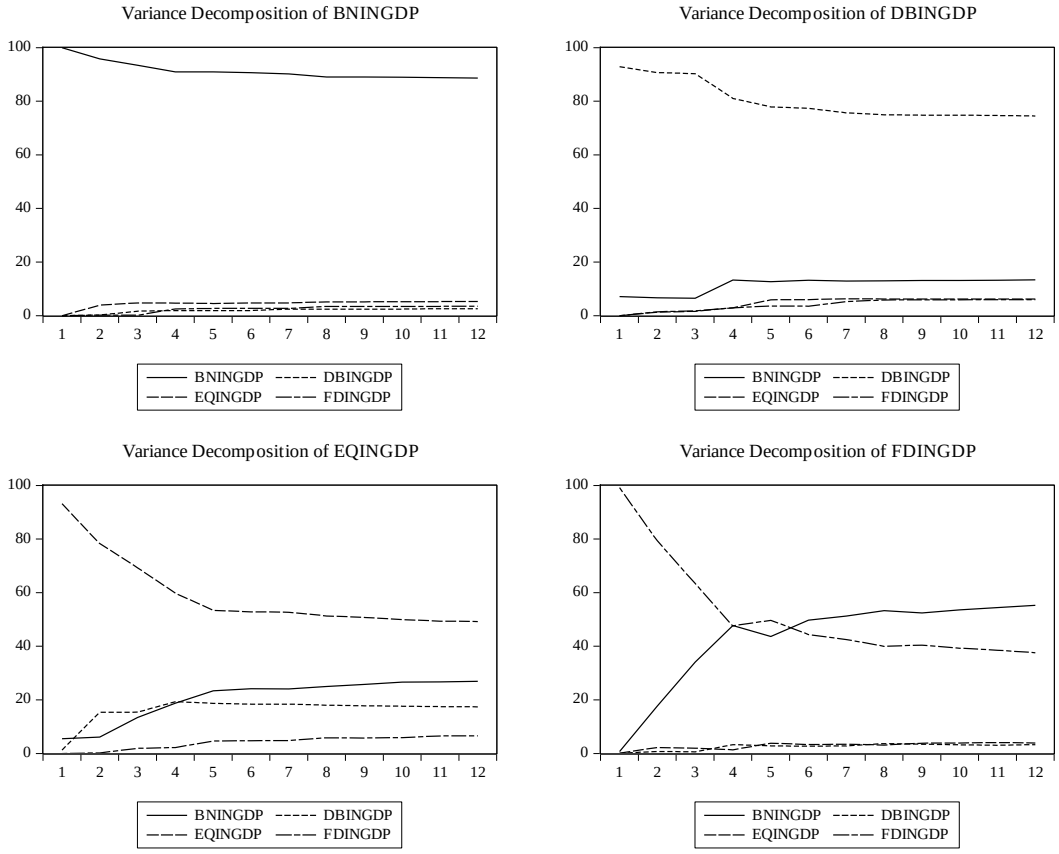
Figure 2. Impulse Responses: Inflows



From Figure 2, bank inflows have a strong initial positive effect on FDI inflows. This effect reverses to being a negative one further along the lag structure. This emerges as quite a strong result and is consistent with what we saw in Table 1. The impulse responses for equity flows show an effect of bank innovations that is positive and sustained. This result does not show up in the VAR estimates.

Figure 3 presents the variance decompositions: the effect on the variance of each flow of an innovation to a given flow. While these offer no information on directionality, they do present evidence of which flows drive the variance of other flows. We would expect that the variance in each flow is determined predominantly by its own innovation and this transpires here for the most part. Interestingly, the strong relationship between bank and FDI flows that was discussed previously with regard to inflows also shows up in the variance decompositions in Figure 3.

Figure 3. Variance Decomposition: Inflows



The stronger results from the variance decomposition seem to correlate with the positive associations from the impulse responses—suggesting that relationships where flows are complements are stronger than where those are substitutes. Interestingly, the effect on the variance of equity of an innovation in bank flows appears here much in the same way as in the impulse responses.

The results from the fixed-effects model are much more explicit about the relationships between the various components of capital flows. The model here augments the VAR analysis by presenting the coefficients to the contemporaneous values of flows. Table 2 presents the results using OLS while Table 3 presents results from two-stage least squares estimation.

Table 2. Panel Least Squares Estimates for Inflows

Dep Var.	FDI	FDI	Bank	Bank	Equity	Equity	Debt	Debt
Constant	29.87	29.31***	242.43	34.45 **	0.08	71.60 **	–88.29**	5.47
FDI			–1.50***	– 0.87***	0.21**	0.67	0.14	0.04
Debt	0.05	0.03	0.55***	0.58***	0.03	0.06		
Equity	0.18 **	0.52***	0.10	0.40**			0.08	0.08
Bank	–0.12 ***	–0.09 ***			0.01	0.06*	0.12***	0.10***
FDI(-1)	–0.08	0.08	–0.56 *	–0.21	0.48***	0.01	–0.22	–0.14*
Debt(-1)	0.08	0.19 ***	0.11	–0.02	–0.42***	–0.31***	–0.27***	–0.19***
Equity(-1)	0.09	0.12 **	0.67***	0.64***	0.16	–0.12**	0.02	0.13*
Bank(-1)	0.15 ***	0.14 ***	0.35***	0.57***	0.02**	–0.08***	–0.07*	–0.06**
SD FDI	–0.42		–4.73***		–0.66*		0.08	
SD Debt	0.29 **		–0.72		–0.56***		–0.79***	
SD Equity	–0.81		–0.17		0.77***		1.19***	
SD Bank	0.24		–0.10		–0.06		1.13***	
Adj R-sq	0.86	0.83	0.57	0.39	0.61	0.51	0.31	0.17
DW	2.26	2.06	2.20	2.24	2.09	1.92	2.23	2.08
Obs	187	263	187	263	187	263	187	263

Note: Significance levels: * 10%; ** 5%; *** 1%.

Table 3. Panel TSLS Estimates for Inflows

Dep Var.	FDI	FDI	Bank	Bank	Equity	Equity	Debt	Debt
Constant	49.40	33.37***	252.6**	70.49***	–22.73	–13.58**	–128.2***	–9.05
FDI	-	-	–3.26***	–2.27***	0.80***	0.19	0.42	0.63**
Debt	0.17	0.36***	-	-	0.02	0.20	-	-
Equity	0.75***	0.15	1.91	0.10	-	-	0.56	0.36
Bank	–0.22***	–0.26***	1.10**	1.56***	0.14	0.01	0.32***	0.34***
FDI(-1)	0.39**	0.14	–1.07	0.48	0.52***	0.40***	–0.32	–0.41***
Debt(-1)	0.35***	0.13	1.06**	0.32	–0.41***	–0.37***	0.04	–0.09
Equity(-1)	0.04	0.21**	0.35	0.79***	0.04	0.15**	–0.22*	–0.27**
Bank(-1)	0.14***	0.20***	0.54***	0.62***	–0.08	0.01	–0.16**	–0.21***
SD FDI	–0.35	-	–2.64	-	–0.12	-	1.51**	-
SD Debt	0.47**	-	1.31	-	–0.52***	-	–0.23	-
SD Equity	–0.46	-	–1.72	-	0.54	-	0.62	-
SD Bank	0.11	-	–0.22	-	–0.25	-	1.01***	-
Adj R-sq	0.78	0.79	0.33	0.41	0.48	0.52	0.09	0.06
DW	2.42	2.37	2.44	2.33	2.26	1.91	2.09	2.26
Obs	180	180	180	180	180	180	180	180

Note: Significance levels: * 10%; ** 5%; *** 1%. The equations for debt flows use a different set of instruments in these estimations to improve model performance. More information is available from the author upon request.

From these results, we can see that the strong positive relationship between lagged bank and FDI flows found in the VAR estimates also appears here. We do, however, have a small negative effect on contemporaneous bank flows on FDI flows—implying

substitution. We also see a positive effect of the standard deviation of debt flows on FDI—evidence of substitution towards FDI in the face of volatility in bank flows.

There is also a strong negative effect between bank and FDI flows when the causation runs the other way; this effect is not present in the VAR. Bank flows also react positively to equity flows—evidence of some complementarity there. Furthermore, an increase in the volatility of FDI decreases bank flows. This is suggestive of FDI variations possibly causing a move away from bank flows but this effect is not present in the TSLS estimates.

The effects on equity inflows and debt flows are quite mixed. There is something of an effect of lagged (one period) debt on equity flows. This is consistent with the VAR results in Table 1 and the impulse responses in Figure 1. The TSLS estimates also show a strong positive effect of FDI on equity flows. There is a negative relationship between debt flow volatility and equity flows. Finally, as in the empirical literature, in the least squares models, debt flows do not exhibit much persistence.

While not overwhelming, there is some evidence to suggest that the positive relationships are more persuasive when examining the effect of the levels of capital flows (implying complementarity). The results equally suggest, however, that the positives are stronger when assessing the impact of the volatility of flows (implying substitution—especially in the effect on FDI flows).

4. Some Conclusions

In contrast with much of the recent literature on international financial integration through capital flows, this paper has presented an examination of the interactions of the components of capital inflows—namely, FDI, debt inflows, equity inflows and bank inflows. This paper is largely exploratory in nature and seeks to find, through an analysis of the patterns in the data, whether the components of inflows together enhance the extent of financial integration, or if individual flows potentially crowd out other flows.

We saw from the results that there is a possibility that an increase in bank inflows might crowd out FDI flows with a lag. As such, if policymakers employ liberalization policies relating specifically to bank inflows, this might have the effect of promoting FDI flows. These effects could well be an unintended consequence of a country's financial liberalization policy. This is naturally also true of the employment of capital controls. Consider the case of equity versus debt flows, if controls are instituted on equity flows. We note that there was some evidence—not emphatic—of some degree of substitution between debt inflows and equity inflows. As such, this study might represent a useful addendum to the literature that assesses the direct effect of liberalization policies on their respective capital flows.

Some useful results from this paper examine the effect of the volatility of flows. We saw above that the standard deviation of debt inflows potentially resulted in an increase in FDI inflows. Interestingly, any policy designed ostensibly to reduce the variability of debt flows might have the (presumably) unintended consequence of reducing FDI inflows. Conversely, from the results, we can conclude that any policy designed to make FDI (debt) inflows more stable might result in actually enhancing bank (equity) inflows.

We can present some thoughts regarding policy implications to the conclusions mentioned above. Policymakers need to be mindful of the possibility of any crowding out and that crowding out might have significant implications in the design of financial liberalization policies. It would not be implausible to suggest that policies need to contain multiple dimensions such that the "crowded out" flow is also part of the flow that is the original subject of the policy. Furthermore, those flows that are (possibly) complementary might find that the resources that are required to establish and maintain policies of financial liberalization could be reduced.

In general there is some evidence to suggest that the positive relationships are more persuasive when examining the effect of the levels of capital flows. This is consistent with the basic idea that capital flows evolve together as part of an increasingly financially integrated landscape. The results equally suggest, however, that the positives are stronger when assessing the impact of the volatility of flows. This suggests that the relative instability of flows remains an important factor in the overall extent of financial integration in the region.

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Appendix

Table A1. Data and Sources

Data	Source
FDI direct investment abroad	*IFS* line 78BDD
FDI direct investment in	*IFS* line 78BED
Portfolio equity assets	*IFS* line 78BKD
Portfolio debt assets	*IFS* line 78BLD
Portfolio equity liability	*IFS* line 78BMD
Portfolio debt liability	*IFS* line 78BND
Bank assets	*IFS* line 78BQD
Bank liability	*IFS* line 78BUD
GDP (for calculating flow/GDP)	*IFS* line 99b (except for Japan: line 99bc)
Inflation year-on-year growth in consumer prices	*www.adb.org*
Time deposit rate	*IFS* line 60l
Exchange rate per US$	*IFS* line rf
Year-on-year growth in GDP (control variable)	*www.adb.org*

CHAPTER 12

Business-Cycle Transmission Mechanism in ASEAN+3: Financial Integration or Trade?

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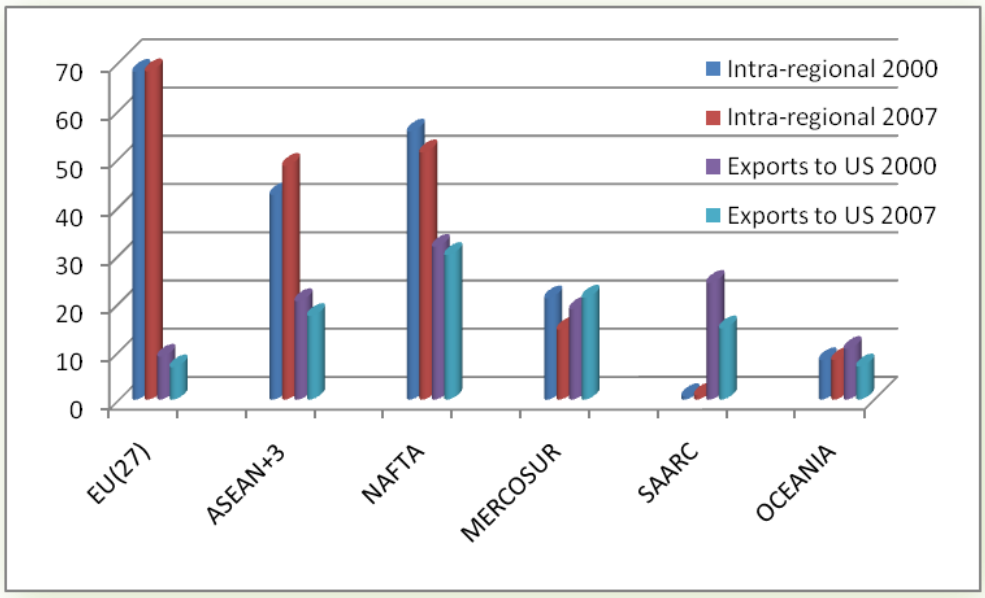
The recent global recession requires policymakers to identify the relative importance of shock-transmission mechanisms in each region and devise policy counter-measures against future external-country shocks. In the past decade world dynamics have changed considerably due to increased openness and integration, requiring examination of the characteristics of business cycles at regional levels. This chapter shows that due to the presence of a short-term causal relationship of financial variables with GDP in the Association of South-East Asian Nations Plus Three (ASEAN+3) region, the slowdown contagion spread to most countries within the region. The slowdown triggered a trade variables shock-transmission mechanism, too. As a result, we observe co movements of business cycle of the region with the business cycle of the shock originating external country. Therefore, business cycle convergence and decoupling phenomena of the region to the shock originating external country (US) depend not only on the origin of the shock in the external country but also on the relative importance of the transmission mechanisms between shock originating external countries and other regions. For policy purposes, knowing the correct transmission mechanism will help in tailoring an appropriate response to the idiosyncratic disturbance and is helpful in achieving long-term regional development goals.

Keywords: International business cycles, crisis, cycle, regional growth, exports
***JEL Classifications*:** E32, R11, F44

1. Introduction

The increased openness and integration across nations—whether through trade liberalization or financial integration—has changed world dynamics. Regional blocs are growing and the share of intra-regional trade in world trade is now more than the share of inter-regional trade. In the Association of South-East Asian Nations Plus Three (ASEAN+3) region, intra-regional trade accounts for almost half of its total trade (Figure 1). The most significant development in the world arena was the accession of China to the World Trade Organization (WTO) in 2001. Since its accession, China has increased its exports almost four times while its imports have increased three times. Some 45 percent of its trade receipts stem from Asia while the United States and the European Union account for 21 per cent of its exports (WTO, 2008). Given the increasing globalization, economies have enhanced their integration regionally and globally.

Figure 1. Evolving Trade Patterns Around the World



In this context, if economic turbulence originates from external-country shocks, so far, most research has focussed on exploring whether other countries or regions are

decoupled from the shock or not. If, however, the disturbance is global and systemic in nature, affecting all countries at the same time, the studies focus on examining correlations among the macroeconomic variables at country or regional levels. In the case of external-country shocks, the studies focus on observing the business-cycle movements of countries or regions to the business cycle of the crisis-affected country or region. If there is co-movement in the business cycle of the region to the shock originating external country, then the countries are said to have convergence in their business cycles with the shock originating external country. If not, then countries or regions business cycles are said to be decoupled to the business cycle of the shock originating external country. By focussing on outcomes and not considering transmission mechanisms, the task of designing policy to dampen the effect of shocks on a country's or region's output becomes cumbersome.

Despite consensus on the spill-over determinants of the business cycles that include trade integration, financial integration, exchange rate, remittances, commodity prices and fiscal convergence, ambiguity persists in the spill-over impact of these determinants on business-cycle synchronization. We hypothesize that in the case of external-country shocks, all spill-over determinants of business cycles might not be relevant at the same time. Rather, the spread of contagion might depend on the origin and nature of the shock, the relative importance of the transmission mechanisms and the specific characteristics of each region or country due to the interplay of integration forces such as production networks.[1] To explore this, we identify the relative importance of shock propagation channels in ASEAN+3, and test the empirical findings for each country by observing the region's responses to the external-country shocks.

The remainder of the paper is organized as follows: Section 2 provides a brief overview of previous studies, while Section 3 sets out the methodological framework along with data sources. Section 4 presents test results for panel unit-root and panel co-integration and also traces the transmission mechanism among macroeconomic variables. Section 5 concludes.

[1] The regional propagation dynamics, however, might be different from the country-specific channels and therefore regional and countries' decoupling outcomes could be different.

2. Evidence from the Literature

Apart from other explanations such as industrial structure, we investigate, at the regional level, whether out of all the shock-transmission channels—namely, trade integration, financial integration, exchange rate, industrial structure, commodity prices and fiscal convergence—there are any specific channels that behave like an Achilles heel for ASEAN+3 under different crisis scenarios. Examples are: the relative importance of each transmission mechanism during the sub-prime mortgage crisis shock of August 2007 (falling US housing prices) and the shock generated by the fall of Lehman Brothers in September 2008. Due to the different origins of the shocks, knowing the relative importance of each channel would tell us about the special characteristics of ASEAN+3 (production networks) (Figure 2).

Figure 2. Growth Pattern Across ASEAN+3

In the literature, there is theoretical agreement on the factors that cause movements in business cycles. There is, however, no consensus on the role of these factors (channels) in bringing about convergence or decoupling among countries' or regions' business cycles. This is important because apart from the domestic determinants of growth such as human capital, there are exogenous channels—for example, foreign direct investment (FDI), short-term capital flows, exports and imports—that contribute to growth and also act in the same manner as growth-destabilizing factors such as in times of crisis.

Agreement is lacking among empirical theorists on the impacts of international trade linkages on business cycles. Closer trade ties could result in either a tighter or a

looser correlation of business cycles and there will be output correlations among trading partners trading intensively (Baxter and Kouparitsas 2005; Frankel and Rose 1998). Kenen (2000), using a Keynesian model, and Kose and Yi (2006), using the international business-cycle model, conclude a positive relationship between trade and output. Imbs (2004) finds a sizeable impact of intra-industry trade on bilateral correlations compared with the smaller inter-industry trade impacts. Empirical findings also show common business cycles for the East Asian region (Sato and Zhang, 2006). Rana (2006, 2007) and Shin and Sohn (2006) find trade to be an important determinant of business-cycle synchronizations. Kumakura (2006) suggests the increasing share of electronic products in foreign trade as a reason for business-cycle co-movements for Pacific countries, while Hallet and Richeter (2008) find the declining importance of the United States for Asia. Therefore, we include industrial structure in our empirical estimations to account for its effect on GDP. In addition, Arndt (2006) argues that intra-industry trade in countries of the European Economic Community (EEC) is intra-industry in nature but different from production sharing as the former involves the two-directional flows of finished varieties. Therefore, production sharing under a preferential trading arrangement (PTA) would be trade creating and would reduce asymmetries between countries, resulting in cyclical convergence. The opposing view, however, suggests that trade integration leads to more specialization based on comparative advantage in the production of goods. Consequently, the importance of asymmetrical or sector-specific shocks increases with economic integration, leading to idiosyncratic business cycles (Krugman, 1993). Hence, consensus is lacking among theorists.

Financial integration also presents ambiguous theoretical support for its impact on business-cycle synchronization. Imbs (2004, 2006), Inklaar et al. (2008) and Kose et al. (2003) find a positive correlation between financial integration and business-cycle co-movements. This relationship is, however, weak in developing countries due to a plunge in stock-markets distributing negative wealth effects for asset holders around the world. Bordo and Helbling (2004) find no significant effect of financial integration. Conversely, international diversification of portfolios might allow consumption smoothing due to risk-sharing that might not require diversification in production bases and might lead to greater specialization and fewer co-movements in business cycles

(Kalemli-Ozcan et al., 2001). Kose et al. (2008) find evidence for the convergence of business cycles within Organization for Economic Cooperation and Development (OECD) countries and emerging countries but suggest decoupling of business cycles between these two groups. Fidrmuc and Korhonen (2009) also find little correlation between the business-cycle frequencies of India and China and the OECD. Again, we observe ambiguous theoretical support for the role of financial integration in bringing about business-cycle synchronization.

Regarding exchange rate volatility, Leung (1997) argues that empirical evidence has failed to show any systematic link between short-term exchange rate volatility and the volume of bilateral and multilateral trade. She further suggests, however, that patterns of trade could be affected by exchange rate volatility and argues that currency invoicing of trade matters and currency hedging provide reasonably cost-effective ways of managing exchange rate volatility. Siregar et al. (2010) have argued that volatile local currencies are central to the poor performance of trade and overall economic growth in many countries in the ASEAN+3 region. McKinnon (2000) comments on the East Asian currency standards by considering the financial depth in these countries. He argues that while a common monetary standard is not as good as a common currency, it is preferable among close trading partners compared with (unrestricted) exchange rate flexibility. Similarly, Mundell (2000) argues that free-trade areas and currency areas reinforce each other. Using a gravity equation, Baldwin (2006), Glick and Rose (2002), Micco et al. (2003) and Rose (2000) find currency unions raise bilateral trade. Cappiello et al. (2006) and Lane and Milesi-Ferretti (2007), however, show greater financial integration as a result of euro introduction. Co-movements of business cycles can also occur when a country pegs its exchange rate (Patnaik et al., 2007). Thus, diverging views are formed regarding exchange rate volatility and its impact on business cycles.

Currency carry trade can also be used as a speculative vehicle to transmit shocks and bring about co-movements in other regions. The World Bank *Global Development Finance* report (2009) estimates the volume of carry trade between US$200 billion and US$1 trillion. The report suggests that carry trades keep high-yielding currencies such as the Indonesian rupiah, Mexican peso, South African rand and Brazilian real at relatively high appreciated levels. During the Global Financial Crisis (GFC), however, sudden withdrawals from affected countries led to rapid currency depreciations as

investors sought safe havens in US Treasury securities. Estimates of recent losses by emerging-market corporations from their foreign exchange positions exceed US$40 billion, with perhaps the largest losses in Brazil (where some 200 firms incurred losses of an estimated US$28 billion, (Jara et al. 2009), Poland (where authorities estimate total losses at US$5 billion), and the Republic of Korea (where the government had spent US$1.3 billion by January 2009 to stave off bankruptcies of firms with derivative losses) (World Bank, 2009).

Fiscal convergence could also lead to business-cycle co-movements because of lowering country-specific shocks (Darvas et al., 2005; Inklaar et al., 2008). In the current crisis, the World Bank is of the view that stimulating aggregate demand would be helpful but countries would be reluctant to do this due to its spill-over effects on other countries. If, however, a country such as the United States does this alone, investors will lose confidence in its fiscal sustainability and will withdraw financing. These constraints can be handled through global commitment to coordinated action of fiscal expansion (World Bank, 2009). The World Bank *GDF* report (2009) also refers to commodity prices and remittances as other channels affecting business-cycle co-movements. Commodity prices affect the business cycles because a fall in consumer demand also results in a fall in commodity demand due to a cut in investment and consumption decisions. Therefore, those countries highly dependent on commodity exports are affected while in other countries it might help to buffer the adverse impacts due to improvement in the current account because of a fall in commodity prices. In addition to FDI and other sources, the United States, Europe and the United Arab Emirates (UAE) have become important sources of financing through remittances for the developing countries of the region. The dampening of income and investment flows is likely to slow growth in certain regions (World Bank, 2009).

Regarding the special characteristics of each region—for example, in ASEAN+3—the global value-chain and production networks are different from those in Europe. According to Gill and Homi (2007), production networks have more extensive spread in East Asia than in other regions. Gill and Homi (2007) suggest that the spread has been due to regionalism and regionalization, and note that low trade barriers, an efficient duty drawback regime for exports, encouragement of export-oriented FDI, good logistics and wage differentials across the countries have been the result of regionalism.

Furthermore, proximity to production networks, scale economies and other agglomeration economies that affect the cost structure of intermediate inputs are mainly due to regionalization. Because of these processes, the economies become closely integrated and one country's income growth generates demand for parts and components in other countries in the value supply chain. Ando and Kimura (2003) describe the production networks in ASEAN+3 as a vertical intra-industry trade phenomenon that involves back-and-forth links where several countries participate in various stages of single production chains compared with the horizontal intra-industry trade pattern in Europe. The European intra-industry trade model involves bi-directional flows of finished-goods varieties. Kimura et al. (2007) further find in the vertical intra-industry trade in East Asia that unit prices of exports and imports differ widely. The fragmentation theory proposed by Jones and Kierzkowski (1990) explains the structure of production networks in ASEAN+3.

Gill and Homi (2007) assert that ASEAN+3 first integrated globally and is now increasing its share regionally. Comparative intra-regional trade patterns are shown in Figure 1, demonstrating that intra-regional trade was more developed in the regions where intra-industry trade was predominant, such as ASEAN+3 and the European Union. Gill and Homi (2007) further argue that production networks require low-cost, long-term financing for capital investment and short-term working capital for financing trade. Moreover, production networks are exposed to currency risk when the cost structure of different components is dependent on local currency wages and credit risk and the network comprises a large and diverse number of companies governed by different contractual agreements.

In order to find convergence or decoupling phenomena in regions with the business cycle of the crisis-originating country, we employ a panel vector error correction (PVEC) framework to explore the short and long-term transmission channels in the ASEAN+3 region. Our focus will be on the short-run dynamics active in the region. We separate the financial flows (financial integration) from real economy variables such as goods exports and services exports (trade integration), and industrial structure and find their short and long-term effects on growth. We do not consider imports in a regional framework due to the presence of intra-industry trade phenomena, and one

country's imports are reflected in other countries' exports. In addition, the effects of exchange rate changes can be reflected in the export figures and financial flows.

Based on the discussions above, four external channels—namely, long-term FDI, short-term foreign equity and creditors' flows of world financial markets, goods and services exports in markets for goods and services and internal manufacturing structure (MF)—are considered to influence economic growth. The analysis concerns examining the effect of FDI, short-term capital flows, services and goods exports, and MF on ASEAN+3's GDP in the short run and the long run in a PVEC framework.

The literature also explains output co-movements across various countries and regions. Kose et al. (2008) have argued that differences in country coverage, sample period, aggregation methods for creating country groups and different econometric methods could lead to different conclusions and business-cycle co-movements. For example, some empirical researchers find declining business-cycle co-movements such as between the United States and other Group of Seven (G7) countries (Helbling and Bayoumi, 2004); the United States and the aggregate of Europe, Canada and Japan (Heathcote and Perri, 2004). In contrast, some studies find strengthening of business-cycle co-movements such as across industrialized countries (Bordo and Helbling, 2004). Similarly, Hecq et al. (2005) find output co-movements among five Latin American countries: Brazil, Argentina, Mexico, Peru and Chile. For North American Free Trade Agreement (NAFTA) economies, Kose et al. (2003) find increases in business-cycle co-movements in the past decade. Fidrmuc et al. (2008) favored a decoupling hypothesis between OECD countries' business cycles and India and China. Artis et al. (2008) and Fidrmuc (2004) find intra-industry trade a better indicator for business-cycle asymmetries than simple trade intensities. Sato and Zhang (2006) find common business cycles for East Asia. Hughes and Richter (2008) observe decoupling of the US business cycle from Asia.

3. Data and Methodology

During the past two decades, linkages across countries at the regional level as well as across regions have been transformed. Apart from bilateral and multilateral forces, the emergence of regional blocs and the resultant intra-industry trade phenomena have been important in transforming the structure of economies at the regional level. Hence, the response of countries and regions to external-country shocks will be different. In view of the integration forces at work, we analyze separately the likely impact of the shock-propagation mechanism on ASEAN+3's business cycles.

The data cover the period from 1980 to 2009 inclusive. The GDP, FDI and export (EX) figures are collected from the *World Development Indicators* and the UN Conference on Trade and Development (UNCTAD). Standard and Poor's Index (S&P) data are sourced from Robert Shiller (2001) and US 10-year Treasury Constant Maturity Rate (T-Bill) data are sourced from the Federal Reserve Bank of St Louis. GDP, FDI and EX figures are defined in real values by deflating to 2000 prices using GDP deflators and expressed in natural log form. S&P data are January/June averages in index form; US T-Bill data are in percentage yield form.

The use of a panel data format allows reliable detection of long and short-term relationships between independent and dependent variables. The 13 members of ASEAN+3 included in this estimation are: Cambodia, China, Hong Kong, Indonesia, Japan, Laos PDR, Malaysia, Myanmar, the Philippines, Singapore, South Korea, Thailand and Vietnam. We estimated for only 12 countries, however, by excluding Myanmar due to data issues.

The GFC had an impact on the business cycles of all ASEAN+3 members. The depth and timing of the impact differed between economies; the proximate cause of this impact is not completely empirically determined in the literature. This paper explores the causal relationship between the dependent variable GDP and independent variables of FDI, exports, industrial structure proxied by manufacturing share in GDP (MF), and short-term capital flow instruments for the members of ASEAN+3. Short-term capital flows are estimated separately by the use of two instrumental variables: S&P and T-Bills.

The selection of S&P Index and US T-Bill yields as instruments is relatively well based in the literature. Claessens et al. (1995) provide a summary of the research into the relationship between T-Bills and capital flows: alternative means of generating returns are important motivators for capital flows to developing countries. Moreover, the US Treasury yields are generally viewed as having a low risk profile, making T-Bills an excellent instrument for evaluating the impact of a "flight to safety" in times of crisis. A similar logic underpins the selection of a stock-market indicator in the S&P. Rajan (2006) discusses the attractive influence of varying returns to capital, noting in particular the expanding attitude to risk of investors. Wongbangpo and Sharma (2002) note the high volatility of returns to assets amongst ASEAN nations. The S&P represents a riskier and higher-return alternative to T-Bills ("chasing alpha" in the *lingua franca* of hedge funds) and is therefore an appropriate instrument for evaluating short-term capital shifts.

3.1. Country-by-Country

We seek to test through causality testing whether the real, short or long-term financial channels are viable mechanisms for the impact transmission. In order to provide policy direction for individual members of ASEAN+3, we initially examine independent time series for all countries (IS). Cambodia and Myanmar are not estimated due to data paucity.

Our first examination is on a country-by-country basis where each equation, and the associated tests, is separately estimated. Macroeconomic time series typically contain unit roots (Granger, 1986; Wasserfallen, 1989). This might lead to spurious regression and unreliable estimates. The differencing procedure of Box and Jenkins (1976) might be appropriate for any estimations. As discussed by Granger (1988), any causality testing must be preceded by co-integration testing, as the existence of co-integration has implications for the evaluation of causality.

Perron (1989) discusses the potential for structural breaks in the permanent trend of time-series data. To further evaluate unit roots within each series, we test unit roots following Clemente et al. (1998) and Zivot and Andrews (1992). These tests endogenously determine the presence of structural break(s) to reduce the bias associated with standard unit-root tests.

If there are no unit roots present in a data series, the above estimation is valid on levels. If there is one or more unit roots then the above evaluation is valid on stationarity achieved by first differencing of the series. A unit-root series might, however, evince co-integration as defined by Engle and Granger (1987), where x_t and y_t are integrated processes of order 1, but where a stationary linear combination vector, $\beta^1 Z_t$, exists. We use the standard multivariate co-integration test based on Johansen-Juselius (1991) to evaluate the long-run relationship.

As discussed by Engle and Granger (1987), if x_t and y_t are I(1) and co-integrated, an error-correction model (ECM) should be specified:

$$\Delta y_t = \alpha_1 + \theta_1 \Delta y_{t-1} + \theta_2 \Delta x_{t-1} + \theta_3 (x_{t-1} - y_{t-1}) + \varepsilon_t, \quad (1)$$

where Δ is the first-difference operator. Granger (1988) noted the necessity of estimating an ECM when evaluating I (1) co-integrated processes to avoid spurious regressions and erroneous conclusions.

A particular advantage of this estimation methodology is the possibility of evaluating short-term dynamic effects in isolation from the long-term equilibrium adjustment influence. This allows our vector ECM models to distinguish between the short-term impact of financial and real shocks.

3.2. Panel Data

The 1990s development of ASEAN as a trading bloc, as demonstrated by the China–ASEAN free-trade agreement (FTA) and similar agreements, spurred significant analysis of East Asian economic integration. In particular, Gill and Homi (2007), Kimura et al. (2007) and Kumakura (2005) find extensive production networks vertically integrated throughout East Asia, whilst Kose et al. (2003) and Sato and Zhang (2006) find common business cycles for East Asia. Consequently, any evaluation of crisis-transmission mechanisms for any individual member of ASEAN+3 must be sufficiently flexible to evaluate the general impact of shocks across the group.

In order to empirically investigate the short-term determinants of business-cycle synchronization across ASEAN+3, defining the error-correction term as the lagged residual from the long-run equation, we are able to estimate the following panel vector error-correction model:

$$\Delta y_{it} = \alpha_i + \beta ec_{i,t-1} + \sum_{j=1}^{q} \gamma_j \Delta y_{it-j} + \sum_{j=1}^{q} \delta_j \Delta x_{it-j} + \varepsilon_{it} \quad (2)$$

where q is the lag length set at 2 based on likelihood ratio tests, *y* is GDP and *x* is the vector of independent variables. Subscripts *i* and *t* represent country panel and time respectively. This extension of the earlier-discussed vector ECM (VECM) is referred to as a panel VECM (PVECM). As above, this vector auto-regressive framework over panel data enables the separation of short-term dynamics from long-term equilibrium adjustment. This PVECM will allow us to determine the impact of the specified macroeconomic variables on ASEAN+3 GDP.

As with the VECM, we need to first check the stationarity of variables using unit-root tests. In the absence of stationarity, the variables are differenced and tested for co-integration across the panel data. This enables us to determine the presence or absence of a long-run relationship between dependent GDP and independent FDI, EX, MF, S&P and T-Bill variables. The presence of long-term adjustment vectors indicates the use of a PVEC technique to determine the short-term impact of variables.

4. Results

4.1. Unit-Root Tests

4.1.1. Country-by-Country

All dependent variables are tested for stationarity to reduce the risk of spurious regression: high t-values with no genuine economic meaning. We use three separate tests on country-by-country dependent variables: augmented Dickey–Fuller (ADF), Phillips–Perron (PP) and the KPSS test of Kwiatkowski et. al (1992). ADF and PP test against the null hypothesis of a unit root; KPSS tests against the null of stationarity. KPSS is used as a confirmatory test, as the low power of ADF-variety tests in small samples makes testing against the alternative hypothesis desirable (Thangavelu and Rajaguru, 2004).

Results of ADF, PP and KPSS unit-root tests for GDP of series are displayed in Table 1. All variables are non-stationary at levels. Myanmar and Japan are non-

stationary at first differences and stationary at second differences. All other variables are I(1), after first differencing all variables (Myanmar and Japan are second differenced) become stationary.

4.1.1.1. Structural Break Robust Unit-Root Testing

The potential for unit-root testing to be biased in the presence of permanent changes in the pattern of time series is discussed by Perron (1989). With the great degree of economic and social development experienced by members of ASEAN+3 over the period of our time series, the potential for structural breaks is significant. In particular, the Asian Financial Crisis (AFC) of 1998 has a strong apparent impact on GDP stationarity (Figure 1). Consequently, we test the time series for multiple structural breaks as suggested by Zivot and Andrews (1992). The results of these tests are displayed in Table 2. Given the variety of shocks experienced by East Asia over the past three decades, we also employ the Clemente–Montanes–Reyes unit-root test, as it is robust over two structural breaks. We employ the additive outlier method as this more closely represents economic history in the region—in particular, the experience associated with the AFC. The results of the Clemente–Montanese–Reyes unit-root tests are displayed in Table 3.

The structural-break robust unit-root test results indicate that the GDP series for all members of ASEAN+3 are stationary after differencing (rho is statistically significant).

4.2. Panel Data

With the panel data, different unit-root tests are proposed through the literature as the use of panel data allows for increased power of unit-root testing. The Levin et al. (2002) (LLC) test is the most widely used method for panel data unit-root tests. It is appropriate for our panel data tests due to its power over panels of moderate size. The LLC requirement of identical assumptions across individuals matches the ASEAN+3 testing concept. Im et al. (2003) (IPS) tests using averaged ADF statistics are also investigated, due to the IPS tests' relaxing of the identical serial correlation pattern assumption.

Results of LLC and IPS testing panel variables are displayed in Table 4. The results for all tests indicate stationarity after first differencing.

Table 1. Country-by-Country Unit-Root Results

Unit Root Tests			GDP	FDI	NetExports				GDP	FDI	NetExports
Cambodia	ADF	Level	-1.5	-1.1	-0.05	**Malaysia**	ADF	Level	-0.5	-1.94	0.06
		1st Diff	-2.07	-3.28**	-4.63***			1st Diff	-4.01***	-6.94***	-4.12***
		2nd Diff	-3.34**	-5.16***	-7.21***			2nd Diff	-6.22***	-6.7***	-6.16***
	PP	Level	-1.06	-1.1	-0.13		PP	Level	-0.5	-1.8	0.06
		1st Diff	-2.17	-3.28**	-4.63***			1st Diff	-3.99**	-6.94***	-4.08***
		2nd Diff	-3.34**	-9.82***	-12.59***			2nd Diff	-15.61***	-31.76***	-13.86***
	KPSS	Level	0.65*	0.69*	0.65*		KPSS	Level	0.67*	0.39	0.66*
		1st Diff	0.09	0.14	0.15			1st Diff	0.13	0.07	0.13
		2nd Diff	0.11	0.24	0.3			2nd Diff	0.32	0.24	0.5*
China	ADF	Level	-0.5	-1.92	2	**Myanmar**	ADF	Level	0.95	-1.83	1.17
		1st Diff	-2.96*	-4.64***	-4.16***			1st Diff	-2.14	-3.8**	-3.27**
		2nd Diff	-5.16***	-7.18***	-7.49***			2nd Diff	-6.26***	-3.89**	-5.99***
	PP	Level	-0.21	-4.69***	2.02		PP	Level	2.6	-2.71*	0.88
		1st Diff	-2.96*	-4.52***	-4.16***			1st Diff	-2.14	-3.8**	-3.18**
		2nd Diff	-5.27***	-6.95***	-21.56***			2nd Diff	-6.39***	-4**	-12.56***
	KPSS	Level	0.63*	0.63*	0.68*		KPSS	Level	0.6*	0.76**	0.6*
		1st Diff	0.1	0.52*	0.35			1st Diff	0.48*	0.12	0.41
		2nd Diff	0.09	0.21	0.37			2nd Diff	0.17	0.18	0.4
Hong Kong	ADF	Level	-0.54	-1.51	-1.36	**Philippines**	ADF	Level	3.97	-2.91*	0.15
		1st Diff	-2.78*	-4.24***	-3.17**			1st Diff	-2.66*	-9.19***	-3.86**
		2nd Diff	-4.72***	-3.97**	-6.13***			2nd Diff	-5.46***	-6.27***	-9.13***
	PP	Level	-0.28	-1.41	-1.2		PP	Level	2.02	-2.85*	-0.03
		1st Diff	-2.78*	-6.48***	-3.11**			1st Diff	-2.73*	-10.14***	-3.87**
		2nd Diff	-4.83***	25.25**[1]	-10.28***			2nd Diff	-5.71***	-53.83***	-9.77***
	KPSS	Level	0.75**	0.73*	0.64*		KPSS	Level	0.65*	0.53*	0.64*
		1st Diff	0.09	0.24	0.23			1st Diff	0.36	0.03	0.15
		2nd Diff	0.08	0.35	0.23			2nd Diff	0.21	0.05	0.15
Indonesia	ADF	Level	-1.27	-0.49	1.01	**South Korea**	ADF	Level	-2.59	-1.34	-0.66
		1st Diff	-3.75**	10.18**[1]	-3.81**			1st Diff	-4.13***	-5.48***	-4.32***
		2nd Diff	-6.76***	-5.44***	-7.6***			2nd Diff	-6.16***	-7.9***	-4.6***
	PP	Level	-1.2	0.2	0.84		PP	Level	-3.45**	-2.97*	-0.66
		1st Diff	-3.77**	11.08**[1]	-3.81**			1st Diff	-4.13***	-5.33***	-4.27***
		2nd Diff	-11.38***	31.44**[1]	-19.35***			2nd Diff	-18***	-10.06***	-16.58***
	KPSS	Level	0.66*	0.6*	0.63*		KPSS	Level	0.66*	0.59*	0.67*
		1st Diff	0.19	0.43	0.28			1st Diff	0.56*	0.34	0.1
		2nd Diff	0.5*	0.4	0.36			2nd Diff	0.25	0.2	0.4
Japan	ADF	Level	-2.04	-2.19	-0.79	**Singapore**	ADF	Level	-0.75	-1.38	0.15
		1st Diff	-2.45	-2.08	-5.21***			1st Diff	-4.2***	-6.81***	-3.17**
		2nd Diff	-5.75***	-8.64***	-6.21***			2nd Diff	-6.73***	-5.57***	-5.35***
	PP	Level	-2.22	-2.2	-0.79		PP	Level	-0.72	-0.98	0
		1st Diff	-2.43	-5.75***	-5.21***			1st Diff	-4.16***	-12.11***	-3.2**
		2nd Diff	-9.1***	12.51**[1]	-21.13***			2nd Diff	-17.23***	-27.57***	-8.34***
	KPSS	Level	0.63*	0.42	0.65*		KPSS	Level	0.67*	0.64*	0.66*
		1st Diff	0.35	0.05	0.12			1st Diff	0.11	0.5*	0.09
		2nd Diff	0.5*	0.17	0.34			2nd Diff	0.33	0.4	0.29
Lao	ADF	Level	0.2	-1.55	-1.59	**Thailand**	ADF	Level	-1.26	-1.3	-0.48
		1st Diff	-5.18***	-2.96*	-4.92***			1st Diff	-2.63*	-5.35***	-2.91*
		2nd Diff	-4.55***	-5.05***	-10.39***			2nd Diff	-5.29***	-8.78***	-6.63***
	PP	Level	0.58	-1.56	-0.8		PP	Level	-1.34	-1.29	-0.33
		1st Diff	-5.79***	-2.98*	-4.95***			1st Diff	-2.64*	-5.35***	-2.91*
		2nd Diff	-13.74***	-6.53***	-10.04***			2nd Diff	-6.32***	-16.75***	-7.12***
	KPSS	Level	0.68*	0.41	0.66*		KPSS	Level	0.65*	0.63*	0.65*
		1st Diff	0.2	0.15	0.08			1st Diff	0.23	0.06	0.11
		2nd Diff	0.44	0.5*	0.1			2nd Diff	0.28	0.26	0.12
S&P	ADF	Level	-1.05	**10 Year**	-4.2***	**Vietnam**	ADF	Level	2.12	-2.74*	-0.34
		1st Diff	-4.56***	**T-Bill**	-7.5***			1st Diff	-2.65*	-6.72***	-4.06***
		2nd Diff	-8.21***		-7.18***			2nd Diff	-4.83***	-0.45	-6.12***
	PP	Level	-1.05		-1.1		PP	Level	1.23	-2.74*	-0.35
		1st Diff	-4.56***		-11.94***			1st Diff	-2.17	-6.72***	-3.96**
		2nd Diff	-11.61***		-17.74***			2nd Diff	-4.83***	-14.07***	-11***
	KPSS	Level	0.65*		0.62*		KPSS	Level	0.68*	0.63*	0.67*
		1st Diff	0.12		0.5			1st Diff	0.22	0.17	0.06
		2nd Diff	0.5*		0.5			2nd Diff	0.06	0.47*	0.5*

*,**,*** denotes rejection of the hypothesis at the 0.1, 0.05 and 0.01 levels respectively

Table 2. Zivot–Andrews Unit-Root Results

Zivot–Andrews	Differences		
	T-stat	*P*	*Breaks*
China	–5.055**	1	2001
Hong Kong	–4.334	0	1998
Indonesia	–8.411***	1	1998
Japan	–3.366	0	1988
Laos	–6.67***	1	1988
Malaysia	–2.782	0	1991
Myanmar	–2.903	1	1987
Philippines	–2.831	2	2002
South Korea	–2.536	0	1998
Singapore	–3.288	1	2001
Thailand	–3.63	1	1997
Vietnam	–4.676	1	1985

Note: Value of P selected by AIC; **, *** denotes rejection of the hypothesis at the 0.05 and 0.01 levels respectively.

Table 3. Clemente–Montanes–Reyes Unit-Root Results

	Levels				Differences			
	rho	*T-stat*	*P*	*Breaks*	*rho*	*T-stat*	*P*	*Breaks*
China	–0.52	–2.82	0	1989, 1998	–1.42	–4.57	2	1987
Hong Kong	–0.46	–2.82	0	1989, 2001	–1.50	–6.28**	1	1996, 2001
Indonesia	–0.54	–3.09	0	1990, 2002	–0.90	–6.98**	1	1988, 1996
Japan	–0.61	–3.08	0	1987, 1997	–1.73	–6.69**	2	1989
Laos	–0.52	–2.98	0	1991, 2000	–1.95	–6.17**	2	1987
Malaysia	–0.56	–2.90	0	1990, 1997	–1.36	–6.55**	1	1987, 1996
Myanmar	–0.70	–3.33	0	1996, 2002	–2.19	–7.79**	2	1986, 1992
Philippines	–1.90	–1.30	0	1991, 2001	–1.71	–6.05**	2	1986, 2001
South Korea	–0.50	–2.90	0	1988, 1996	–1.59	–9.54**	1	1990, 1996
Singapore	–0.52	–2.83	0	1990, 1997	–2.38	–7.39**	2	1986, 2001
Thailand	–0.49	–2.89	0	1990, 2001	–2.28	–7.19**	3	1989, 1996
Vietnam	–0.49	–2.82	0	1992, 2001	–1.06	–5.78**	2	1987, 1996

Note: ** denotes rejection of the unit-root hypothesis at the 0.05 level.

Table 4. Panel Unit-Root Results

Panel unit-root testing

Levels—intercept					Levels—intercept and trend		
	GDP MF	FDI	EX	MF	GDP	FDI MF	EX
*Levin, Lin & Chu t**	–0.20 0.3	–0.86	0.69		–0.82	2.18 0.7	0.30
Breitung t-stat	- -	-	-		–1.02	–0.20 0.3	–0.84
Im, Pesaran and Shin W-stat	4.60 0.6	0.98	4.96		0.60	0.71 0.2	0.36
First differences—intercept					First differences—intercept and trend		
	GDP MF	FDI	EX		GDP	FDI MF	EX
*Levin, Lin & Chu t**	–6.61 –2.3	–2.62	–6.45		–6.26	–2.35 –2.1	–5.26
Breitung t-stat	- -	-	-		–7.58	–4.77 –4.5	–6.36
Im, Pesaran and Shin W-stat	–6.80 –2.6	–7.65	–6.25		–6.38	–5.18 –4.3	–4.35

4.3. Co-Integration Tests

4.3.1. Country-by-Country

The potential interrelation of FDI, short-term capital and exports is well discussed in the literature, particularly by Kose et al. (2003), who link these factors with business-cycle synchronization. As a consequence, separating genuine co-integration from spurious regression or correlation is an important statistical process.

Engle and Granger (1987) discuss a procedure for testing the presence of co-integration by using level OLS to generate residuals. These residuals, or errors in equilibrium, are then tested for integration. Johansen and Juselius (1990) developed a multivariate co-integration test using maximum likelihood estimators of the co-integrating vectors for an auto-regressive process, and a likelihood ratio test for the number of co-integrating vectors.

We use Johansen's (1988, 1991) maximum eigenvalue test and trace test to evaluate the number of co-integrating vectors. The optimum lag length is determined using Akaike's and Baysian Information Criteria (AIC, BIC). The results of Johansen's co-integration test for both S&P and T-Bill series are displayed in Table 5. The results from Johansen's tests indicate at least one co-integrating vector is present in all series, except Hong Kong, Malaysia, South Korea and Thailand.

Table 5. Johansen Trace and Maximum Eigenvalue Tests for Co-Integration

Trace test	GDP, FDI, MF, EX, S&P			GDP, FDI, MF, EX, T-Bill		
	v=0	v≤1	v≤2	v=0	v≤1	v≤2
Cambodia	115.85*	63.59*	30.70*	52.26*	32.88*	19.05
China	70.81*	39.96	16.87	30.85	23.09	11.34
Hong Kong	61.26	35.82	15.16	25.44	20.65	9.65
Indonesia	89.26*	39.75	14.1	49.50*	25.65	10.68
Japan	65.46*	31.62	7.58	33.85*	24.03	5.76
Laos	87.71*	45.15*	23.73	42.56*	21.43	14.39
Malaysia	57.27	31.1	17.21	26.18	13.88	10.23
Myanmar	82.95*	54.72*	29.03*	28.23	25.68	20.88*
Philippines	74.01*	35.13	16.42	38.88*	18.72	10.49
South Korea	61.53	37.28	20.28	24.25	17	14.48
Singapore	67.40*	34.42	15.66	32.98*	18.76	12.66
Thailand	49.93	28.16	14.76	21.78	13.39	9.14
Vietnam	76.95*	35.89	14.83	41.06*	21.05	13.06
Maximum eigenvalue test	GDP, FDI, MF, EX, S&P			GDP, FDI, MF, EX, T-Bill		
	v=0	v≤1	v≤2	v=0	v≤1	v≤2
Cambodia	122.72*	48.45*	26.83*	74.26*	21.62	15.19
China	93.17*	43.19*	19.23	49.97*	23.97	16.22
Hong Kong	61.25	35.81	15.16	25.44	20.65	9.65
Indonesia	89.26*	39.75	14.1	49.51*	25.65	10.68

Japan	65.47*	31.62	7.58	33.85*	24.03	5.76
Laos	87.72*	45.16*	23.73	42.56*	21.43	14.39
Malaysia	57.27	31.1	17.21	26.18	13.88	10.23
Myanmar	82.95*	54.72*	29.04*	28.23	25.68	20.88*
Philippines	74.02*	35.13	16.42	38.89*	18.72	10.49
South Korea	61.53	37.28	20.28	24.25	17	14.48
Singapore	67.40*	34.42	15.66	32.98*	18.76	12.66
Thailand	49.93	28.16	14.76	21.78	13.39	9.14
Vietnam	76.95*	35.89	14.83	41.06*	21.05	13.06

Note: * denotes rejection of the hypothesis at the 0.05 level.

4.3.2. Panel Data

The literature discusses in depth the trade, financial and growing political integration of ASEAN+3 nations. Consequently, it might be possible that the effects of a shock on the region as a whole are greater than the shock's measureable impact on individual countries. Therefore, we undertake co-integration testing of the ASEAN+3 panel data system.

Pedroni (2004) notes the existing Johansen tests for co-integration might not be useful when considering cross-sectional time-series analysis. Under the hypothesis that the cross-section shares a common co-integration pattern, Pedroni (2004) proposed a residual-based test statistic for the null of no co-integration. It enables heterogeneous cross-section members by allowing varying slope coefficients. The test is also robust to differing co-integrating vectors between panel members. This is possible by considering statistics from cross-sectional regression residuals and statistics from single time-series regression residuals. The significant, large positive values for *v-stat* in the intercept and trend test indicate rejection of the null of no co-integration, as displayed in Table 6.

Table 6. Pedroni Tests for Panel Co-Integration

	Pedroni residual—individual intercept	
	GDP, EX, FDI, MF, S&P	GDP, EX, FDI, MF, T-Bill
Panel v-Stat	–0.44	–0.57
Panel rho-Stat	2.67	2.73
Panel p-Stat	0.98	0.67
Pedroni residual—individual intercept and trend		
	GDP, EX, FDI, MF, S&P	GDP, EX, FDI, MF, T-Bill
Panel v-Stat	5.07***	4.92***
Panel rho-Stat	4.8	4.1
Panel p-Stat	4.12	1.56

Note: *** denotes rejection of no co-integration null at 1%.

4.4. Error-Correction Model Results

4.4.1. Country-by-country

Engel and Granger (1987) show the presence of co-integration implies an error-correction mechanism whereby the change in at least one of the current variables is a function of the previous period error in equilibrium. It is important to separately identify and analyze these long-term impacts from the short-run relationship. The ECM enables this identification. The null hypothesis of no long-run causality is tested by estimating the significance of the t-statistic for the error-correction coefficient, ρ . To establish the influence of the variables as part of a short-term system, we test for joint significance using a Wald test. If short-term causality cannot be established in the instances of non–co-integrated series (Hong Kong, Thailand, Malaysia and South Korea) then we employ the Charemza and Deadman (1992) strong exogeneity test to examine joint influence. The results of these tests are indicated in Table 7.

Table 7. VECM S&P Results

	Wald-J		**Coefficient**	
Dependent GDP	Overall	FDI	EX MF	S&P
China	No	-	- -	-
Indonesia	No	-	- -	-
Japan	No	-	- -	-
Laos	No	-	- -	-
Myanmar	No	-	- -	-
Philippines	No	-	- -	-
Singapore	No	-	- -	-
Vietnam	No	-	- -	-

Table 7 indicates no significant short-run relationship of FDI, EX, MF, or the S&P index on GDP growth. Table members are those whose VAR specification indicated at least one co-integrating vector after testing.

Table 8. VECM T-Bill Results

	Wald-J		**Coefficient**	
Dependent GDP	Overall	FDI	EX MF	T-Bill
China	No	-	- -	-
Indonesia	No	-	- -	-
Japan	No	-	- -	-
Laos	No	-	- -	-
Myanmar	No	-	- -	-
Philippines	No	-	- -	-
Singapore	Yes***	-	0.20** -	–0.014***
Vietnam	No	-	- -	-

Table 8 indicates no significant short-run relationship of FDI, EX, MF, or the S&P index on GDP growth for the majority of countries. Singapore's VEC analysis indicated a significant positive relationship between exports and GDP, and a significant negative relationship between US T-Bill yields and GDP. Indicated table members are those whose VAR specification indicated at least one co-integrating vector after testing.

Table 9. Granger Causality Joint Test Results for S&P Series

Dependent GDP	**Block causality F-stat**		
	FDI	EX MF	S&P
Hong Kong	-	- -	-
Malaysia	-	3.47* -	-
South Korea	-	- -	-
Thailand	-	- -	-

Table 9 indicates evidence at the 10 percent level that Malaysian exports Granger-cause Malaysian GDP. No other statistically significant causal relationships were present. Indicated table members are those whose VAR specification was unable to reject a zero co-integrating vector hypothesis

Table 10. Granger Causality Joint Test Results for S&P Series

Dependent GDP	**Block causality F-stat**		
	FDI	EX MF	T-Bill
Hong Kong	-	- -	-
Malaysia	-	3.47* -	3.48*
South Korea	-	- -	-
Thailand	-	- -	-

Table 10 indicates evidence at the 10 percent level that Malaysian exports and US T-Bill yields Granger-cause Malaysian GDP. No other statistically significant causal relationships were present. Indicated table members are those whose VAR specification was unable to reject a zero co-integrating vector hypothesis.

4.4.2. Panel Data

Given the variables are co-integrated in the panel data specification, the panel vector error-correction model is employed. This methodology allows separation of long-term and short-term impacts of independent on dependent variables. This

distinction enables an examination and comparison of these transmission channels in terms of short-term shocks as distinct from long-term trends.

This two-step process first involves estimating the long-run OLS equation to obtain the estimated residuals; and then, defining the lagged residuals as the error-correction term in the dynamic PVECM framework. The null hypothesis of no long-run causality is tested by estimating the significance of the t-statistic for the error-correction coefficient, β . To establish the influence of the variables as part of a short-term system, we test for joint significance with a block exogeneity Wald test. The results of these tests are displayed in Table 11.

Table 11. PVECM Results

GDP dependent			
GDP(-1)	0.018	**10-Year Treasury (-1)**	0.013
	[0.12]		[0.58]
GDP(-2)	0.146	**10-Year Treasury (-2)**	-0.013
	[0.94}		[-0.64]
Merch % (-1)	0.000	**S&P Index (-1)**	0.001
	[0.33]		[5.19]
Merch % (-2)	0.000	**S&P Index (-2)**	-0.001
	[0.34]		[-2.61]
Exports (-1)	-0.097	**FDI (-1)**	0.015
	[-0.60]		[0.37]
Exports (-2)	0.000	**FDI (-2)**	0.024
	[0.00]		[0.68]
R-Squared	0.15	**ECM**	-0.0000858 *[-1.14078]*

The PVECM results indicate the short-term capital instruments have a significant impact on GDP in the short-run analysis. The impact of the S&P instrument is small, but strongly significant at the 1 percent level. The S&P coefficients are notably more significant than the T-Bill coefficients, which might indicate a stronger effect of a change in the S&P index (our "chasing-alpha" instrument) than in T-Bill yields (our "flight-to-safety" instrument).

5. Conclusion

The recent economic history of East Asia is one of strong economic growth, widening international influence and growing regional cohesiveness. The strong influence of regional integration on growth is one of the unique characteristics of ASEAN+3, and a key part of the East Asian miracle. The emergence of Asia as an import member of the international community seems necessarily tied to the impact of global economic shocks upon Asia. The degree to which individual members are influenced by these idiosyncrasies depends on the form the shocks take.

The most recent shocks were those of 2007 and 2008: the real and financial shocks respectively of the GFC. The real shock was transmitted through trade variables. Our empirics indicate that, on a country-by-country basis, business cycles in Singapore and Malaysia were impacted directly by this crisis. As a whole, the region demonstrates no short-term relationship between GDP and exports. Due to this minimal degree of short-term exposure, we would expect to see ASEAN+3 exhibit decoupling from the US business cycle after the sub-prime crisis.

The 2008 shock associated with the collapse of Lehman Brothers was a financial shock, transmitted through short-term capital flows. On a country-by-country basis, evidence of convergence is again limited to Malaysia and Singapore. Notably, this effect is stronger with the T-Bill instrument than the S&P—possibly indicating Singapore and Malaysia are more vulnerable to a "flight to safety" than to influxes of capital "chasing alpha".

As a whole, the ASEAN+3 region demonstrates strong and significant vulnerability to short-term capital movements. This result is robust to either the "alpha" instrument of the S&P or the "safety" instrument of T-Bills. This result provides evidence against theories that hold short-term capital flows to be non-influential on economic growth. Due to the significant short-term capital exposure of the ASEAN+3 region, we would expect the financial channel-transmitted shock of 2008 to have a synchronizing influence on ASEAN+3 and US business cycles.

Our empirical analysis indicates business-cycle synchronization in ASEAN+3 is significantly influenced by shocks. Due to the integration process in the regions, the

importance of trade channels in transmitting external-country shocks from the major economies such as the United States has lessened. On the other hand, the recent shock has re-emphasized financial variables as the most significant channels for shock transmission. Knowing the correct transmission mechanism will help in tailoring an appropriate response to the idiosyncratic disturbance and is helpful in achieving long-term regional development goals.

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CHAPTER 13

Modelling East Asian Economies in a Small Open Economy VECM: The Influences of International and Domestic shocks[1]

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The contribution of international and domestic shocks to macroeconomic outcomes in Asian countries is of significant policy importance to both these economies and their significant trading partners. This paper applies a data and theory-consistent SVECM model that specifically identifies and separates temporary and permanent shocks to Singapore, Thailand, the Philippines, Malaysia and Indonesia. We show the differences and similarities in these economies in response to shocks and assess whether Chinese shocks have a more pronounced effect than those originating in the United States. The implication for policymakers is that despite the rapid growth of China's importance to countries in this region, external influences are currently better represented by the United States. In the future, this might no longer be the case.

Keywords: structural VECM models, external shocks, East Asia
JEL Classifications: F41, F42, C32, C51

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1. Background

Economic modelling for open economies in an empirically coherent and theoretically acceptable manner is a pressing problem. The increasing global financial integration of Asian economies over the past few decades and the effects of two significant financial crises in 1997–98 and 2007–08 encompass the effects of international conditions in models of Asia and make this an important research imperative.

Developments in the modelling frameworks used by many central banks internationally have favored the use of DSGE models. These have a coherent theoretical structure based on fundamental microeconomic relationships and can be reduced to a tractable empirical specification. They also, however, present a number of problems. First, the parameter estimates produced across a range of countries do not seem to reflect the diversity observed in the data (see, for example, Beltran and Draper, 2008; Canova and Sala, 2007). Second, these models have not yet produced credible open-economy results—for example, in Justiniano and Preston (2010), the DSGE does not come close to replicating the basic observed correlation between Canadian and US GDP growth.

An alternative approach is provided by Structural Vector AutoRegression (SVAR) models, which combine empirical coherence with restrictions imposed by a broad theoretical framework chosen by the researcher. A number of contributions have illustrated the increasing importance of using SVARs for identifying structural shocks in small, open economies, such as the work of Buckle et al. (2007), Cushman and Zha (1997), Dungey and Pagan (2009), Dungey and Vehbi (2010), Kim and Roubini (2000) and Mountford (2005). In addition to the different data sets used, a distinctive characteristic of these studies is the way in which they identify the structural shocks from the system.

This paper takes the open-economy SVAR approach developed in Dungey and Pagan (2009) and Dungey and Vehbi (2010)—previously applied to Australia and the United Kingdom respectively—and applies it to the Association of South-East Asian Nations (ASEAN) region. The purpose of the paper is to investigate the historical

evolution of domestic responses to domestic and external output shocks originating in the United States and China during the period 1986–2009. Despite their structural differences, the majority of the industrialized countries in the East Asian region can be considered small, open economies that are heavily dependent on the economic performance of the United States. The most dramatic instance of this is the recent US-originated sub-prime crisis, which adversely affected most of the East Asian economies, with countries such as Taiwan and Singapore experiencing the greatest impact, further reflecting their strong dependence on external markets. Policy responses to the crisis also varied across the Asian economies depending on individual economic stances prior to the onset of the crisis, varying from significant tightening of monetary policy in Korea and Taiwan to using fiscal stimulus in China and Japan.

The countries analyzed in this paper are Singapore, Thailand, the Philippines, Malaysia and Indonesia. A key advantage of the model framework in comparison with the methods used in previous studies is that it specifically accounts for the mixed nature of the data and cointegration between some variables, therefore taking into account, and indeed taking advantage of, the known empirical and theoretical relationships linking open economies to the international environment. The novel identification scheme of the structural shocks on the other hand ensures that the model has similar theoretical underpinnings to a standard New Keynesian DSGE model.

This paper contributes to a mounting literature on small, open economy modeling, including, for example, Beenstock and Longbottom (1981), Dennis et al. (2007), Leitemo (2006) and Ravn (1992), and to the emerging literature on combining methods of identification in VAR models in Dungey and Fry (2009). In this model, exclusion restrictions and cointegration are combined to identify the model, while maintaining the empirical coherence in the spirit of Akram and Nymoen (2009), who demonstrate the policy-related importance of models providing sound representations of the underlying data. The combination of identification methods harnesses the empirical properties of the data, employing a mix of I (1) and I (0) variables while identifying and recovering the effects of permanent and temporary shocks.

2. Related Literature

Several papers have examined the effects of structural shocks on East Asian economies using open-economy SVARs. A commonly raised issue in the majority of these studies is whether to explore the possibility of forming a monetary union in the East Asian region, similar to the European Monetary Union (EMU), which was launched in Europe in 1999. Using a three-variable VAR model comprising global, regional and local outputs of seven East Asian economies and EMU countries, Chow and Yoonbai (2003) compare the degree of homogeneity among the East Asian countries with that of EMU countries. Their main finding is that each country in the region is sufficiently unique, implying that it would be costly to adopt a common currency peg. Zhang et al. (2004) also use a three-variable SVAR model to identify the respective demand, supply and monetary policy shocks in 10 East Asian countries in order to explore the feasibility of a monetary union in the region. Overall, they do not find strong evidence in favour of integration. In a similar study, Huang and Feng (2006) use a four-variable SVAR model to analyse various types of shocks in East Asian economies. Although their results are in line with the findings of Zhang et al. (2004), they also point out that several countries in the region have symmetric responses to shocks with equal magnitudes, suggesting the possibility of a feasible monetary union in the future. Finally, using the methodology proposed by Chow and Yoonbai (2003), Hsu (2010) finds that most East Asian economies have become relatively symmetric in terms of economic shocks and adjustments, implying that a common currency area might become viable through deepening regional integration. A recent working paper by Zhang et al. (2010) is closest to our study from a methodological perspective, using a SVAR model with block exogeneity to investigate whether external shocks originating in the United States played a dominant role in influencing the macroeconomic fluctuations in East Asia during the period 1978–2007. The authors find that the influence of US shocks on real output fluctuations in the East Asian region are very strong.

Our methodology, outlined in the following section, contributes to and extends the existing literature in two main areas. First, by incorporating long-run cointegration

restrictions, the model specifically accounts for stationary versus non-stationary data properties and explicitly identifies the permanent and temporary shocks. Second, the model framework strongly emphasizes the role of exchange rates in the transmission of foreign shocks to the domestic economy by allowing the real exchange rate to react to all variables contemporaneously. This in turn is a reflection of the forward-looking nature of this variable. This paper also uses extended sample sizes compared with the ones used in these studies to include the recent sub-prime-related financial crisis.

3. Theoretical Framework

The standard macroeconomic framework for small, open economies with inflation-targeting monetary policy represented in contemporary research revolves around a three-equation model. Closed-economy representations include those in the standard graduate textbook of Woodford (2003), while extensions to the open economy can be found in Gali and Monacelli (2005), Monacelli (2005) and the papers gathered in Gali (2008). The Gali and Monacelli (2005) framework underpins the theoretical specification of this paper.

Building from standard New Keynesian assumptions of utility maximizing consumers in an economy with profit-maximizing producers who face Calvo pricing and where consumers have preferences over both domestic and foreign-produced consumption goods, the model can be summarized with three standard equations representing an open-economy IS curve, a Phillips curve and an exchange rate equation. In the Monacelli (2005) extension to the Gali and Monacelli (2005) approach, imperfect pass-through of exchange rate shocks is assumed. In addition to these three equations, the system includes a monetary policy reaction function taking the form of a Taylor rule. The structure of the theoretical model takes the form:

$$y_t = \mu E_t y_{t+1} + (1-\mu) y_{t-1} - \emptyset(r_{t-1} - E_{t-1}\pi_t) + \theta_1 \Delta q_t + \theta_2 y_t^* + \epsilon_{AD_t} \quad (1)$$

$$\pi_t = \delta E_t \pi_{t+1} + (1-\delta)\pi_{t-1} + \lambda y_t + \theta_3 \Delta q_t + \epsilon_{AS_t} \quad (2)$$

$$r_t = \rho r_{t-1} + (1-\rho)(\beta E_t \pi_{t+1} + \gamma y_t) + \epsilon_{MP_t} \quad (3)$$

$$E_t \Delta q_{t+1} = (r_t - E_t \pi_{t+1}) - (r_t^* - E_t \pi_{t+1}^*) - \epsilon_{RER_t}, \quad (4)$$

where (y_t) and (y_t^*) represent domestic and foreign output gaps, (r_t) and (π_t) are the interest rate and inflation, (q_t) is the real exchange rate and ϵ_{AD_t}, ϵ_{AS_t}, ϵ_{MP_t} and ϵ_{RER_t} represent the aggregate demand, aggregate supply, monetary policy and real exchange rate shocks respectively.

The theoretical specification should not be viewed as a constraining influence on the empirical coherence of the application. Rather the theory helps to motivate and justify empirical restrictions. Thus, we do not propose to follow the usual Bayesian approach of estimating the deep parameters of the particular theoretical specification. Rather, the empirical relationships in the data will be dominant, but identification will be aided by the use of a coherent theoretical framework. This will be achieved using the specification outlined in the next section.

4. Econometric Specification and Identification

Suppose that the economy is described by a VAR (p) model of the form

$$y_t = A_1 y_{t-1} + A_2 y_{t-2} + \ldots + A_p y_{t-p} + u_t, \quad (5)$$

where the $A's$ are $(n * n)$ coefficient matrices, y_t is a $(n \times 1)$ vector of observable variables and u_t is an $(n * 1)$ vector of unobservable error terms with $u_t \sim (0, \Sigma_u)$.

Assuming that all the variables are at most difference stationary, the generic model can be written as a VECM of the form

$$B_0 \Delta y_t = \Pi^* y_{t-1} + \Gamma_1^* \Delta y_{t-1} + \ldots + \Gamma_{p-1} \Delta y_{t-p+1} + \varepsilon_t, \quad (6)$$

where the $\Gamma^{*'}s$ are $(n \times n)$ matrix of short-run coefficients, Π^* is the structural matrix and ε_t is an $(n \times 1)$ structural form error with zero mean and covariance matrix $I_K . B_0$ is a $(n \times n)$ matrix of contemporaneous relations among the variables in y_t.

Assuming that the B_0 matrix is invertible, equation (6) can be written as

$$\Delta y_t = \Pi y_{t-1} + \Gamma_1 \Delta y_{t-1} + \ldots + \Gamma_{p-1} \Delta y_{t-p+1} + u_t, \quad (7)$$

where $\Pi_t = B_0^{-1}\Pi^*, \Gamma_j = B_0^{-1}\Gamma_j^* \ (j = 1, \ldots, p-1)$ and $u_t = B_0^{-1}\varepsilon_t$, which relates the reduced form errors, u_t's, to the underlying structural errors ε_t's. When Π has a reduced rank of $r \leq n-1$ then Π can be written as $\Pi = \alpha\beta'$, where β is an $(n \times r)$ matrix that contains the long-run relationship and α is an $(n \times r)$ matrix of the "speed of adjustment" coefficients and the u_t is a white-noise error with zero mean and covariance matrix Σ_u. Substituting Π into equation (7) produces the model in error correction form:

$$\Delta y_t = \alpha\beta' y_{t-1} + \Gamma_1 \Delta y_{t-1} + \ldots + \Gamma_{p-1} \Delta y_{t-p+1} + u_t. \quad (8)$$

As the u_t's are the reduced form residuals, and are generally strongly correlated, the effects of a single shock on the whole system cannot be isolated without imposing restrictions on the system. Multiplying both sides by B_0 gives

$$B_o u_t = \varepsilon_t \quad (9)$$

$$\Sigma = B_0^{-1} \Sigma_\varepsilon (B_0)',$$

where Σ, B_0 and Σ_ε are all $(n \times n)$ matrices. Exact identification of Σ_ε requires the imposition of $(n^2 - n)/2$ additional restrictions on B_0^{-1}. While traditional VAR models use a Cholesky-type recursive identification scheme to identify the structural errors, the structural approach differs by the ability to choose any restrictions on B_0 so as to achieve identification.

The existence of cointegration among the $I(1)$ variables could also provide extra identifying restrictions. According to Granger's Representation Theorem, equation (8) has the following Beveridge–Nelson Moving Average (MA) representation (see Lutkepohl and Kratzig, 2004, for details).

$$y_t = F \sum_{i=1}^{t} u_i + \sum_{j=0}^{\infty} F_j^* u_{t-j} + y_0^*, \quad (10)$$

where the matrix $F = \beta_\perp(\alpha'_\perp(I_n - \sum_{i=1}^{p-1}\Gamma_i)\beta_\perp)^{-1}\alpha'_\perp$ and y_0^* contain the initial values. It is important to note that the rank of F is $n-r$, where r is the number of cointegrating vectors. Therefore there are $n-r$ independent common trends. The second term in the expression is an infinite order polynomial with coefficients F_j^* going to zero as $j \to \infty$. Hence it represents the transitory shocks to the system. The long-run effects of shocks are represented by the first term in equation (10), $F\sum_{i=1}^{t} u_{it}$, which captures the common stochastic trends. The common driving stochastic trends are the variables $\alpha'_\perp \sum_{i=1}^{t} u_i$, where their factor loadings are given by $\beta_\perp(\alpha'_\perp(I_n - \sum_{i=1}^{p-1}\Gamma_i)\beta_\perp)^{-1}$. By replacing u_t's with their structural counterparts, we obtain

$$y_t = F\sum_{i=1}^{t} B_0^{-1}\varepsilon_t + \sum_{j=0}^{\infty} F_j^* B_0^{-1}\varepsilon_{t-j} + y_0^*, \tag{11}$$

where the effects of both short and long-run structural shocks can be obtained. The long-run effects can be captured by FB_0^{-1}, which has a rank $n-r$ since $rk(F) = n-r$, and B_0 is not singular. Therefore, while r of the structural shocks have transitory effects, $n-r$ of them will have a permanent effect (linearly independent) and can be restricted to zero providing $r(n-r)$ independent restrictions. Given exact identification of the Σ_ε requires $(n^2-n)/2$ independent restrictions; $r(n-r)$ of them can be identified using the cointegration relationship alone.

Using the Wold decomposition theorem, Δy_t can be written as

$$\Delta y_t = C(L)u_t, \tag{12}$$

or as its structural counterpart as

$$\Delta y_t = C(L)B_0^{-1}\varepsilon_t, \tag{13}$$

where $C(L)$ is a polynomial of order q in the lag operator. Assuming that the first $(n-r)$ shocks are permanent (ε_{1t}), we can write Δy_t as

$$\Delta y_t = C(L)B_o^{-1}\begin{pmatrix}\varepsilon_{1t}\\ \varepsilon_{2t}\end{pmatrix}. \tag{14}$$

For the remaining shocks, ε_{2t}, to be transitory requires

$$FB_0^{-1}\begin{pmatrix}0_{(n-r)*r}\\ I_{r+k}\end{pmatrix} = F\alpha = 0, \tag{15}$$

which implies that $\alpha_1 = 0$, where α_1 is the $(n-r)*r$ matrix of adjustment coefficients of the $I(1)$ variables that give rise to the permanent shocks driving the cointegrating relationships (see Pagan and Pesaran, 2009, for details). An important implication of this result is that it precludes the use of error correction terms in equations that define the permanent shocks.

Using (15), the permanent component of Y_t can be written as

$$\Delta y_t^p = FB_0^{-1}\varepsilon_t. \tag{16}$$

Given equation (16) and following Dungey and Pagan (2009), equation (8) can be written in "gap deviation" form, $\tilde{y}_t = y_t - y_t^p$, as the following

$$B^*(L)\Delta\tilde{y}_t = \alpha^*\beta' y_{t-1} - \sum_{j=1}^{p-1}\Delta y_{t-j}^p + B_0^{-1}\varepsilon_t, \tag{17}$$

where $\alpha^* = B_0{}^{-1}\alpha$. Since the gap variables are correlated with both the error correction terms and the changes in permanent components, exclusion of error correction terms will result in misspecification (see Dungey and Pagan, 2009, for more details). Therefore the conventional use of the output gap will be replaced with the differenced output together with the corresponding error correction term for this variable.

4.1. Handling Exchange Rate Regime Changes

A significant feature of recent history for many ASEAN economies is the change from fixed or managed exchange rate regimes to a floating environment, which mainly occurred about the time of the 1997–98 Asian crisis. This is particularly evident for Thailand, Malaysia, Indonesia and the Philippines—the sample countries considered here—where substantial currency devaluations were observed in the second half of 1997. This poses considerable challenges to the empirical identification of the model presented above. In particular, in a fixed exchange rate regime, a monetary policy reaction function of the form of equation (3) does not pertain, nor do the Phillips or IS curves react to exchange rate changes in the same way across fixed and floating

regimes. Furthermore, the exchange rate equation given in equation (4) is not relevant. One way to address this problem within the New Keynesian framework described above is to augment the expression of equations (1) to (4) to incorporate the regime shift as follows:

$$y_t = \mu E_t y_{t+1} + (1-\mu) y_{t-1} - \emptyset(r_{t-1} - E_{t-1}\pi_t) + \theta_2 y_t^* +$$

$$I_t[\mu E_t y_{t+1} + (1-\mu) y_{t-1} - \emptyset(r_{t-1} - E_{t-1}\pi_t) + \theta_1 \Delta q_t + \theta_2 y_t^*] + \varepsilon_{AS_t} \quad (18)$$

$$\pi_t = \delta_1 E_t \pi_{t+1} + (1-\delta_1)\pi_{t-1} + \lambda_1 y_t + I_t[\delta_1 E_t \pi_{t+1} + (1-\delta_1)\pi_{t-1} + \lambda_1 y_t + \theta_3 \Delta q_t] + \varepsilon_{AS_t} \quad (19)$$

$$r_t = I_t[\rho r_{t-1} + (1-\rho)(\beta E_t \pi_{t+1} + \gamma y_t)] + \varepsilon_{MP_t} \quad (20)$$

$$E_t \Delta q_{t+1} = I_t[(r_t - E_t \pi_{t+1}) - (r_t^* - E_t \pi_{t+1}^*) - \varepsilon_{RER_t} \quad (21)$$

where I_t is an indicator variable taking the value 1 in the floating exchange rate regime period and 0 in the fixed rate period. This provides a straightforward means of accounting for the structural shift induced by the exchange rate regime. Its advantage is that it retains the use of longer-term relationships in the model, particularly the relationship across international output, while respecting that the relationships between different parts of the economy must change with such a dramatic policy change. This representation can be easily accommodated within the econometric framework laid out in the previous subsection. Given the lack of sufficient data available in the sub-periods identified as fixed and floating regimes, this adaptation is not, however, practically feasible. Instead, we estimate the individual country models using the whole sample period of 1986Q1 – 2009Q4, while imposing a step dummy for the crisis period to avoid parameter instability.

5. Empirical Results

The model presented in Section 4 suggests that data for output, inflation, interest rates and exchange rates are pertinent inputs to the model. Figures A1–A5 in Appendix 1 map these data from 1986Q1 to 2009Q4 for each of Singapore, Thailand, the Philippines, Indonesia and Malaysia. Variable definitions and their sources are provided in Appendix 2.

The most immediately notable feature of these figures is the Asian crisis in 1997–98. The switch from a fixed to a floating exchange rate regime is immediately obvious for all countries with the exception of Singapore, which already had a floating exchange rate regime prior to the Asian crisis. A serious recession eventuated in many cases and IMF support programs were implemented shortly thereafter. Likewise, inflation shows a dramatic decrease and, as a general consequence of the adoption of an inflation targeting/floating exchange rate regime, interest rate volatility generally declines. Singapore and the Philippines weathered the crisis more easily than the other economies and did not experience prolonged periods of recession. For Singapore, this was due to the fact that it was already operating under a floating exchange rate regime prior to the crisis. A more evident feature in most of the countries' data is the relatively large rise in inflation in 2007–08 and the subsequent falls in 2009, which were associated with oil price volatility. Consequently, in the following, we augment the specification of the Phillips curve with exogenous oil price inflation; Kim and Roubini (2000) are among a number of authors who include oil prices in VAR models.

Table 1 presents Augmented Dickey Fuller (ADF) test results of the data for each of the countries' variables. In each case the results show that the output and exchange rate series can be regarded as non-stationary. This in turn raises the possibility that these series are cointegrated. Theoretically, this supports an open-economy IS curve, or traditional models of the equilibrium exchange rate such as the Mundell–Fleming model, where the equilibrium exchange rate is a function of the current account balance, which is a function of domestic and foreign outputs. This cointegrating relationship—estimated for each country model separately—is an important part of our model design. Inflation rates are well known to fail to reject the null of a unit root. In general, this

outcome represents a highly persistent price process, which is estimated with poor precision. In the case of the inflation rates for Singapore, the Philippines, Thailand and Malaysia, the AR (1) coefficients in ADF regressions are 0.49, 0.68, 0.34 and 0.29 respectively. Therefore, it is appropriate to treat the inflation rates as I(0) processes together with the inflation rate of Indonesia, which is shown to be stationary. Interest rates for all countries except Thailand are found to be stationary. All interest will also be treated as I(0) processes, given that they are the policy instruments of monetary authorities.

Table 1. Augmented Dickey Fuller Unit Root Test

Levels	y^*	y	Π	r	q	oil
Singapore						
ADF statistic	–1.92	1.59	2.33	3.21*	–1.3	9.01*
Crit. val. (5 %)	–3.45	3.45	2.89	2.89	2.89	1.94
Philippines						
ADF statistic	–1.92	1.91	1.66	3.63*	1.47	9.01*
Crit. val. (5 %)	–3.45	3.45	2.89	2.89	2.89	1.94
Thailand						
ADF statitic	–1.92	2.18	2.11	2.48	1.73	9.01*
Crit. val. (5 %)	–3.45	3.45	2.89	2.89	2.89	1.94
Indonesia						
ADF statistic	–1.92	1.96	6.64*	3.50*	1.81	9.01*
Crit. val. (5 %)	–3.45	3.45	2.89	2.89	2.89	1.94
Malaysia						
ADF statistic	–1.92	1.70	2.44	3.50*	1.69	9.01*
Crit. val. (5 %)	–3.45	3.45	2.89	2.89	2.89	1.94

Note: * Denotes rejection of the null of a unit root at 5% confidence level

5.1. Results from the Data-Consistent SVECM

This section implements the SVECM models for each country, for the sample period of 1986Q1 to 2009Q4. Two additions to the generic specification are made. The first is the addition of a dummy for the East Asian crisis period—defined as 1997Q3 to 1998Q4 in each equation. The second is the addition of oil price inflation as an exogenous variable entering the AS equation. As the interest rate and inflation rate are I(0) variables, this is respected by the addition of pseudo-ecm terms, consisting of the lagged level of the dependent variable to correct for the level effect that would be lost if using a standard VECM. The structural form specification of the system can be represented as follows, using the form of equation (6) and clearly showing the restrictions in the system.

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ b_{21}^{0} & 1 & 0 & 0 & 0 \\ 0 & b_{32}^{0} & 1 & 0 & 0 \\ 0 & b_{42}^{0} & b_{43}^{0} & 1 & 0 \\ b_{51}^{0} & b_{52}^{0} & b_{53}^{0} & b_{54}^{0} & 1 \end{bmatrix} \Delta Y_t = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & \alpha_{32} & 0 \\ 0 & \alpha_{42} & \alpha_{43} \\ \alpha_{51} & \alpha_{52} & \alpha_{53} \end{bmatrix} \begin{bmatrix} \beta_{11} & 1 & 0 & 0 & \beta_{51} \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 \end{bmatrix} Y_{t-1}$$

$$+ \begin{bmatrix} b_{11}^{l} & 0 & 0 & 0 & 0 \\ b_{21}^{l} & b_{22}^{l} & b_{23}^{l} & b_{24}^{l} & b_{25}^{l} \\ 0 & b_{32}^{l} & b_{33}^{l} & 0 & b_{35}^{l} \\ 0 & b_{42}^{l} & b_{43}^{l} & b_{44}^{l} & 0 \\ b_{51}^{l} & b_{52}^{l} & b_{53}^{l} & b_{54}^{l} & 1 \end{bmatrix} \Delta Y_{t-1} + \begin{bmatrix} 0 \\ 0 \\ c \\ 0 \\ 0 \end{bmatrix} Oil + \begin{bmatrix} \varepsilon_t^{AD^*} \\ \varepsilon_t^{AD} \\ \varepsilon_t^{AS} \\ \varepsilon_t^{MP} \\ \varepsilon_t^{RER} \end{bmatrix}$$

(22)

The set of restrictions defined in equation (22) follows several considerations regarding the structure of the model. First, in line with the small, open economy assumption, the foreign economy does not respond to the current values of domestic variables. More importantly, the international linkages apply only through output with no direct linkages through inflation and interest rates, reflecting a New Keynesian IS curve. The monetary authority sets the interest rates with respect to current values of output and inflation. Finally, the real exchange rate equation reacts to all of the variables contemporaneously, reflecting the fact that exchange rates are forward-looking variables (Kim and Roubini, 2000).

5.1.1. Singapore

The impulse responses for the Singaporean economy to foreign and domestically sourced aggregate demand shocks are presented in Figures 1 and 2.

A shock to the foreign output equation results in permanently higher foreign output and permanently higher domestic output, which reflects the permanent nature of the shock captured by our model (see Figure 1). Initially, Singaporean output rises by about 0.8 of the rise in the foreign output; after three years, the multiplier of the foreign shock on domestic output is greater than 1, settling at about 1.06 in the longer term. This implies that the Singaporean economy will bear the full impact of foreign output shocks in the long run, reflecting its high degree of openness. The output shock leads to an increase in Singaporean inflation resulting in a corresponding response from the

monetary authorities to increase interest rates. As a result, this inflationary pressure eases after approximately four years. The initial appreciation of Singapore's domestic currency is followed by a permanent depreciation due to the decline in real interest rates and the permanent increase in domestic output.

Figure 1. Impulse Response Functions (Foreign Output Shock)

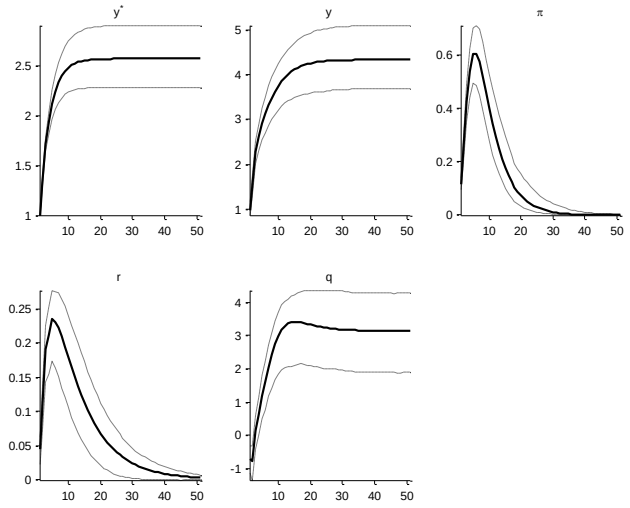
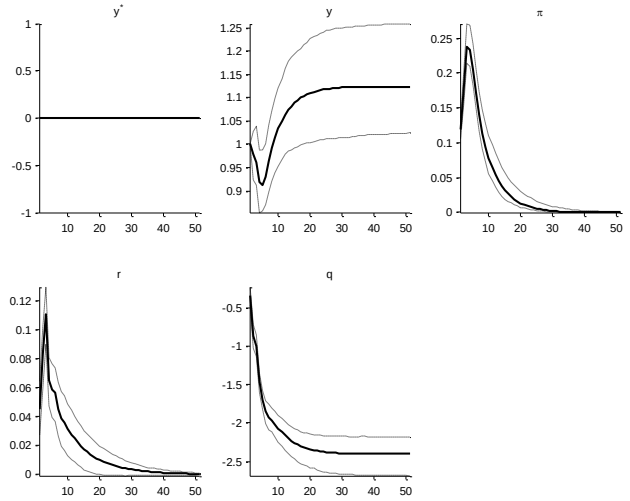


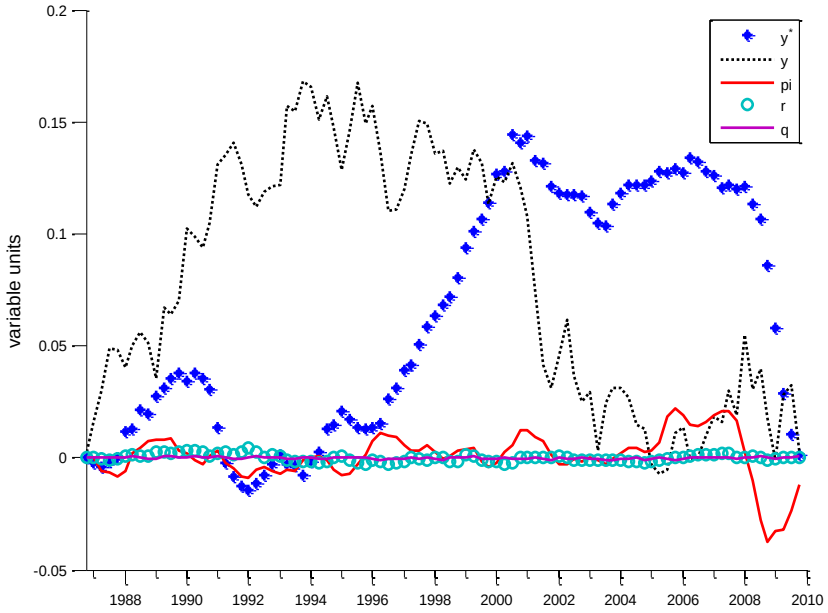
Figure 2. Impulse Response Functions (Domestic Output Shock)



Domestically sourced output shocks result in a permanently higher output in Singapore although the long-run multiplier on the shock is not as high as for the foreign-sourced shocks (see Figure 2). The inflation increases as a result of the increased demand, which is followed by a higher interest rate response of the central bank to control inflation. The increased output results in a permanent currency appreciation despite the decline in real interest rates. We do not report the other impulses from the model, but rather note that the model does not display a price puzzle or exchange rate puzzle.

Figure 3 presents the contributions of shocks associated with each of foreign aggregate demand, domestic aggregate demand, aggregate supply, monetary policy and the real exchange rate to the variation in output over the entire sample period.

Figure 3. Historical Decomposition of Output

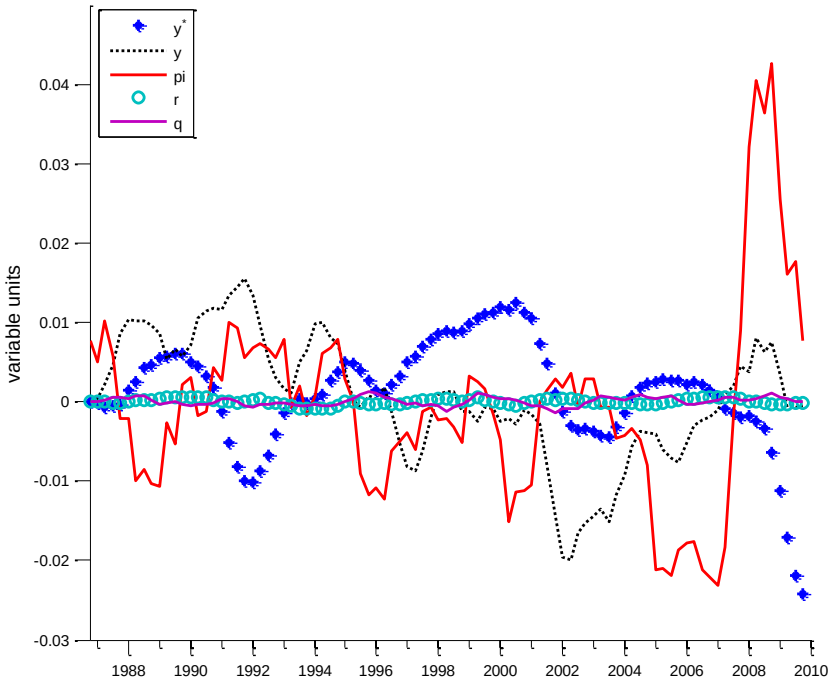


As initial conditions might be important, analysis is restricted to exclude the two years following the beginning of the sample. The most striking feature of the figure is the dramatic change in the relative importance of foreign and domestic aggregate demand shocks to variation in Singaporean output. Prior to 2001, domestically sourced shocks were the largest contributor, peaking from March 1994 until the middle of 1997,

corresponding with the onset of the Asian crisis. In June 2001, the foreign shocks exceeded the contribution of domestic shocks for the first time. After that time, the contribution of foreign-sourced aggregate demand shocks to Singaporean output can be seen to remain high and positive while the contribution of domestic shocks shows a steep decline. This situation persisted until September 2007, after which the positive impact of foreign-sourced shocks is dramatically reduced. This is unsurprising given the onset of the global financial crisis —and additionally, a relatively large negative component sourced from inflationary shocks. Singapore experienced strong inflation followed by deflation in this period, even after accounting for the effects of oil price movements at this time.

The effects of the inflationary pressures in Singapore late in the sample can also be observed in Figure 4, which depicts the historical decomposition of inflation variation over the sample.

Figure 4. Historical Decomposition of Inflation



The relatively large contribution of positive inflation shocks in the period from March 2008 to the end of the sample dwarfs all other sources during the period. At the

same time, it can be seen that there are substantial offsetting effects on inflation from foreign-sourced output shocks—again, presumably relating to the downturns experienced by many economies in response to the global financial crisis. Domestic output shocks in the final two years of the sample initially contributed positively to inflation variation but more recently have been offsetting inflation pressures. About the time of the Asian Financial Crisis, the impact of lower domestic output shocks can be clearly seen as reducing pressure on inflation while at the same time foreign output shocks were providing some inflationary stimulus. In the period after the Asian financial crisis, foreign output shocks contributed more negatively than domestic output shocks, and, from 2004 to 2008, foreign inflation shocks were an important source of downward pressure on inflation volatility.

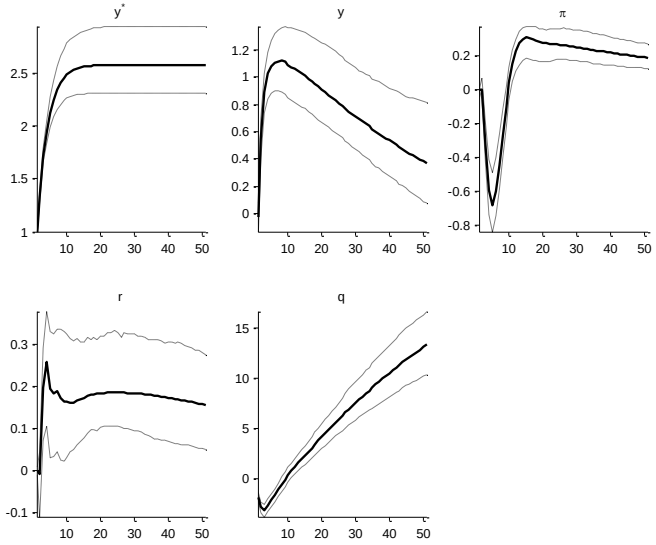
In summary, the Singaporean economy has had a dramatic change of focus regarding the sources of output variation over the sample, with foreign-based shocks becoming more significant than they were in the pre–Asian crisis period. Domestic conditions on the other hand have become less influential.

5.1.2. The Philippines

The empirical identification of the model for the Philippines is the same as that given in equation (22), including the crisis dummy variable and exogenous oil price inflation in the Phillips curve equation. We find that it is feasible to estimate this model for the entire sample period of 1986Q1 to 2009Q4, despite the change in exchange rate regime during this period.

The impulse responses of the Philippines economy to shocks sourced from foreign output are shown in Figure 5.

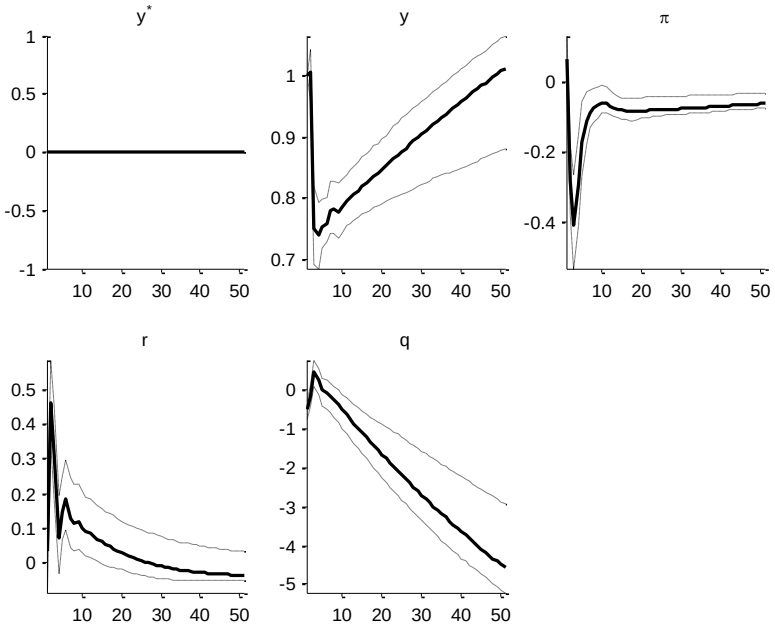
Figure 5. Impulse Response Functions (Foreign Output Shock)



In this case, the long-run effect of the foreign output shock on domestic output is lower than in Singapore—presumably a reflection of its less open nature. The effect dissipates very slowly over the 10-year period shown. Although there is no initial significant positive inflationary response to the shock, inflation picks up as the higher growth rates continue. Inflation returns to equilibrium in the long run in response to the higher interest rates. This might be a result of the mixed exchange rate regime data in the sample. The higher real interest rates are clearly associated with an initial appreciation of the Philippine peso.

A domestically sourced output shock shown in Figure 6 also results in higher real interest rates. Although the initial impact on inflation is significantly positive, it rapidly reverts to an insignificant effect, while nominal interest rates are significantly higher. In this case, the Philippine peso appreciates rapidly yet this is subsequently eroded over the 10-year horizon. The presence of the price puzzle in this model also indicates that it is not yet a satisfactory representation of the Philippines economy.

Figure 6. Impulse Response Functions (Domestic Output Shock)



The historical decomposition of output in the Philippines is shown in Figure 7. It shows the substantial impact of domestic economic output shocks throughout the period. These were particularly prominent during the decade from 1993 to 2003, with the impact of the Asian crisis causing a pronounced effect in 1997. This could be interpreted as the model failing to incorporate sufficient richness to model the Philippine economy. Other potential indicators of development, population growth, climatic conditions and the effects of the US military presence might need to be incorporated in the model. The figure also shows the increased effect of international output shocks to domestic output variation during the period from 1995. This effect builds until 2001, after which international effects have a less pronounced, but nevertheless positive, impact on domestic output variation. In the past two years, the impact of the international financial crisis on reduced international demand is clearly evident in the negative contribution of international output shocks to domestic output variability.

Figure 7. Historical Decomposition of Output

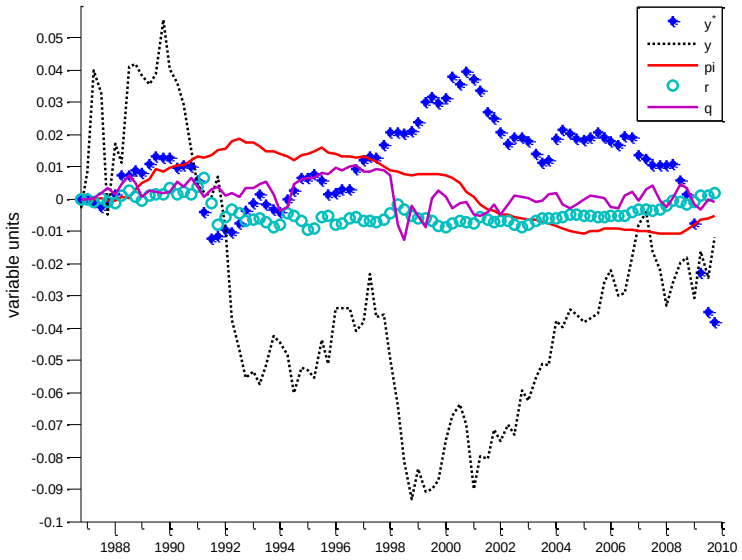
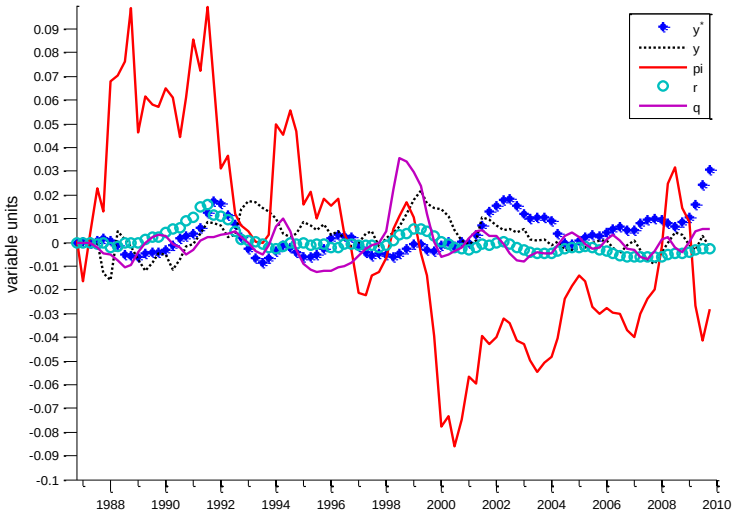


Figure 8 shows the historical decomposition of inflation for the Philippines. The contributions of shocks other than domestic shocks to inflation variation are minimal. This reflects the fact that the model is limited in providing an empirical specification of the inflationary process in the Philippines.

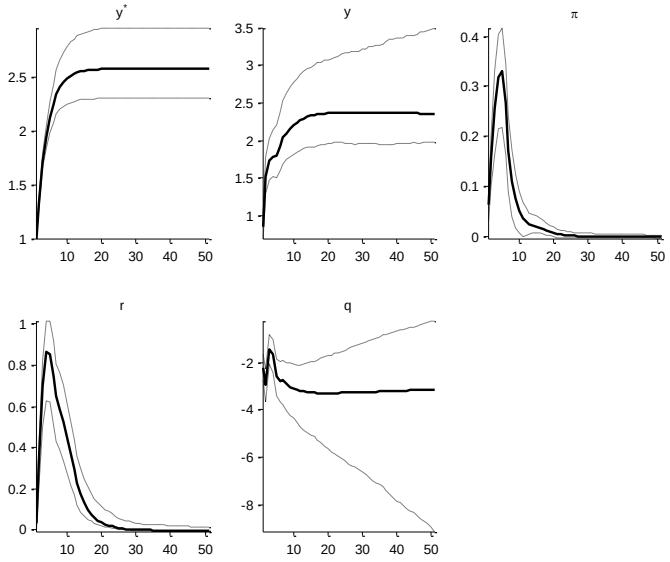
Figure 8. Historical Decomposition of Inflation



5.1.3. Thailand

After experiencing a period of export-led economic growth during 1986–95, the Thai economy began slowing by the end of 1995 as a result of weakening export performance. Heightened by growing concerns regarding the economy's ability to maintain a fixed exchange rate regime, capital inflows reversed substantially, exerting significant pressure on the exchange rate. The subsequent devaluation of Thailand's currency in July 1997 is largely responsible for igniting the Asian financial crises. Using the same identification structure applied in the Singapore and Philippines models, we estimate the model for Thailand for the entire sample period of 1986Q1 – 2009Q4. Figure 9 shows the impulse response functions of Thailand's domestic variables to a US shock. The permanent US shock increases Thailand's output significantly, with an average multiplier of 1 within the first year following the shock. As a result, inflation increases and the central bank responds by increasing interest rates above the level of inflation, thereby reducing the prevailing excess demand and increased inflation. Consequently, the currency appreciates as a result of higher real interest rates.

Figure 9. Impulse Response Functions (Foreign Output Shock)



The impulse responses from a domestically sourced output shock are shown in Figure 10, showing an output, inflation and interest rate increase in response to the shock. The long-run response of output is similar in magnitude to the original shock,

while the inflation response peaks in the second year following the shock and takes more than five years to fully dissipate. Interest rates follow a similar pattern, which mirrors the inflation outcome. This is not unexpected since Thailand follows an inflation-targeting monetary policy regime for the period post 1997.

Figure 10. Impulse Response Functions (Domestic Output Shock)

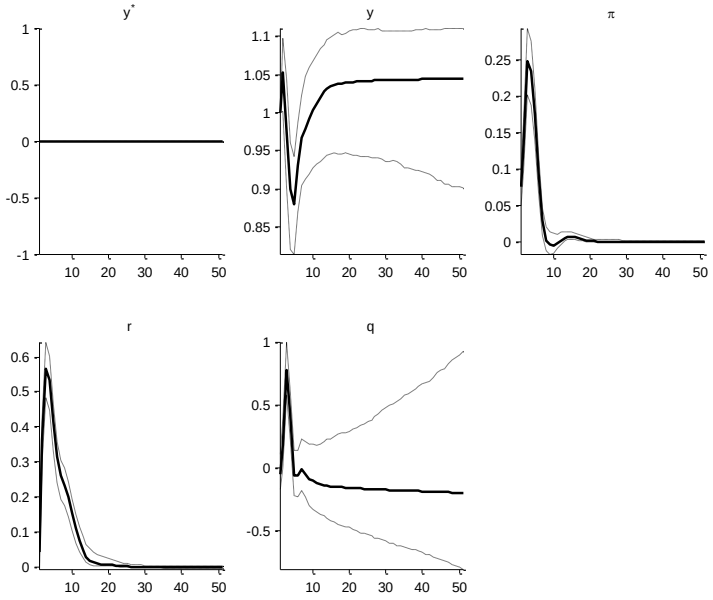


Figure 11 shows the historical decomposition of Thailand's domestic output. It can be seen that the contribution of foreign shocks begins to increase following the Asian crisis, reflecting the increasing openness of the economy due to the floating exchange rate regime, and matches the contribution of domestic shocks after 2006. Figure 12 shows the historical decomposition of Thailand's inflation and strongly suggests that the majority of the inflationary pressure in Thailand is driven by domestically sourced inflationary shocks (traditionally associated with supply shocks in many VAR models).

Figure 11. Historical Decomposition of Output

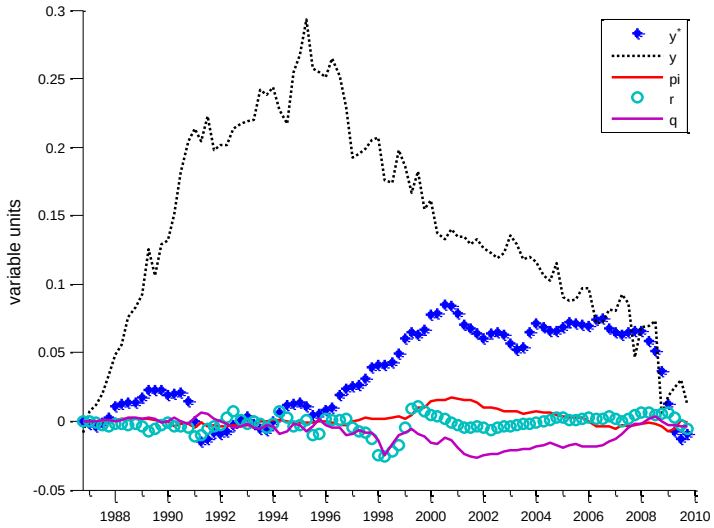
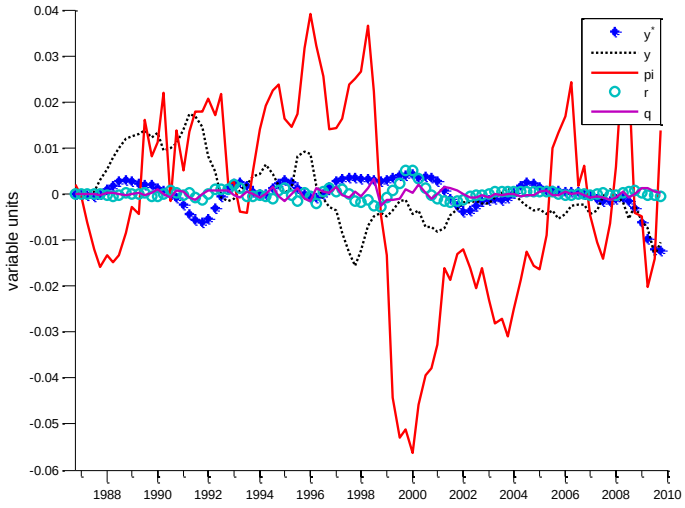


Figure 12. Historical Decomposition of Inflation



5.1.4. Malaysia

Figure 13 shows the impulse responses of real output growth to the US shock. It can be seen that domestic output increases at the same pace as both inflation and foreign output increase. The interest rate increase is only slightly higher than the increase in inflation, which results in an initial currency appreciation. The overall responses to a domestic output shock (Figure 14) follow a similar pattern to other countries examined.

Figure 13. Impulse Response Functions (Foreign Output Shock)

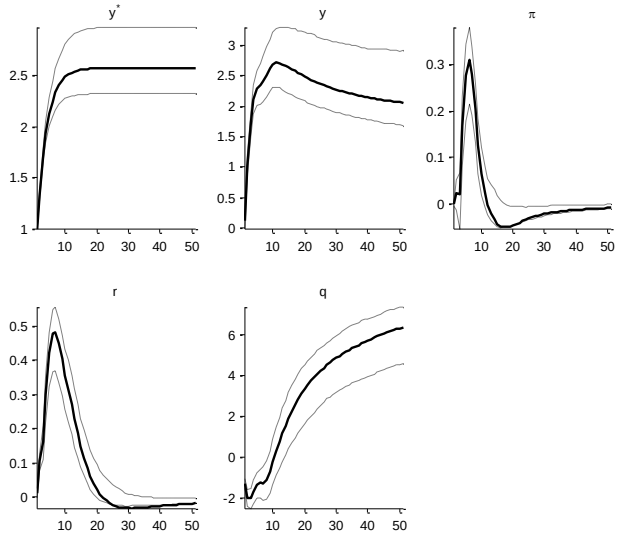
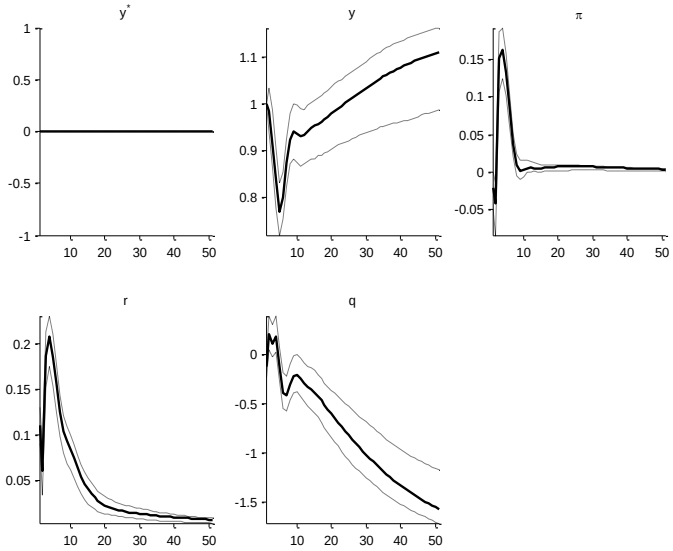


Figure 14. Impulse Response Functions (Domestic Output Shock)



The historical decomposition of Malaysian output is shown in Figure 15. Similar to the case of Singapore, here, we observe an increase in the contribution of foreign-sourced shocks following the Asian crisis, and a corresponding decline in the contribution of domestically sourced shocks. The historical decomposition of inflation on the other hand shows that inflation is rather persistent and is affected mainly by its past behavior.

Figure 15. Historical Decomposition of Output

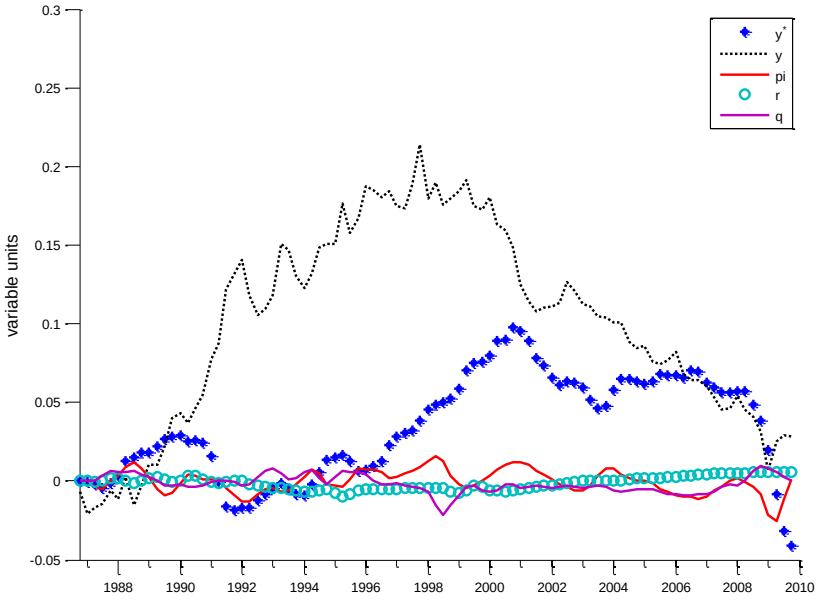
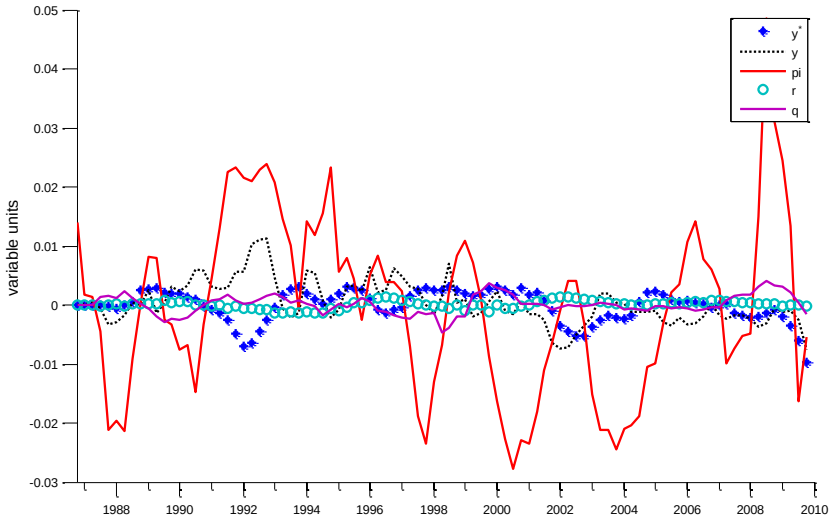


Figure 16. Historical Decomposition of Inflation



5.1.5. Indonesia

Indonesia's output response to a foreign output shock is relatively milder than in other economies, and is not persistent. Inflation initially drops, which is followed by a subsequent decline in interest rates. Inflation picks up again after eight quarters and, in

turn, interest rates increase. The initial increase in real interest rates causes currency appreciation, which quickly reverts as real interest rates decline. The overall responses of Indonesia's endogenous variables to both domestic and foreign shocks, on the other hand, show that further work is needed to enhance the model dynamics.

The historical decomposition of output shown in Figure 19 reflects the relatively closed structure of the Indonesian economy, where the domestically sourced shocks play a major role in output variations. The negative impact of foreign-sourced shocks is evident after 2008. The decomposition of inflation shown in Figure 20 on the other hand does not point to any major contributor to the inflation variation where all the shocks have sizeable impacts.

Figure 17. Impulse Response Functions (Foreign Output Shock)

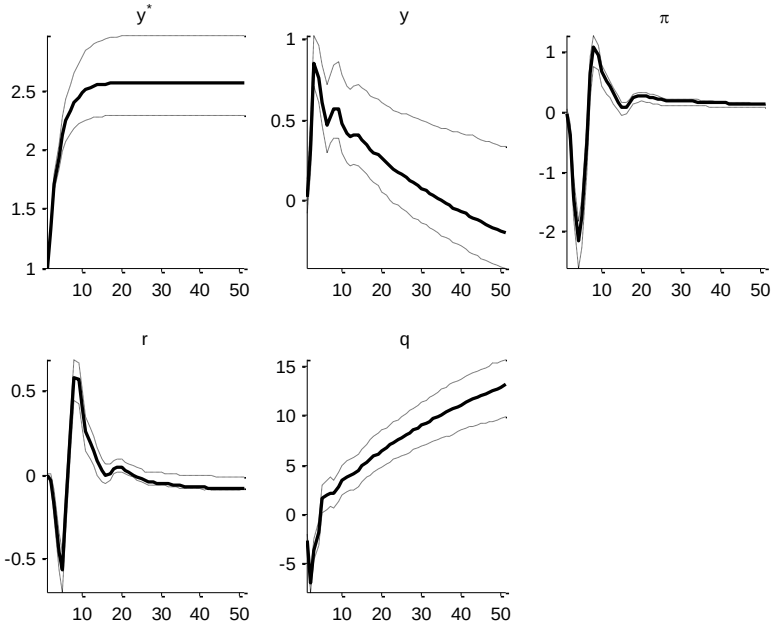


Figure 18. Impulse Response Functions (Domestic Output Shock)

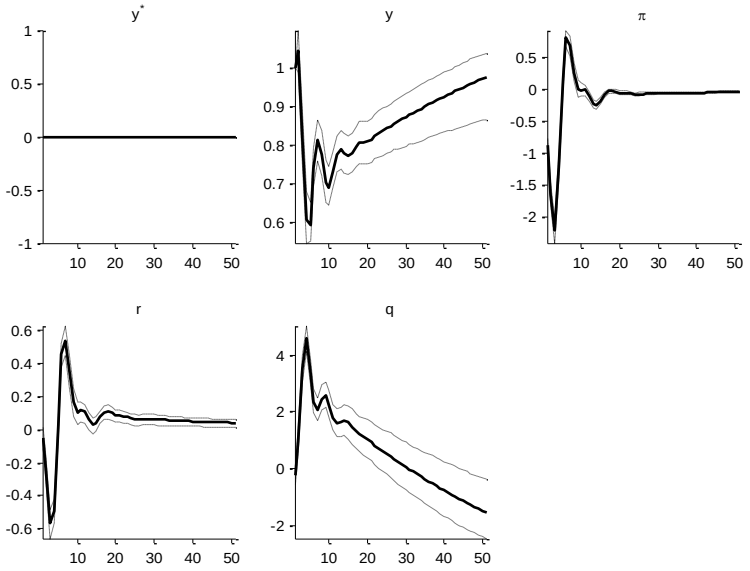


Figure 19. Historical Decomposition of Output

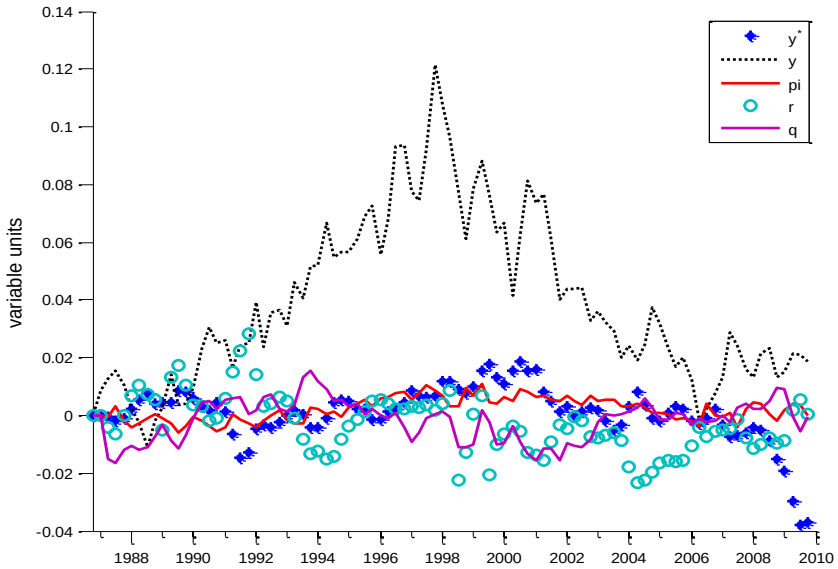
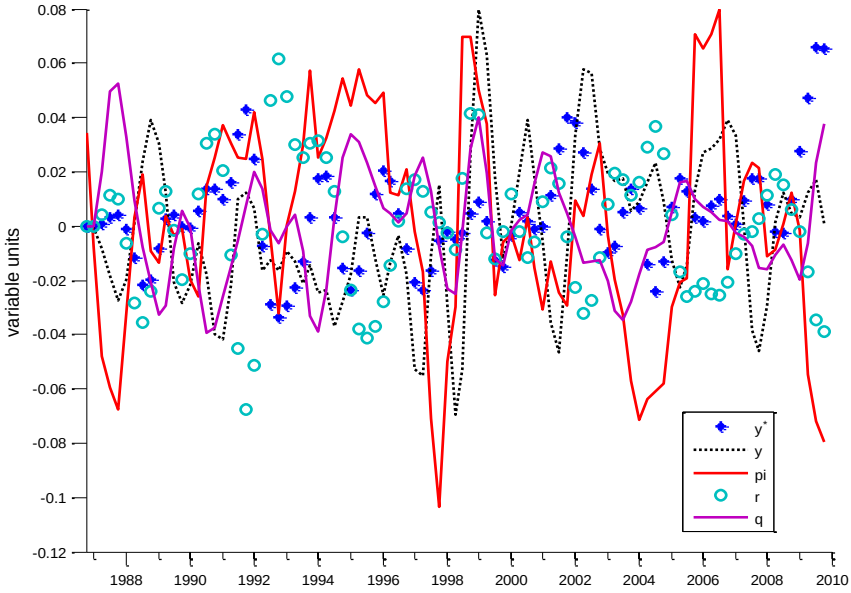


Figure 20. Historical Decomposition of Inflation



6. Comparison of Responses to the United States' and China's Output Shocks Across Countries

This section compares the relative impact of foreign shocks on each of the individual countries' variables. Initially, the responses to a US output shock are reported. Furthermore, we re-estimate each country model using China as the foreign country and report the corresponding results.

6.1. US Output Shock

Figure 21 shows that output in Singapore is the most sensitive to a foreign shock, followed by Thailand and Malaysia; the Singaporean response is almost double that in Thailand. These results are unsurprising given the high degree of openness of these three countries, with the shares of total trade to GDP of 283, 146 and 108 percent in 2009, respectively. The responses do not monotonically relate to trade openness; Thailand is more open than Malaysia in these measures yet Malaysia has a larger initial

response to the shock than Thailand (although this is reversed in the longer term). This might also reflect the changes in regime occurring for both Thailand, which adopted a flexible exchange rate and inflation targeting during the Asian crisis, and Malaysia, which conversely reduced capital inflow and decreased exchange rate flexibility during the crisis. Alternatively, in the Philippines and Indonesia, the expansionary response of output to a foreign output shock is less pronounced—consistent with the relatively more closed characteristics of these two economies (trade represents 51 and 39 percent of GDP respectively in these economies).

Figure 22 presents the responses of inflation to the US output shock. It can be observed that the responses of Singapore, Thailand and Malaysia are highly synchronized where inflation picks up following the increased aggregate demand in the economy. The responses of the Philippines and Indonesia on the other hand are negative, with a more pronounced deflationary effect in the case of Indonesia. The impact of the recession in Indonesia following the IMF programs there in 1997, on these results, needs to be examined further.

Figure 21. Domestic Output Responses to a US Output Shock (solid line)

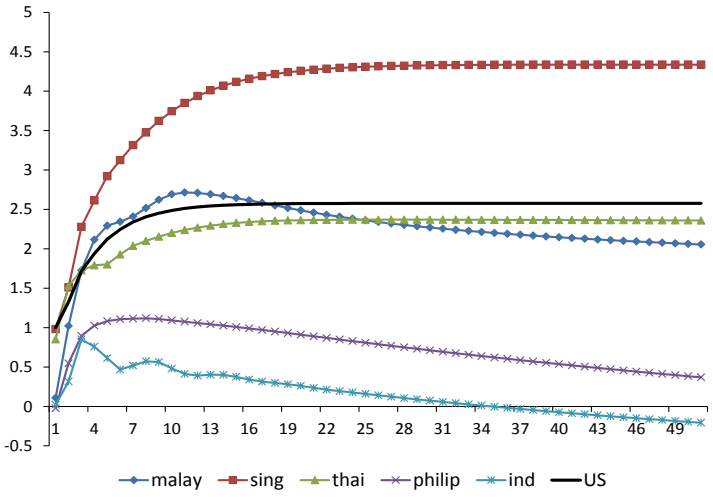
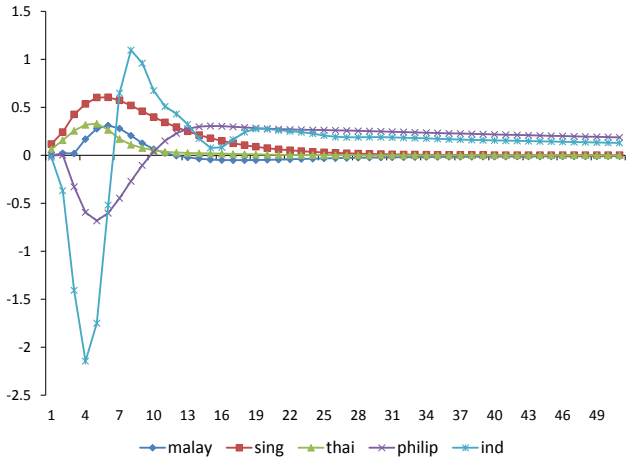
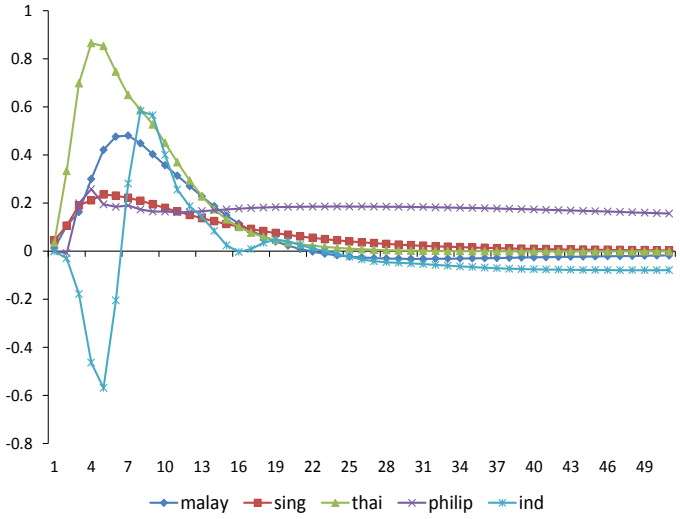


Figure 22. Inflation Responses to a US Output Shock



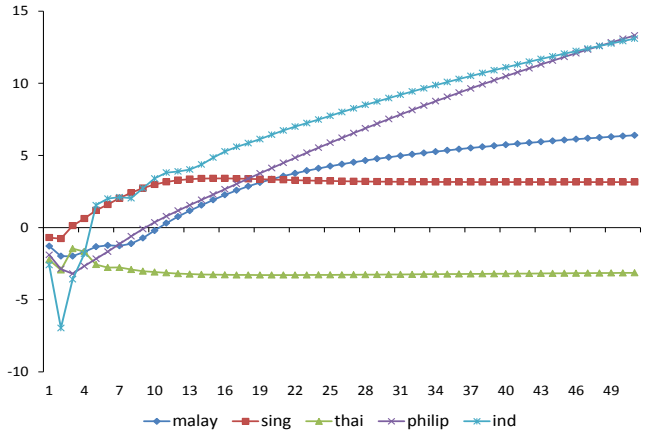
The interest rate responses to the US shock presented in Figure 23 show that the central banks react to the inflation increases by increasing interest rates, with the exception of Indonesia, where an initial reduction in interest rates is observed. This price puzzle for the Indonesian economy leads us to suspect further analysis of the Indonesian situation is required. This is consistent with the inflationary outcomes observed previously.

Figure 23. Interest Rate Responses to a US Output Shock



Finally, Figure 24 presents the responses of each country's real exchange rate to the US output shock. The initial impact of the shock on the currencies of all countries is an appreciation, which is very short-lived in the case of Singapore. This is partly a reflection of the relatively mild interest rate response we observed in the case of Singapore. It is important to note, however, that it is notoriously difficult to explain the behavior of real exchange rates.

Figure 24. Real Exchange Rate Responses to a US Output Shock



6.2. Chinese Output Shock

The impulse responses of each of the five East Asian countries to an external output shock originating in China are shown in Figure 25. Overall, the output responses are positive in the short and medium term, with the exception of the Philippines, where a small negative result is evident. On the other hand, the Chinese shocks are comparatively less important as a source of real output fluctuations in East Asia. This is consistent with the findings of Zhang et al. (2010). The inflation and interest rate responses are positive in the short run with the exception of the Philippines and Indonesia. All the countries experience currency depreciations with similar magnitudes in response to the output shock from China. The evidence from this section strongly suggests that when modeling East Asian economies, more explanatory power is gained by using the US economy as the proxy for global economic conditions than by using China. This is despite China's growing importance to these economies and to the world as a whole. Some of this might be due to the importance of the United States as the

final source of much consumer demand for Asian production as well as the fact that many international trade contracts continue to be priced in US dollars. Both of these factors lead to the concept that the United States is a closer indicator of international economic conditions than fluctuations in Chinese conditions at this point. The exchange rate responses to the Chinese output shock shown in Figure 28, compared with the exchange rate responses to US output shocks in Figure 24, strongly support the importance of the US dollar in international transactions that impact on the Asian economies. Further work is required in this area, which specifically incorporates both the United States and China as external influences, allowing for the interaction between these economies in order to more effectively model the effect of international conditions on Asian economies.

Figure 25. Domestic Output Responses to a Chinese Output Shock (solid line)

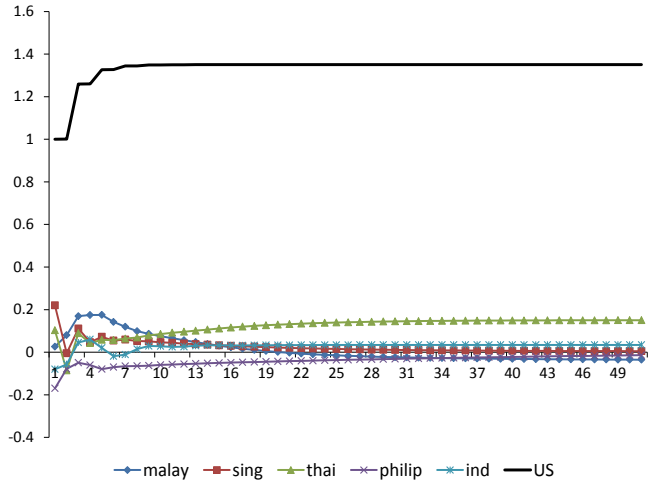


Figure 26. Inflation Responses to a Chinese Output Shock

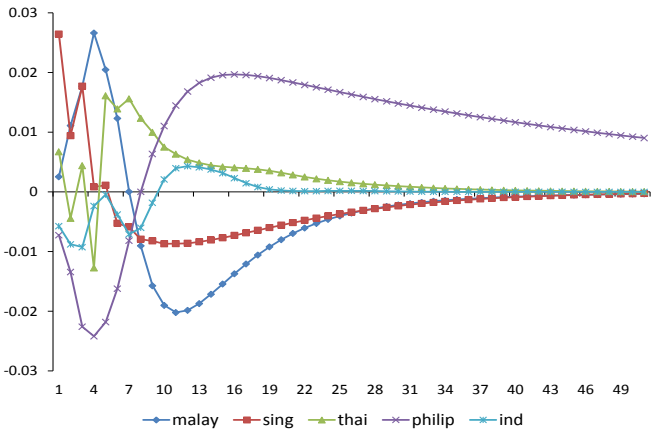


Figure 27. Interest Rate Responses to a Chinese Output Shock

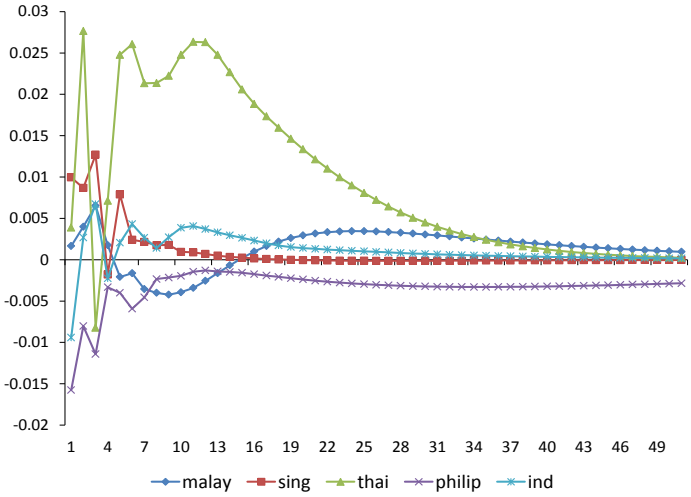
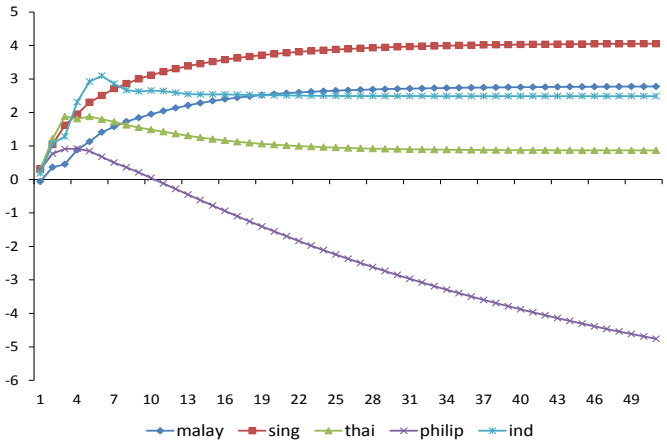


Figure 28. Real Exchange Rate Responses to a Chinese Output Shock



7. Conclusion

Modelling the macroeconomic relationships in the small, open economies of Asia presents a number of challenges. The relatively short data samples and changing monetary policy and exchange rate regimes during the past 20 years have proven to be significant impediments to the implementation of many modeling frameworks. This paper has, however, successfully applied a SVECM framework with underlying modern New Keynesian theoretical foundations taking into account the nature of the underlying data. We harness the mixed I(0) and I(1) nature of the data to provide additional identification and specifically account for the presence of cointegrating relationships between variables where the empirical evidence is compelling. The framework is applied to each of the economies of Singapore, Malaysia, Thailand, the Philippines and Indonesia. In all but the case of Indonesia, we are able to find a specification that does not result in the macroeconomic price and exchange rate puzzles common in this modeling framework. This is a particularly rewarding outcome in a challenging empirical environment. We present the historical analysis of the evolution of shocks in each country, and are able to successfully tie these to the underlying economic events during the sample period.

The framework particularly allows us to investigate the response of the Asian economies to international shocks. In the first instance, we examine how the economies of Singapore, Malaysia, Thailand, the Philippines and Indonesia respond to shocks generated via the US economy. We show that the responses generally reflect the degree of openness of each of these economies—with Singapore (the most open) responding to a far greater degree to US-generated shocks than Indonesia (the least open economy).

The growth of the Chinese economy over the past two decades leads us to consider the alternative of shocks driven by Chinese output shocks in a separate implementation of the model. We find that the Chinese shocks do not have the same impact as US-generated shocks on any of the Asian economies, which we suggest reflects both the role of the US as the source of much final consumer demand for Asian trade and the importance of the US dollar as the currency of denomination for much international trade and portfolio flows.

The implication for policymakers is that despite the rapid growth of China's importance to countries in this region, external influences are currently better represented by the United States. In the future, this might no longer be the case. To understand more fully the development of these effects, future research should examine a time-varying parameter specification to evaluate the changing nature of these relationships, and accommodate the inter-linkages between the United States and China in understanding the ultimate sources of shocks and their direct and indirect effects on the economic outcomes in East Asia.

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Appendix 1. Variable Plots

Figure A1. Singapore's Variable Plots

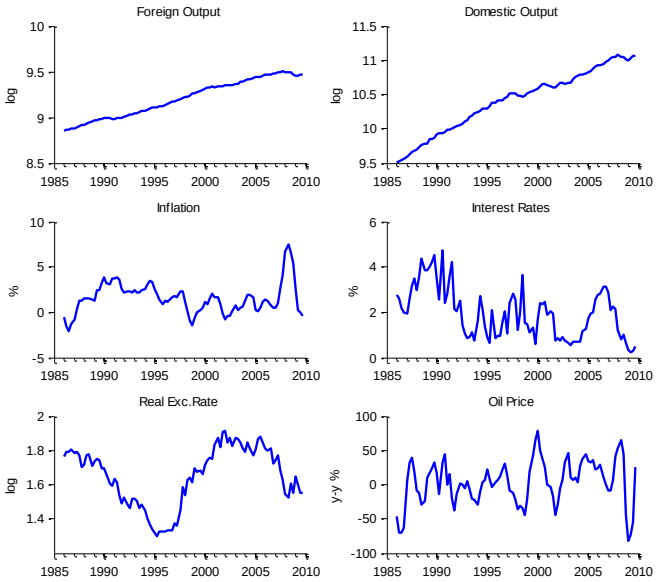


Figure A2. Thailand's Variable Plots

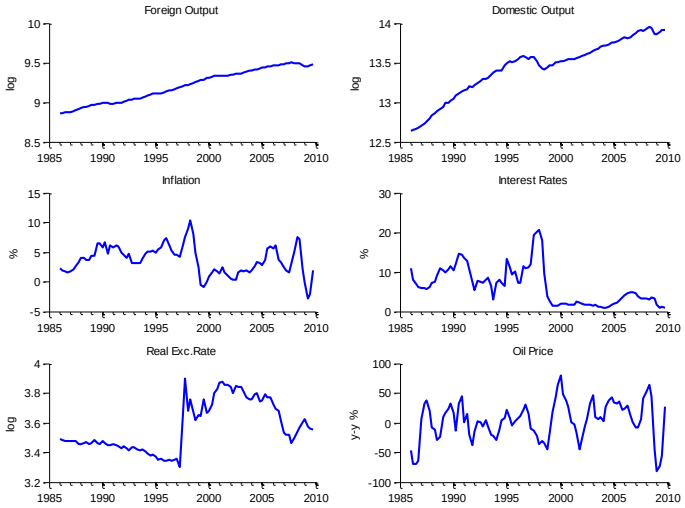


Figure A3. The Philippines' Variable Plots

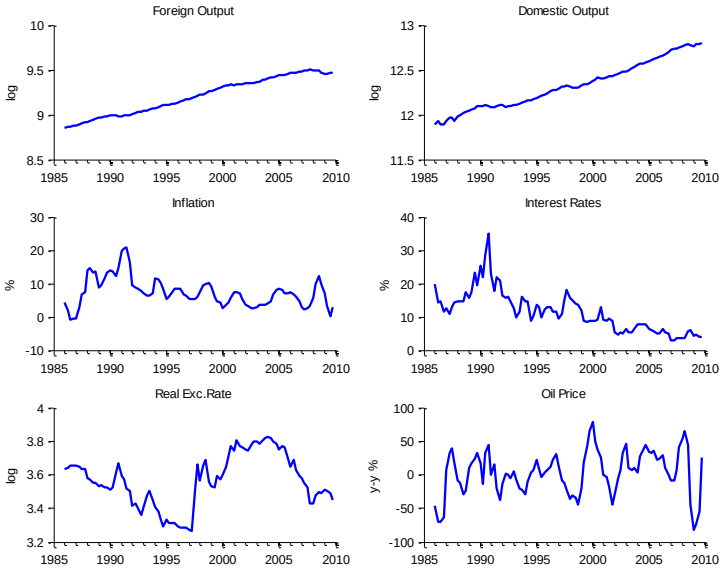


Figure A4. Indonesia's Variable Plots

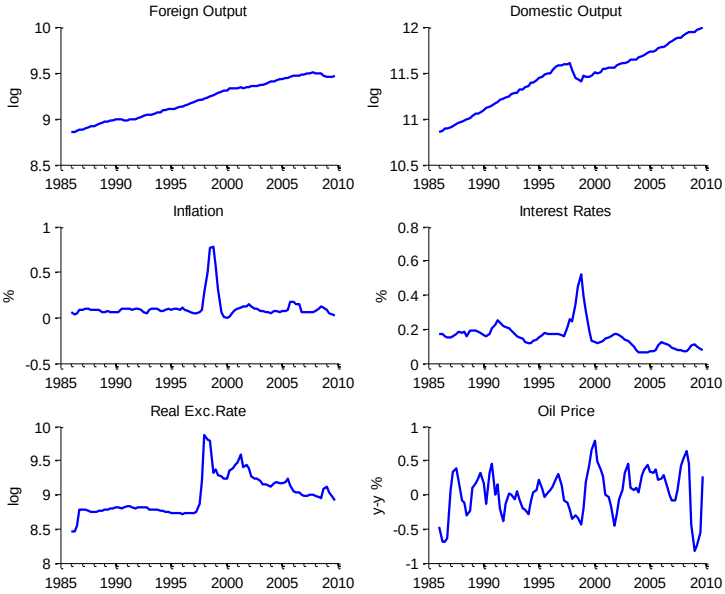
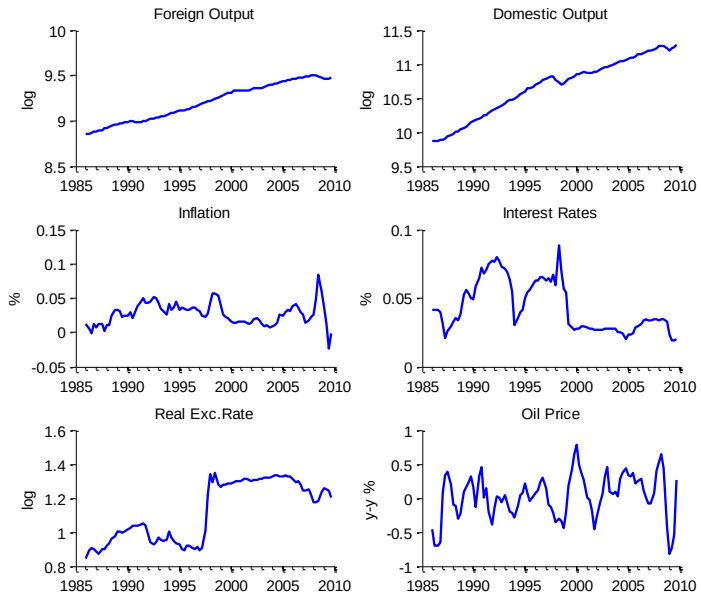


Figure A5. Malaysia's Variable Plots



Appendix 2. Variable Descriptions

Data	Description	Source
y^*	log US Real GDP, constant prices, national currency	IFS
y	log Real GDP, constant prices, national currency	IFS, Datastream, Tilak Abeysinge's homepage (http://courses.nus.edu.sg/course/ecstabey/Tilak.html)
π	CPI, % change per annum	IFS, Datastream
r	Treasury Bill rate, % per annum	IFS, Datastream
q	Real exchange rate, (nominal exchange rate as local currency per unit of foreign currency times the ratio of foreign and domestic CPIs)	IFS, Datastream
oil	Oil prices	Spot Oil Price, West Texas Intermediate, $ per barrel, FRED Database

Chapter 14

International Bank Claims to East Asian Economies: Stabilizers or Destabilizers?

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This study seeks to address a number of rising policy concerns from the aftermath of the recent sub-prime crisis. Did foreign bank lending decline sharply and transmit the financial shocks from the advanced economies to the emerging markets in East and Southeast Asia? Was the decline driven by the drying up in supply of cross-border loans or more by the sharp decline in the demand for this funding? Does greater exposure of foreign banks to a host country lower the sensitivity of their claims to shocks originating from their own economies? Do countries that owe claims from the same international banks affected by movements in international banks' claims on another country? At the outset, we want to assess the stability of these foreign bank loans. In the final analysis, our study confirmed the role of international bank lending, particularly cross-border lending as a channel of shock transmission from home economies to host countries. This then suggests, going forward, more in-depth examination should be carried out of the roles, activities and impacts of these large global banks on the local economy, including that of host authorities' policies on the local presence of these systemically important global banks.

Keywords: International bank claims, cross-border lending, bank exposure, sub-prime crisis, East and Southeast Asian economies

JEL Classifications: F34, F36, G01, O57, C23

[1] The views expressed in this study are those of the authors alone, and do not represent the official views of the SEACEN Center.

1. Introduction

There is an intense, ongoing debate about the consequences of increased internationalization or globalization of banking. In the past, foreign banks often looked more attractive to host-country authorities because they seemed to provide greater transfer of know-how and technology to emerging markets. At the outset of the recent global sub-prime financial crisis, the focus of the host-country authorities shifted more towards financial stability concerns. There is evidence to support the view that foreign bank entry into domestic banking systems is a stabilizing force for the host economy and results in more efficient allocation of scarce resources. Much of the analysis, however, has been in the context of shocks originating in emerging countries.

The claim that the globalization of banking has brought forth stable financial markets in host economies is in fact at odds with the view that such financial linkages have 'fueled the fire' of the transmission of financial stress from advanced economies to emerging countries as evidently illustrated in the recent Global Financial Crisis (GFC) of 2007–09. During the recent sub-prime financial crisis, cross-border bank lending has also been found to be a key transmission channel through which stresses in the international financial markets were transmitted to emerging markets (Cetorelli and Goldberg, 2008, 2010).

Against this backdrop, understanding the determining factors behind the flows of lending of these international banks is therefore critical, especially for domestic policymakers. Our study examines push and pull factors that drive movements in the cross-border loans of banks from three of the Organization for Economic Cooperation and Development (OECD) countries (the United Kingdom, the United States and Japan) to five major Southeast Asian economies (Indonesia, Malaysia, the Philippines, Thailand and Singapore) and Korea.

We extend limited works on the cross-border lending to East Asian economies, such as Siregar and Choy (2010), by focusing on the periods before and after the sub-prime financial crisis. At the peak of the sub-prime crisis—the second half of 2008 to the first half of 2009—international banks' consolidated lending contracted sharply, driven predominantly by the sudden reversal of cross-border lending (Takats, 2010).

Furthermore, the recent trend indicates that cross-border loans of these international banks to emerging markets in Asia dropped more significantly than the local claims of their subsidiaries or branches. This is in sharp contrast with the experience of the Latin American emerging economies. As will be elaborated further, banks from the three OECD economies have predominantly been responsible for the volatilities and significant fall in international bank claims to these major Asian economies during the last global financial meltdown.

While there is a general decline in international bank lending, affecting all the emerging Asian economies included in our study, some of these countries have experienced a much worse, sudden stop of bank flows than others during the GFC (Figure 1). It is therefore worthwhile to compare and contrast these cross-country experiences and draw lessons from their diversity. The contagion effect is also interesting and important to examine here. For example, van Rijckeghem and Weder (2003) have shown that fluctuations in foreign bank claims in one country might spill over to other countries that hold claims from the same foreign banks.

In short, this study seeks to address a number of rising policy concerns from the aftermath of the recent sub-prime crisis. Did foreign bank lending decline sharply and transmit the financial shocks from the advanced economies to the emerging markets in East and Southeast Asia? Was the decline driven by the drying up of supply of foreign bank loans or more by the sharp decline in the demand for this funding? Does the greater exposure of foreign banks to a host country lower the sensitivity of its claims to shocks? Do countries that owe claims from the same international banks affected by movements in international banks' claims on another country? At the outset, we want to assess the stability of these foreign bank loans. If there are any lessons to be learned from the GFC, it is that central banks around the globe have come to appreciate that monetary stability—particularly price stability during the great moderation in the early to mid-2000s—does not necessarily lead to financial stability. Hence, it is timely to revisit the role of foreign banks and ask: has the cross-border bank lending of foreign banks been a stabilizing or a destabilizing effect?

The outline of the study is as follows. The next section presents a number of stylized facts on the relevant cross-border lending. Data description, the working model and empirical testing are presented in Section 3. Discussion of the empirical findings

and, more importantly, policy implications will be covered in Section 4. The paper ends with a brief concluding remark.

2. Stylized Facts and Motivation

Foreign banks' operations in emerging markets across the global banking system, including those of the Asian economies, increased dramatically starting in the second half of the 1990s. The emerging markets, in general, do not rely on foreign deposits for funding, but they usually turn to international banks for credit lines for exports (Mihaljek, 2010). For most East and Southeast Asian economies, the rise of the international banks' presence started with the first phase of reform and deregulation of the banking sector in the late 1980s and early 1990s. For instance, as reported in Table 1, across the six Asian economies examined in this paper, the total foreign bank claims of three major Southeast Asian economies—namely, Indonesia, Malaysia and Thailand—grew at an annual average of 16 percent to 30 percent for the period 1989–96. It is unfortunate, however, that, along with Singapore, Thailand and Indonesia also experienced the most severe declines in foreign bank claims across the six economies, at about 6 percent and 13 percent, respectively, about the time of the most severe impact of the 1997 East Asian Financial Crisis.

Table 1. Annual Average Growth of International Bank Claims in Major East and Southeast Asian Economies

Countries	1983–88	1989–96	1997–2000	2001–02	2003–07	2008	2009
Indonesia	8.59	16.11	–6.27	–13.33	15.16	-0.85	14.01
Korea	–0.97	20.09	–7.49	6.85	34.50	–19.98	16.76
Malaysia	0.84	16.12	15.88	1.39	16.69	–5.91	2.75
Philippines	–2.98	6.08	10.30	–2.0	8.44	–20.35	10.89
Singapore	18.79	9.98	–10.45	–0.95	15.34	–4.23	5.34
Thailand	8.45	30.65	–13.35	–9.19	9.32	1.61	19.38

Source: BIS Consolidated Banking Statistics for the basic data and authors' calculations.

Moreover, about the time of the reversal of the information technology (IT) bubble in the United States in 2001–02, the drastic retreat of foreign banks' claims to these six

economies was also felt, with the exception of Korea and Malaysia, to a lesser extent (Table 1). Meanwhile, as a testament to its mark as an established financial center, Singapore was already experiencing strong double-digit inflows of international bank lending way back in the 1980s. The Philippines, on the other hand, had experienced a reasonable size of international bank flows only in the 1980s and 1990s compared with the rest of the economies. Apart from the case of Malaysia, however, which imposed capital controls during the peak of the Asian Financial Crisis (AFC), it is the only other economy, among the four remaining Asian countries examined here that did not experience a sudden reversal of international bank claims during the East Asian Crisis (Table 1).

The loosening of ownership regulation, most especially during the post-AFC, also significantly facilitated the rise in the activities of international banks in Asia. Indonesia, South Korea and Thailand, for instance, have raised the allowance for foreign equity participation in local banks of up to 100 percent. Meanwhile, the Philippines permitted 60 percent foreign ownership. As a consequence, the significantly more liberal ownership policy that facilitated an aura of stability and confidence in the respective economies' banking systems has frequently been recognized as an important contributing factor to the return of sustained surges of foreign bank inflows to these economies from 2003 to 2007—just before the outbreak of the recent sub-prime crisis in the United States (Table 1).

The total foreign claims of international banks, in general, continued to sustain strong momentum into some of the emerging markets of the Asian region even until the first half of 2008. Only during the weeks and months in the immediate aftermath of the Lehman Brothers debacle were countries in East and Southeast Asia engulfed in a sharp and sudden reversal of international bank claims such that the unimaginable, sheer size of these reversals in international bank flows out of these six Asian economies saw the annual growth rate of these flows hitting negative territory by the end of 2008—with the exception only of Thailand.[2] More recent data reveal that, across the board, inflows of international bank lending to these six economies have returned (Table 1).

[2] Though Thailand only experienced a very marginal increase in international bank inflows.

As for the nationality of the sources of these international bank flows, it is interesting that before the AFC, Japanese banks were the largest sources of funding for the banks and corporations in East and Southeast Asia.[3] For example, at its peak in the period 1989–96, Japanese lending amounted to 56 percent and 54 percent in the cases of Thailand and Indonesia, respectively (Table 2).[4] Not far from these two economies are Korea and Malaysia, which recorded lending by Japanese banks of 28 and 40 percent, respectively. As presented in Table 2, in the aftermath of the AFC, a consistent waning in the share of lending by Japanese banks was experienced by all six economies, and this diminishing dominance in lending by Japanese banks has been taken on recently to some extent by UK banks and ever consistently by US banks. As a result, such is the critical influence of Japanese, UK and US-owned banks that the combined lending of these three big economies accounts for about half of the combined lending by developed countries into these six Asian countries (Table 2).

Table 2. Average Share of Japanese, UK and US Banks in Foreign Bank Lending to Major East and Southeast Asian Economies

Country	Nationality of foreign banks	1983–88	1989–96	1997–2000	2001–02	2003–07	2008	2009
Indonesia								
	Japanese	40.48	54.22	30.82	22.57	15.37	14.09	14.66
	UK	8.40	4.85	8.48	10.08	12.30	13.31	13.20
	US	19.06	8.96	10.56	9.08	9.32	12.75	13.27
Korea								
	Japanese	31.30	28.48	18.72	13.48	8.86	8.94	9.52
	UK	7.78	4.80	7.72	10.45	19.44	25.02	24.37
	US	29.88	18.12	18.93	22.27	23.88	18.91	25.46
Malaysia								
	Japanese	43.57	40.91	22.48	11.98	7.73	8.16	8.71
	UK	8.65	6.40	20.09	26.51	28.12	26.73	27.67
	US	19.88	24.04	19.19	15.15	14.52	11.51	13.15
Philippines								
	Japanese	21.46	19.00	13.45	13.47	10.39	12.97	13.67
	UK	10.69	8.46	9.78	11.75	12.98	14.60	16.92
	US	41.13	42.74	27.52	21.99	17.55	17.46	19.58
Singapore								
	Japanese	40.01	47.24	20.46	16.40	13.26	16.35	16.91
	UK	8.32	9.43	19.96	22.11	23.91	23.77	23.78
	US	12.40	5.51	8.11	12.42	13.18	11.25	11.44
Thailand								
	Japanese	47.33	56.39	38.70	26.62	27.17	31.15	32.39
	UK	3.18	2.79	6.58	10.95	15.26	16.38	16.50
	US	23.94	11.44	9.87	10.68	12.70	10.33	12.00

Source: BIS Consolidated Banking Statistics for the basic data and authors' calculations.

[3] An exception is the Philippines, which is heavily dominated by lending from US-owned banks.

[4] See, for instance, Siregar and Choy (2010), who examine the driving factors behind the total claims of seven Organization for Economic Cooperation and Development (OECD) countries' banks to nine East and Southeast Asian economies.

As discussed above, while international bank lending retreated substantially in almost all of the six Asian economies in the immediate aftermath of the bankruptcy of Lehman Brothers, it could be that a key component of this international bank lending in the form of the local claims of these foreign banks operating within the domain of these Asian economies remained strong and was less adversely affected by the external shock that originated from the United States. As depicted in Figure 1, while these local claims booked by offices of foreign banks in these economies also retreated in Indonesia, Korea, the Philippines and Thailand, this was not the case for Malaysia and Singapore.

In retrospect, when we look back at previous crises such as the AFC and the 2001–02 collapse of the IT bubble in the United States, as emphasized above, the majority of our six Asian economies experienced sharp reversals in total international bank flows for these two separate crisis periods similar to the one that recently occurred at the end of 2008. Remarkably, however, these local claims have continued to register positive average annual growth rates during the past three crisis episodes—namely, the 1997 East Asian Crisis, the 2001–02 IT bubble and the 2007–08 sub-prime crisis.[5] In fact, it is illustrated in Figure 1 that the more volatile and crisis-sensitive component of the total claims of these foreign banks to our Asian economies has been cross-border lending. The swings and sudden reversals of cross-border lending have been the dominant drivers of the overall fluctuations in the total claims of foreign banks in these six East and Southeast Asian economies during the past three decades, but particularly during the past financial crisis. This is in contrast with the Latin American experience wherein the local claims of foreign banks played a more detrimental part in explaining the overall boom and bust of foreign bank claims (Takats, 2010). As for the recent sub-prime crisis years of 2008–09, the average growth rates of cross-border lending to the rest of the economies included in this study were significantly lower than those of the local claims, with the exception of the Philippines case. In fact, the local claims of the foreign banks continued to grow positively in Indonesia, Malaysia, Singapore and Thailand during the height of the sub-prime crisis (Figure 1).

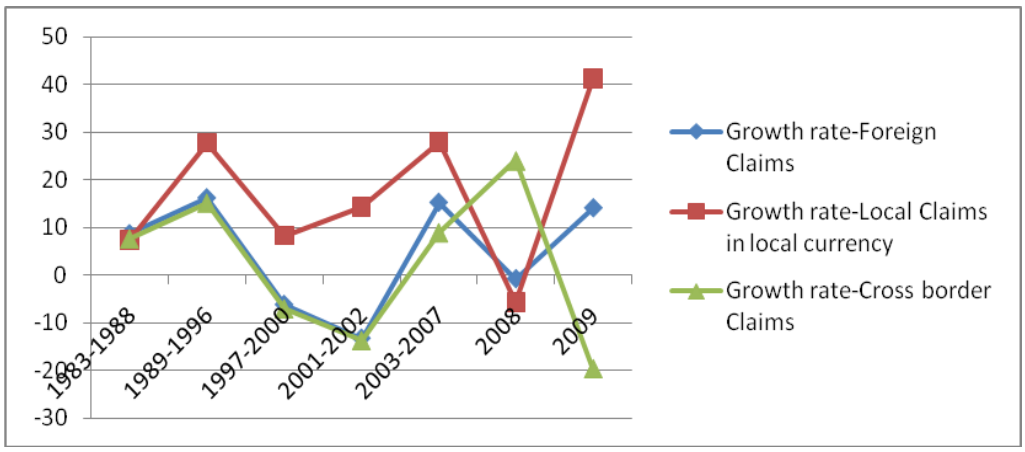
In summary, the cross-country experiences of our six economies highlight the seemingly indisputable evidence that global banks act as a channel of financial shock

[5] The lone exception is the case of the Philippines, which, during the 2001–02 period, also saw local claims by international banks contract along with total foreign bank claims.

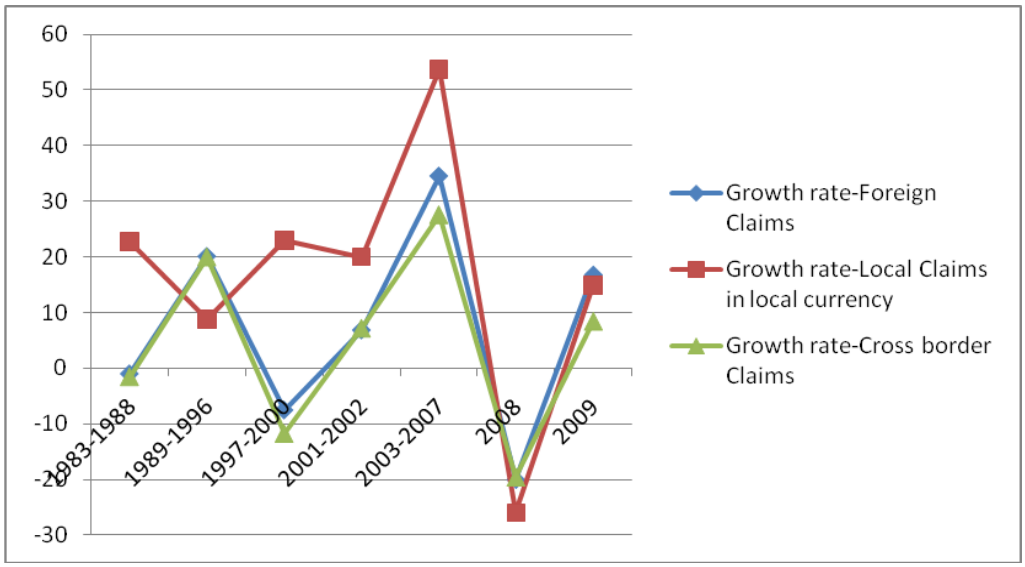
transmission from the global financial markets to the local economy. Formally testing this hypothesis as well as significantly identifying the possible driving factors behind this cross-border lending are therefore imperative and will be the primary objectives of the empirical works of this study.

Figure 1. Average Annual Growth Rate of Foreign and Local Bank Claims in Major East and Southeast Asian Economies

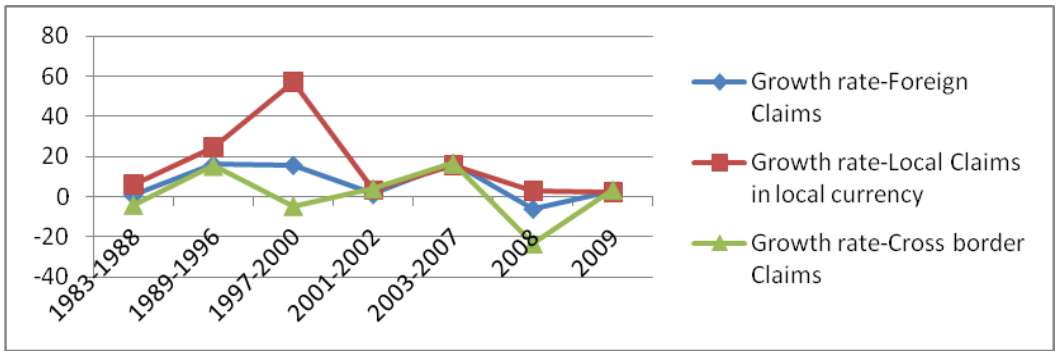
Indonesia



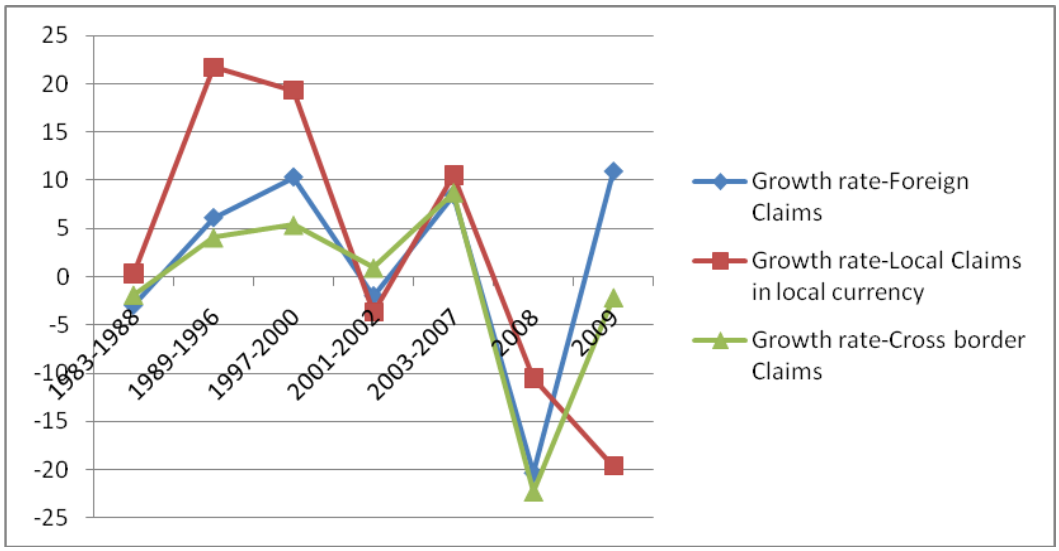
Korea



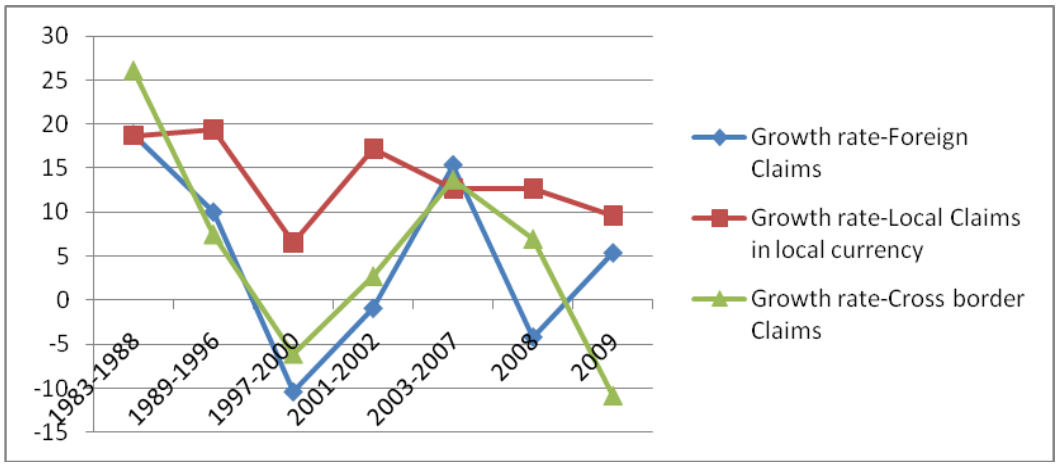
Malaysia



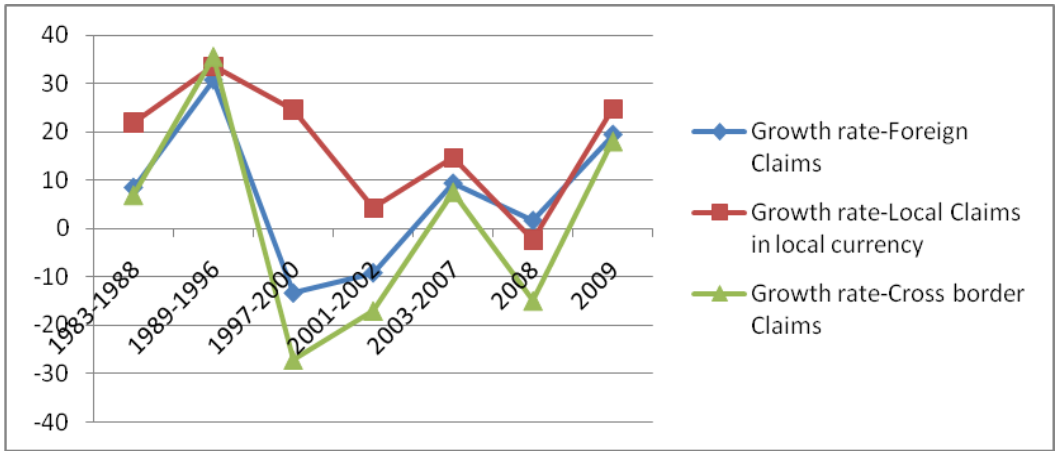
Philippines



Singapore



Thailand



3. Methodology and Empirics

3.1. Dynamic Panel GMM Technique[6]

In a pure cross-sectional regression any unobserved time-invariant country-pair specific effects would be part of the error term, leading to biased estimates of the coefficients. A panel context, however, allows us to control for these unobserved time-invariant country-pair specific effects and, as a result, the problem of biased coefficient estimates is either reduced or eliminated. This is important as there is growing evidence in the literature that cultural biases and differences, for instance, have a substantial impact on a variety of financial flows: portfolio and direct investment (Ekinci et al., 2008; Guiso et al., 2009) as well as foreign bank lending (Giannetti and Yafeh, 2008; Mian, 2006). In addition, the generalized method of moments (GMM) estimator does not require any particular distributions of the error term.

In order to estimate a certain dynamic panel model consistently and efficiently, a GMM estimator introduced by Holtz-Eakin et al. (1990) and Arellano and Bond (1991), and further developed in a series of papers including Arellano and Bover (1995) and Blundell and Bond (1998), is employed. This estimator encompasses a regression equation in both differences and levels, each one with its specific set of instrumental

[6] The discussion that follows draws in part on Calderon and Chong (2001); Chong and Gradstein (2007); and Levine et al. (2000).

variables. We consider the following regression equation for the logarithmic-first differences of international bank claims:

$$y_{ij,t} = \alpha y_{ij,t-1} + \beta X_{ij,t} + \eta_{ij} + \varepsilon_{ij,t}, \quad (1)$$

where y is the logarithmic-first differences of bank claims, X represents the set of explanatory variables apart from the lagged logarithmic-first differences of international bank claims, η is an unobserved, time-invariant country-pair specific effect, ε is the error term, and the subscripts i, j and t represent country pairs and the time period, respectively.

We eliminate country-pair specific effects (η_{ij}) by taking first differences of Equation (1):

$$y_{ij,t} - y_{ij,t-1} = \alpha(y_{ij,t-1} - y_{ij,t-2}) + \beta(X_{ij,t} - X_{ij,t-1}) + (\varepsilon_{ij,t} - \varepsilon_{ij,t-1}) \quad (2)$$

The use of own suitable lagged levels of $y_{ij,t}$ as instruments is required to deal with the problem that by differencing the lagged dependent variable, $(y_{ij,t-1} - y_{ij,t-2})$ is correlated with the error term, $\varepsilon_{ij,t} - \varepsilon_{ij,t-1}$. The same strategy is applied to form instruments for other explanatory variables that are allowed to be endogenous in the sense that they can be affected by current and past realizations of y. This feature enables us to avoid simultaneity bias due to the endogeneity of some of our explanatory variables. Strictly speaking, under the assumption that (i) the explanatory variables, X, are weakly exogenous (no correlation with future realizations of the error term), and (ii) the error term, ε, is not serially correlated, the dynamic panel GMM estimator exploits the following moment conditions:

$$E[y_{ij,t-s} \cdot (\varepsilon_{ij,t} - \varepsilon_{ij,t-1})] = 0 \text{ for } s \geq 2;\ t = 3, \ldots, T \quad (3)$$

$$E[X_{ij,t-s} \cdot (\varepsilon_{ij,t} - \varepsilon_{ij,t-1})] = 0 \text{ for } s \geq 2;\ t = 3, \ldots, T. \quad (4)$$

The resulting GMM estimator based on these conditions is known as the *difference*-GMM estimator. There is, however, an issue with the *difference*-GMM estimator. If lagged dependent variables and explanatory variables are persistent over time, the lagged levels likely represent weak instruments for the first-differenced variables. This causes finite sample bias and low accuracy, which leads to the need to complement the

regression in first differences with a regression in levels. The instruments for the regression in first differences are the same as above. The instruments for the regression in levels, in turn, are the lagged *differences* of the same corresponding variables, under the assumption that although there might be a correlation between the levels of the right-hand-side variables and the country-pair specific effect in equation (1), none exists between the differences of these variables and the country-pair specific effect.

The additional moment conditions for the regression in levels are:

$$E[y_{ij,t-s} - y_{ij,t-s-1}) \cdot (\eta_{ij} + \varepsilon_{ij,t})] = 0 \text{ for } s = 1 \tag{5}$$

$$E[X_{ij,t-s} - X_{ij,t-s-1}) \cdot (\eta_{ij} + \varepsilon_{ij,t})] = 0 \text{ for } s = 1. \tag{6}$$

The consistency of the GMM estimator depends on whether lagged values of the explanatory variables are valid instruments in the regression. To address this issue, we consider two specification tests: the first is the Hansen test of over-identifying restrictions, which tests the overall validity of the instruments. Failure to reject the null hypothesis supports the model. The second test examines the hypothesis that the error term is not serially correlated. We test whether the differenced error term—that is, the residual of the regression in differences—is second-order serially correlated.[7] If the test fails to reject the null hypothesis of absent second-order serial correlation, we conclude that the original error term is serially uncorrelated and use the corresponding moment conditions.

3.2. Measurement and Results

3.2.1. The Evidence from Total Foreign Bank Claims

Our baseline general econometric model lays out the possible determinants of international bank claims represented by the following dynamic panel equation:

$$\begin{aligned}\Delta \log Claims_{ij,t} = \alpha_0 + \alpha_1 \Delta \log Claims_{ij,t-1} + \beta_1 \text{int}\, diff_{ij,t} + \beta_2 VIX_t + \beta_3 Clender_{ij,t} + \\ \beta_4 growthrate_{j,t} + \beta_5 growthrate_{i,t} + growth_{i,t} \times \exp osure_{ij,t} + \upsilon_{ij,t},\end{aligned} \tag{7}$$

[7] Second-order serial correlation of the differenced residual indicates that the original error term is serially correlated and follows a moving-average process at least of order one.

where *i* and *j* represent country pairs *i* and *j*, and *i* = 1 to 3 denotes the major BIS-reporting home-country banks of Japan, the United Kingdom and the United States, while, *j* = 1 to 6 denotes the East Asian host countries of Indonesia, Korea, Malaysia, the Philippines, Singapore and Thailand. The dependent variable in this section of the paper, $\Delta\log Claims_{ij,t}$, is the logarithmic differences of total foreign bank claims[8] from banks in the home country *i* to host countries *j*; $\Delta\log Claims_{ij,t-1}$ is the lagged of the dependent variable. In equation 7, we assume that $\nu_{ij,t}$ contains the following two effects: i) the unobserved time-invariant country-pair specific effect, $\eta_{ij,}$; and ii) a stochastic error term, $\varepsilon_{ij,t}$, varying across time and cross-section.

We follow the voluminous literature on the fundamental determinants of capital flows by accounting in our empirical model for the home or push and host or pull factors that figure prominently in this extensive literature. On this basis, we include the nominal interest differential between host country *j* and home country *i* ($intdiff_{ij,t}$) as well as the respective real GDP growth of host country *j* ($growthrate_{j,t}$) and home country *i* ($growthrate_{i,t}$). We expect a positive coefficient on the $intdiff_{ij,t}$ variable as higher interest rates in the host country or, conversely, lower interest rates in the home countries, *ceteris paribus*, should lead to an increase in international bank flows in the host economies. We also expect a positive coefficient on the real GDP growth of host countries as higher returns in these countries should then lead to a rise in international bank flows in these countries. There is, however, ambiguity as to the expected sign of the real GDP growth in home countries as, on one hand, recessionary economic conditions in home countries entail lower profit opportunities at home, which should then encourage foreign banks to seek better or higher returns abroad in which case we expect a negative coefficient on the $growthrate_{i,t}$ variable. On the other hand, weak economic conditions in the home countries might signal a worsening of the capital position of foreign banks, which should then discourage, or worsen, retrenching their lending overseas.

Apart from considering the impact of traditional push and pull factors on international bank claims, we also take into account a measure of the state of the global

[8] Total foreign bank claims are the sum of international claims and local claims in local currency, while international claims comprise cross-border claims in all currencies and local claims in foreign currencies.

financial market, the S&P 100 Volatility Index (VIX_t) of the Chicago Board Options Exchange, which is widely used as an indicator of expected short-term volatility of the global financial market. A high value of the VIX indicates more volatile market expectations and as such we expect a negative coefficient on the VIX variable as greater global volatility should lead to a reduction in international bank flows to host economies (Hermann and Mihaljek, 2010).[9] In line with the well-cited study of van Rijckeghem and Weder (2003), we also include in our empirical model a measure of the potential contagion or spill-over of changes in international bank flows from one country to another, which is denoted by the $Clender_{ij,t}$ variable. More popularly known as the common lender effect, this argues that movements in international banks' claims on one country might be transmitted to other countries that owe claims from the same international banks (Peria et al., 2005). We follow Peria et al. (2005) in accounting for this effect and thus operationalize $Clender_{ij,t}$ as the changes in claims from home-country *i* banks to all major East Asian host countries other than that of the individual East Asian host country *j*.[10,11] We should then expect that if the common lender effect works, the coefficient on $Clender_{ij,t}$ would be positive and significant.

Turning finally to our main variable of interest—that is, in order to test the impact of the financial crisis on the stability of international bank lending to our respective host economies—we interact our home countries' real GDP growth rate variable, $growthrate_{i,t}$, with a measure of foreign banks' exposure to our individual host countries, noting that we measure foreign bank exposure as the ratio of home country *i*'s international bank claims on host country *j* to the total worldwide claims of home country *i*'s banks.[12] Since crises coincide with deterioration in macroeconomic fundamentals such as real GDP growth rates—as happened in developed markets during

[9] It is also based on this expected relation that the VIX is construed as a factor that measures the global supply of international bank lending. Higher volatility corresponding with a high value of the VIX makes it more difficult for banks to raise additional capital (Takats, 2010).

[10] As pointed out by Peria et al. (2005), in an ideal sense, the common lender effect can be equated with a portfolio allocation choice wherein changes in values of claims trigger an adjustment in other assets or claims. The limitation of working, then, with aggregated country-level data on international bank claims is that they obscure this portfolio allocation decision at the individual bank level.

[11] These major East Asian host countries are: China, Indonesia, Korea, Malaysia, the Philippines, Singapore and Thailand.

[12] This measure of foreign bank exposure is similar to that in Peria et al. (2005), however, based on some unique reason pertaining to the Latin American context, they measured the numerator as home country *i*'s international bank claims on the *private sector* of host country *j*. In this paper, we do not make that distinction between private and non-private sectors.

the recent GFC—this interaction variable recognizes the idea that crises are basically indistinguishable from downturns in GDP. In this view, this allows us to test—depending on the sign and significance of the interaction term—the impact of foreign bank exposure on how they react to a shock originating in their own economy. *A priori*, if higher exposure translates into stable international bank lending, we should expect the interaction between home-country foreign banks' real GDP growth rate and its exposure to be positive.

The estimation results of three alternative specifications of the dynamic panel model for the whole sample period of 2000Q1 to 2010Q3 are summarized in Table 3. Altogether, with the exception of the nominal interest rate differential variable (which came out only significant but has the incorrect sign in specification [1]), all of the estimated coefficients are significant and for those variables that have clear *a-priori* signs they came out with their expected signs. Several key findings are worth highlighting. To start, we find evidence that international bank flows increase (decrease) their claims on host markets once these same economies experience stronger (adverse) macroeconomic growth performance. This result confirms the presence of a 'demand factor' influencing the flows of these claims. All these Asian economies experienced slower growth, particularly during the peak of the recent GFC, translating into weaker demand for funding from the international banks.

Table 3. Dynamic Panel Estimation Results of Determinants of Changes in International Total Bank Claims, 2000Q1 – 2010Q3

Variables	(1)	(2)	(3)
$logdiffclaims_{t-1}$	–0.060 (0.081)	–0.097 (0.077)	–0.092 (0.072)
intdiff	–0.403 (0.175)**	–0.284 (0.165)	–0.245 (0.168)
$Growthrate_J$	0.333 (0.113)***	0.222 (0.108)**	0.233 (0.101)**
$growthrate_i$	0.145 (0.116)	–0.709 (0.229)***	–0.717 (0.218)***
vix		–0.215 (0.062)***	–0.155 (0.068)**
Clender			0.231 (0.045)***
$growthrate_i$ * exposure		0.536 (0.168)***	0.573 (0.162)***
Sargan test (p-value)	0.08	0.09	0.10
AB test for AR(2) (p-value)	0.20	0.38	0.43
No. of instruments	762	764	765
No. of lags	2	2	2

Note: Standard errors in parentheses. Significance levels: *** 1%; ** 5%. Numbers in the last two rows of the table are *p*-values.

Similarly, we find a number of 'supply-side factors' have also come into play here. First, the negative and significant coefficient (though insignificant and positive only in specification [1]) on the home countries' real GDP growth rate indicates that foreign banks' behavior veers towards seeking better or higher returns abroad when domestic economic conditions are weak and fragile. The results confirm that a weaker economic outlook in the home country translates into a rise in the foreign banks' claims on the host economy.

Second, we also find evidence in support of the common lender effect in view of the positive and significant coefficient on changes in international bank claims in other countries. This seems to support the argument for the presence of a contagion effect in international banking. In particular, it demonstrates that changes in foreign bank claims on one country might spill over to other countries that hold claims from the same banks (van Rijckeghem and Weder, 2003). Third, consistent with theoretical expectations, a rise in the expected short-term volatility of the global financial market, as proxied by the widely used S&P 100 Volatility Index (VIX_t) of the Chicago Board Options Exchange, has indeed adversely contributed to the overall sharp decline in the total claims of the foreign banks. The overall robustness of the supply-side factors substantiates the role of the international bank claims as a key transmission channel of the impacts of a distressed banking sector in the advanced economies into the emerging markets of Asia.

Finally, the positive and significant coefficient on the main variable of interest, the interaction between home-country foreign banks' real GDP growth rate and its exposure suggest that controlling for macroeconomic conditions in developed economies, crisis episodes or shocks that originate in developed economies do not necessarily translate into less stable financing in international bank claims to host countries in Asia. This is in contrast, however, with the earlier preliminary examination of the flows in international bank claims wherein we observed a sharp and sudden reversal during the GFC. Perhaps one reason for this seemingly conflicting result is that the foreign bank claims data used in this section are not 'pure' cross-border claims data. This is in view of the fact that the foreign bank claims data as consolidated by the BIS do not just comprise the cross-border claims but also the local claims of the foreign banks' offices on residents of the country in which the foreign bank is located. Thus, it is highly likely that the local claims component in the data might be mitigating this effect since this

particular component of the foreign banks' claims held up well during the GFC. To alleviate this concern, we also conduct our estimations using publicly available data on cross-border claims and the results are then discussed in the subsequent section.

3.2.2. The Evidence from Cross-Border Claims

We should emphasize at the outset that bilateral data on cross-border claims similar to those we used in the previous section are not publicly available.[13] What are publicly available are the aggregate cross-border claims of all the BIS-reporting home-country banks to non-BIS reporting countries, including the Asian economies examined here. In short, unlike what was done in the previous section, here, investigation of the respective bilateral claims of the three major home-country banks of Japan, the United Kingdom and the United States is not permitted.[14] Barring this limitation, we again estimated our baseline empirical dynamic panel model (equation 7), and the results of these respective sets of dynamic panel estimations are presented in Table 4.

Table 4. Dynamic Panel Estimation Results of Determinants of Changes in Cross-Border Bank Claims, 2000Q1 – 2010Q3

Variables	(1)	(2)	(3)
$logdiffclaims_{t-1}$	–0.020 (0.064)	–0.095 (0.077)	–0.120 (0.061)
$Growthrate_J$	0.475 (0.121)***	0.762 (0.188)***	0.239 (0.155)
$growthrate_i$	–0.089 (0.195)	0.002 (0.171)	0.015 (0.167)
vix		–0.137 (0.033)***	–0.073 (0.021)**
Clender			0.574 (0.163)***
$growthrate_i$ * exposure		–1.170 (0.432)***	–0.575 (0.294)**
Sargan test (p-value)	0.18	0.26	0.59
AB test for AR(2) (p-value)	0.53	0.35	0.29
No. of instruments	294	294	294
No. of lags	2	2	2

Note: Standard errors in parentheses. Significance levels: *** 1%; ** 5%. Numbers in the last two rows of the table are *p*-values.

Three critical observations stand out from the results. First, only one demand-side factor is robustly significant and comes out consistently with the expected sign and this

[13] Added to this is the difficulty that the BIS does not disaggregate or separately report from the international claims consolidated data the 'pure' cross-border claims from that of the local claims in foreign currency.

[14] This then implies that the subscript *i* in equation (7), presented in the earlier section, is now denoted by all the BIS-reporting banks to the individual Asian host countries.

is the case of the real GDP growth of host country *j* ($growthrate_{j,t}$).[15] This affirms our earlier results that international bank claims, in general, and cross-border claims, in particular, are inherently pro-cyclical—that is, these claims tend to rise during economic booms in host countries but tend to quickly and sharply reverse during periods of economic distress. Second, we confirm the presence of a contagion effect (common lender effect) as well as the negative role of the expected short-term volatility of the global financial market as proxied by the S&P 100 Volatility index to global credit supply. Finally, and more importantly, the negative and significant coefficient in the interaction between the BIS-reporting home countries' real GDP growth rates and their exposure to the Asian host countries suggests that crisis episodes or shocks emanating from these developed economies lead to a further decline in cross-border claims. This is in marked contrast with the results reported in the previous section. This finding confirms the previous trend analyses that cross-border lending has particularly been the channel of transmission of adverse shock to these Asian economies during the financial crisis. Furthermore, this is also very much suggestive of the role of the local lending or claims of foreign banks' offices in the respective countries examined here in resisting or mitigating the adverse consequences of external shocks.

4. Policy Challenges Going Forward

The era of great moderation (low inflation) across the globe has been found to be gravely inadequate to safeguard much-needed stability in the financial sector. Even during the period of sound macroeconomic conditions, the financial system was subject to various self-amplifying mechanisms in upward trends (bubbles), downward trends (busts) and phases of the credit cycle. There has been growing awareness and

[15] The interest rate differential variable was dropped altogether from the estimation as it was highly correlated with most of the variables and came out insignificant in all regressions. The real GDP growth of home country *i* also turned out to be consistently insignificant and this could be caused by the way we generate these data wherein since the left-hand-side cross-border claims are the aggregate positions of all the BIS-reporting home-country banks to individual Asian economies, we deem it appropriate to take a weighted average of the GDP values of all the BIS-reporting home-country banks with the weights being the share of the respective BIS-reporting home-country bank to the total GDP of all BIS-reporting home-country banks.

acceptance of the role of the central banks as a financial stability authority, in addition to a monetary authority.

New responsibility will come with new challenges. In this study, we highlight the role of lending activities of international banks, particularly cross-border lending, as a potential source of financial instability. Going forward, a number of policy responses to manage potential risks associated with international bank lending have been tabled and debated. The following sub-sections will elaborate some of them.

4.1. Cross-Border Supervision

For the most part, the role of the central bank/monetary authority in managing the banking system has largely been unchallenged. Across the world—particularly in emerging markets—central banks play an important role as the lender of last resort, which has been well established and agreed to. In contrast, the supervisory role of the central bank continues to be viewed differently and debated. The 1997 East Asian Crisis sparked an urgency to detach the supervisory role from the central bank/monetary authority. As discussed, the principal argument for the separation of the supervisory role from the central bank is to enhance the effectiveness of the central bank's responsibility as the monetary authority. The recent GFC, on the other hand, demonstrated the need for the central bank to play a greater part in the supervision of financial institutions.

Cross-border banking with the presence of multinational banks (including the newly emerging regional multinational banks) enhances the 'interconnectedness' factor. It is now a well-known fact that globalized banks play a crucial role in the international transmission of monetary policies and economic shocks globally. In the first instance, the lack of cross-border supervisory cooperation has resulted in asymmetrical information on cross-border risk exposures, leading to an under-appreciation by supervisors and regulators of underlying systemic risks and connections (Kodres and Narain, 2009). In addition, it is rather obvious that the existence of asymmetrical information among supervisors in different jurisdictions leads to untimely and uncoordinated responses (Nijathaworn, 2010). Furthermore, adequate cross-country supervisory cooperation and coordination are necessary to overcome loopholes such as

currency substitution, or switching from domestic lending in foreign currency to direct foreign credit.

One potentially effective method to facilitate cross-border policy cooperation and coordination is through a college of supervisors.[16] The college of supervisors is defined as a "permanent, although flexible, structure for cooperation and coordination among the authorities of different jurisdictions responsible for and involved in the supervision of the different components of cross-border banking groups, specifically large group[s]" (CEBS, 2009). As a general rule, the establishment of a supervisory college should be considered for significant financial institutions in terms of size, interconnectedness with other components of the financial system and/or the roles they play in the market, which might cause systemic impacts on the country's financial system, hence affecting the region's financial stability.

A recent survey has identified a number of regional and global banks that have a strong presence in major Asian economies (Siregar and Lim, 2010). The Hong Kong Shanghai Banking Corporation (HSBC), Citibank and the Standard Chartered Bank are among the three major international banks that have wide and extensive branch networks in the Asian region (Table 5). In addition to these three international powerhouses, the Southeast Asian region has also witnessed the emergence of its own multinational banks. In Malaysia, banks such as the Malayan Banking Berhad (Maybank), Commerce International Merchant Bankers Berhad (CIMB) and Rashid Hussain Berhad (RHB) have expanded their networks beyond Southeast Asian countries. A number of Singaporean banks—namely, the Development Bank of Singapore (DBS), the United Overseas Bank (UOB), and the Overseas Chinese Bank Corporation (OCBC)—have achieved similar success in their efforts to become regional banks.

[16] As of September 2009, there are more than 30 colleges to supervise complex institutions.

Table 5. Cross-Border Banks in SEACEN Economies

Countries	Top 3 domestic FIs in your jurisdiction that have significant presence in the region	Top 3 foreign FIs in your jurisdiction that originate from SEACEN member economies	Top 3 other foreign FIs (apart from originating in SEACEN member economies) that have significant presence in your country
Indonesia	- Bank Mandiri - Bank BRI - BCA	- CIMB Niaga (Malaysia) - Bank International Indonesia (Maybank Malaysia controls about 43%)	- Citibank - HSBC - Standard Chartered Bank
Korea	- None	- DBS (Singapore) - UOB (Singapore) - OCBC (Singapore)	- Citibank - HSBC - Standard Chartered Bank
Malaysia	- Maybank - CIMB Group - Public Bank	- OCBC (Singapore) - UOB (Singapore) - Bangkok Bank (Thailand)	- Citibank - HSBC - Standard Chartered Bank
The Philippines	- Metropolitan Bank Corporation (Metrobank) - Philippine National Bank (PNB)	- Chinatrust (Taiwan) - Maybank (Malaysia) - Korea Exchange Bank (Korea)	- Citibank - HSBC - Standard Chartered Bank
Singapore	- DBS Bank Limited - OCBC - UOB	- Maybank (Malaysia) - Bangkok Bank (Thailand) - RHB Bank (Malaysia)	- Citibank - HSBC - Standard Chartered Bank
Chinese Taipei	- Bank of Taiwan - Taiwan Cooperative Bank - Mega International Commercial Bank	- DBS (Singapore) - OCBC (Singapore) - Bangkok Bank (Thailand)	- Citibank - HSBC - Standard Chartered Bank
Thailand	- Bangkok Bank - Kasikorn Bank - Siam Commercial Bank	- UOB (Singapore) - CIMB Thai (Malaysia) - OCBC (Singapore)	- GE Capital - ING - Standard Chartered

Source: Siregar and Lim (2010).

As of May 2010, a number of major central banks in Asia have been invited to participate in colleges of supervisors. Bank Negara Malaysia, for instance, is involved in the colleges of supervisors organized by the Financial Stability Agency of the United Kingdom for the Standard Chartered Group, the BaFIN for the Deutsche Bank Group and the OFSI for the Bank of Nova Scotia Group. Similarly, the Monetary Authority of Singapore (MAS) and Bangko Sentral ng Pilipinas have also participated in a number of colleges of supervisors set up for major European and US banks. In addition, under the

foreign banking laws of a number of Southeast and East Asian economies, one of the conditions for a foreign bank to establish its subsidiary domestically is that the home supervisor of that particular foreign bank must sign a memorandum-of-understanding (MOU) with the host central banks. This MOU facilitates bilateral exchanges of data and information between the two bank supervisors. As of late 2010, however, there has not been any arrangement for supervisory colleges for Asian regional multinational banks such as Malaysian and Singaporean banks discussed earlier.

4.2. Reducing the Complexity of Large Cross-Border Banks through 'Subsidiarization'

An important cross-border banking issue is the relationship between the home and host supervisory agencies and central banks. In the event that a foreign bank that is systemically important in a host country finds itself in a crisis, this could lead to potential conflicts between the home and host-country authorities. These conflicts could be particularly significant if the relative size of the parent bank and its overseas affiliate is substantially different, or if the economic importance of the overseas affiliate to the parent bank is mainly marginal—for example, funding of the overseas affiliate is sourced mainly from local deposits. For instance, home-country authorities will not be keen on supporting a small overseas affiliate, or the overseas affiliate will receive less attention from the parent bank or home supervisor, if the impact of such a failure of the overseas affiliate is relatively low or immaterial to the financial group's overall position, even if the troubled overseas affiliate is relatively systemically important for the host country. On the other hand, host-country authorities could find it politically difficult to use public or taxpayer resources to support a foreign-owned bank when it gets into trouble.

One of the answers to the challenge of a systemically important foreign bank failing in a host country is to ensure local incorporation as a subsidiary rather than as a branch. All else being equal, local incorporation gives host authorities greater supervisory control over local operations such as by making it more difficult for assets to be removed from local operation to the parent bank—that is, ring-fenced. Furthermore, it enables the possible imposition of specific capital-related prudential requirements that

can provide some separation between the subsidiary and the parent bank, thus reducing intra-group contagion risk (Mihaljek, 2008).

4.3. Other Policy Considerations

4.3.1. Increasing Capital Levels and Buffers

Introduced as part of the new capital standard under Basel III, 'ample' or conservation buffers reflect the large perceived negative externality associated with the failure of a large cross-border bank and as such should be available to enable banks to maintain large enough capital levels to offset losses in times of adverse financial shocks. Counter-cyclical capital buffers, on the other hand, rest on the concept that banks should build up extra capital in times of excessive credit growth and as such banks can tap the buffer during periods of financial distress without having to raise new capital immediately. Implementing such types of capital buffers can improve the banking sector's resilience to financial crises as well as mitigate its impact on the entire economy.

4.3.2. Deposit Insurance Scheme

Deposit insurance coverage could be lowered for large cross-border banks. There is a perception that large cross-border banks pursue scale—for example, mergers and acquisitions—in order to become "too big to fail". In order to mitigate such an incentive, a spreading or sharing of the risk in the official financial safety net (a form of co-insurance) can be introduced by reducing the deposit insurance coverage for large cross-border banks. This will also reduce the scope for free riding on the part of large cross-border banks as far as the financial safety net mechanism of the banking sector is concerned.

4.3.3. Establishment of Cross-Border Collateral Arrangements

This involves the central bank in one jurisdiction providing domestic currency liquidity to eligible financial institutions against collateral placed by their offices in another jurisdiction into the liquidity-providing central bank's account at the local central bank. In essence, this is another way for central banks to provide a cross-border bridge to support funding requirements in another jurisdiction should interbank cross-

border intermediation become impaired (Committee on the Global Financial System–Bank for International Settlements, 2010).

4.3.4. A Systemic Risk Charge or a Systemic Risk Levy on "Too Big to Fail" or "Systemically Important" Cross-Border Institutions

In essence, the bigger the financial institution, the higher is the likelihood that it will be rescued in times of financial distress. In other words, the cost of the financial rescue is directly related to the systemic relevance or size of the financial institution. One solution is a systemic risk charge that depends mainly on the size of the cross-border bank. This follows from the basic principle of the theory of externalities, which suggests that a polluter should be charged with a tax that is equivalent to the social costs of the pollution. We can then regard the systemic instability created by the cross-border bank's activities as an externality and a systemic risk charge could be regarded as a way to 'internalize' this problem of too big to fail.

One such suggested approach is for regulators to assign systemic risk ratings to a financial institution and then assess a capital or systemic risk surcharge based on this rating. Banks with higher systemic risk ratings would receive higher capital or risk surcharges. In short, the surcharge is based on the financial institution's corresponding contribution to systemic risk. In principle, under certain assumptions, a surcharge on capital is equivalent to a levy on capital in terms of stifling the incentive for large cross-border banks to engage in systemic risk activities. An important difference between the two is, however, that a levy removes the funds from the financial institutions' balance sheets, whereas a capital surcharge leaves the funds under the control of the financial institutions (Doluca et al., 2010).

In view of this difference, the advantage of the levy is that it can be used to fund a "systemic stability fund" that would act as a private safety net in the event of a financial crisis. The idea is that the accumulated levies can then be reinvested into "convertible" or liquid instruments by the systemic stability fund into the same financial institutions that paid these levies. These liquid instruments serve to fulfill the financial rescue role that in the event a large cross-border bank gets into trouble, these same instruments can be used by the supervisory authorities to "bail-in" the weakened cross-border bank without resorting to the use of public or taxpayer resources.

5. Concluding Remarks

The recent sub-prime crisis forced a rethink of the mandate of central banks in the area of financial stability. Prior to the latest financial crisis, the primary mandate for most central banks in Asia was monetary policy stability—in particular, price stability. Recent crises demonstrate that years of monetary stability during the period of great moderation did not safeguard economies from looming financial instabilities. It clearly illustrated as well that the globalized banking system played a crucial role in transmitting the crisis from the advanced economies to various corners of the world, including the emerging markets of East and Southeast Asia.

For policymakers, it is no longer adequate to view domestic banking systems in particular and financial systems in general from a domestic economy perspective. The increasing interconnectedness of domestic banking liquidity to the global funding environment enhances the links between domestic financial stability and external shocks. Our study examines the role of international bank claims—in particular, cross-border lending—as a critical channel of transmission of worldwide financial shocks to local economies. We focus on the crisis period to garner greater appreciation of the exposure of local financial systems to these external shocks. In addition, we look into a number of home-country indicators of economic fundamentals. The exposure and home-country fundamental variables have been found to be significant factors, and confirmed the role of international bank lending as a channel of shock transmission from home countries to host economies. Furthermore, the common lender effect—whereby movements in international banks' claims on one country can be transmitted to other countries that owe claims from the same international banks—underscores the spill-over effect that was evident as well during the 1997 financial crisis.

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Chapter 15

The Rise of Asian-Owned Foreign Banks and the Implications for Credit Stability in Asia

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This chapter focuses on foreign banks' local lending and its implication for credit stability in Asia. Employing a large and the most recent banking data set for 10 major Asian economies for 2000–09, this study provides fresh evidence that the country of origin of foreign banks explains variations in lending behavior. Asian-owned foreign banks showed the mildest change in credit growth during the recent Global Financial Crisis (GFC), contributing to credit stabilization in Asia in times of stress, whereas non-Asian foreign banks—particularly those from North America and Europe—cut off credit sharply from the Asian periphery, undermining credit stability in the region. Preliminary evidence suggests that the breakdown in the wholesale funding market in the GFC put pressure on non-Asian foreign banks, thus transmitting credit turbulence to Asia. The study calls for policies supporting regional financial integration with Asian-owned foreign banks, which help to build a robust and stable Asian banking system.

Keywords: foreign banks, international banking, credit stability, money market transmission, financial crises, Asia

JEL Classifications: F21, F36, G01, G21, G28

1. Introduction

There has been a surge of foreign bank entry to Asian countries since the Asian Financial Crisis (AFC) in 1997–98, which has important welfare effects. On one hand, foreign ownership has the potential to improve overall banking efficiency and modernize banking industries in Asia; on the other hand, foreign bank entry raises serious concerns about its implications for credit stability, especially during crisis periods.

A certain amount of empirical studies exist exploring the implications of foreign bank lending on domestic credit stability. Yet the evidence has been dominated by developed countries (for example, Peek and Rosengren, 2000) and Central Europe and Latin America (Dages et al., 2000; de Haas and van Lelyveld, 2005; Goldberg et al., 2002). There are few systematic analyses on this issue for Asian economies, probably due to the limited presence of foreign banks in Asia and lack of data until very recently. With the data becoming available, this study is a first attempt to examine the Asian evidence with a focus on foreign banks' lending behavior during the recent Global Financial Crisis (GFC). It employs a large banking data set compiled for 10 major Asian economies covering the period 2001–09.

Changes in credit growth are used to proxy and gauge credit stability. If foreign banks reduce credit supply sharply during economic downturns (that is, foreign banks' credit supply augments business-cycle effects), they cause a deterioration in credit stability. Similarly, if foreign banks show slow credit contraction during a depression (that is, they help alleviate business-cycle effects), they are considered to be contributing to credit stability in the host country.

An important finding from this study is a distinctive and stabilizing role played by Asian-owned FBs in Asian credit markets during the GFC. The evidence suggests that these banks' lending momentum remained strong in spite of the crisis, whereas their non-Asian counterparts—mainly of North American and European origin—and local banks reduced credit sharply and considerably, which had important implications for local credit stability. The former helped stabilize the credit line but the latter devastated credit conditions during the turbulence.

The evidence lends support for national and regional polices to promote regional financial integration with Asian-owned foreign banks. This implies adoption of long-term liberal polices to support the entry of Asian-owned FBs and their business expansion in the region. With proper supervision and regulation, these banks are expected to contribute to regional financial stability and dynamism.

The remainder of the paper is structured as follows. The following section introduces the existing empirical literature and theoretical underpinnings, followed by a review of FBs in Asia, highlighting the role of Asian-owned FBs. Sections 4 and 5 explain the empirical framework and the data set. Section 6 presents the results, and the final section concludes with policy recommendations.

2. Literature Review

The existing literature reports mixed evidence of FBs' lending behavior during crises, which is distinguished by host and home-country crises and has varying implications for local credit stability. Dages et al. (2000) find that FBs showed stronger credit growth compared with domestic banks during host-country crises in Argentina, Mexico and Central and Eastern Europe in the 1990s; they claim this is because the parent bank has an international, diversified asset portfolio and can act as the 'lender of last resort'. Moreover, FBs view local economic problems as opportunities to expand their presence and business activities. On the other hand, Morgan and Strahan (2004) also produce tentative evidence of a positive link between FB presence and local economic volatility from a panel of 100 countries. Foreign banks might have destabilized credit supply and therefore local macroeconomic situations. They explain it as FBs having access to other markets and being better able to relocate or 'fly their capital' to other markets when the economic situation of a particular host country deteriorates.

Many studies suspect that during home-country crises, foreign credit can be destabilizing, because when economic conditions in the home country worsen, the parent bank is likely to downsize its business and foreign operations are likely to be

among the first to be cut off. Host countries can easily fall victim to sudden cut-offs of credit lines when economic conditions in the home country worsen—the so-called common lender effects (Masson, 1998). These 'common lender effects' were observed in the United States in the 1990s when Japanese bank subsidiaries responded to the banking crisis in Japan by reducing lending in the United States (Peek and Rosengren, 2000). There is, however, also evidence that FBs tended to increase their lending in Central and Eastern Europe when economic conditions in their home countries worsened. Worsening home-country conditions led banks to seek external lending opportunities.

The theoretical foundation of the relationship between FB lending and local credit stability is not yet fully established, but the work of Morgan and Strahan (2004) is one of the few substantial modeling attempts. One of their key findings is that types of shocks in the host country play an important role in identifying the direction of effects on credit stability. They show the intuition of the model in a simple but useful credit supply-and-demand diagram to explain the inner mechanisms of the above empirical cases (Appendix B).

Although this theoretical framework applies to international banking in general, including FBs' cross-border lending and local lending, it is important to recognize their different nature and implications for stability. Cross-border lending implies the case where foreign banks extend credit from overseas to local borrowers. In comparison with cross-border lending, local lending tends to be retail oriented and lending decisions are made locally with consideration of the local business situation and under host-country regulations. A closer connection with the host country's environment and business cycles makes local lending more likely to be affected by shocks from the host, whereas cross-border wholesale lending with decisions made overseas is inclined to reflect headquarters' conditions subject to home-country influence (Herrero and Simon, 2006).

The origin of FBs and its relation to local credit stability is mentioned only briefly in the literature. Clarke et al. (2001) suggest that diversity in foreign ownership matters for stability and that too much exposure to banks from any single country can increase instability. For instance, Spain—in control of 30 major banks in Latin America with almost 10 percent of the Latin American banking sector—is a high-risk factor in the

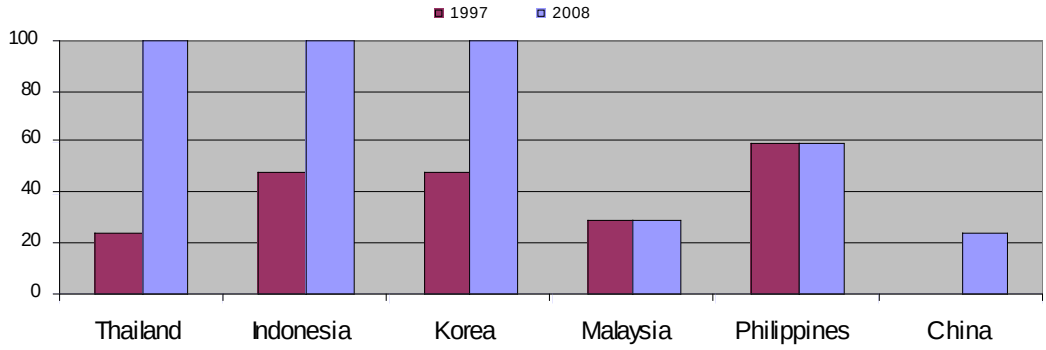
region, if Spain is subject to fluctuations. Hence, an increase in diversity reduces the risk of concentration and thereby improves stability. Nevertheless, there is no systematic analysis conducted beyond this conjecture.

Building on this existing literature, this study examines how FBs' local lending in Asia responded to the GFC and whether the increasingly diversified FB group helped reduce instability and smooth the turbulence in the credit market. The next section reviews foreign bank presence in Asia and the rising number of Asian-owned FBs.

3. Foreign Banks in Asia

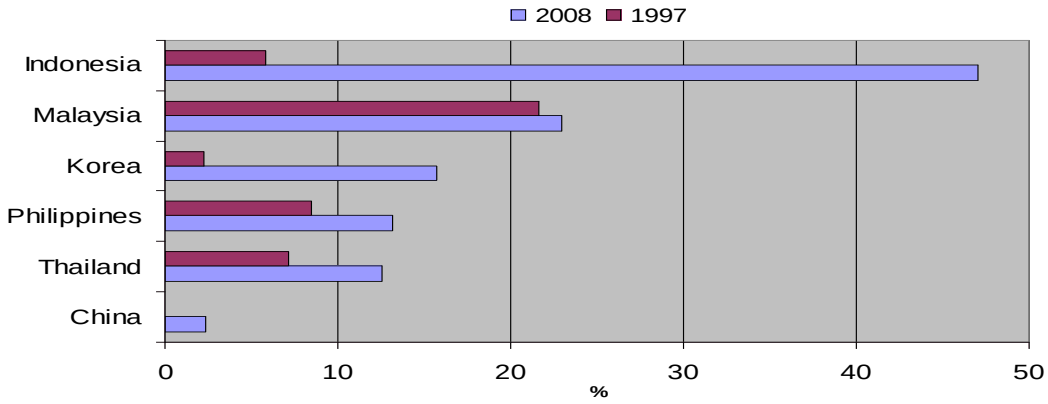
Foreign banks in Asia show distinctive features compared with other regions. First, despite the gradual rise of FBs after the AFC, their presence remains at a moderate level in the majority of Asian countries. Second, Asian and non-Asian FBs differ significantly in their lending behavior. Though non-Asian FBs account for a significant share of foreign bank presence in Asia, Asian-owned FBs start to play an increasingly important role in Asian lending markets specifically during the GFC.

Figure 1. Upper Limits on Foreign Ownership of Banks: 1997 and 2008



Source: Gopalan and Rajan (2009).

Figure 2. Increase in Asset Shares of Foreign Banks: 1997 and 2008



Source: Gopalan and Rajan (2009).

As in Latin America, in Asia, foreign bank entry has been most important in the aftermath of financial crises. Asia was one of the most closed financial systems in the world. Heavy banking regulations and closed banking sectors are often cited as the main factors hampering banking development in Asia. Since the 1997–98 AFC, there has been a notable trend of financial sector deregulation in Asia and the easing of entry barriers has been one of the most prominent. For instance, Thailand, Indonesia and Korea all removed ceilings on foreign ownership of domestic banks. China, which has one of the most prohibitive banking sectors in the world, opened itself to investment from overseas financial institutions in 2001 (see Figure 1).

An increasing number of foreign banks have since entered the newly liberalized Asian financial markets and shares of foreign banking assets have grown substantially over the past decade, from 5.8 to 47 percent in Indonesia, from 2.2 to 15.7 percent in Korea, and from 7.1 to 12.6 percent in Thailand (see Figure 2). Nevertheless, the average share of foreign bank assets in total banking assets in Asia remains about half that of Latin America (see Figure A3 in Appendix A).

3.1. Asian-Owned Foreign Banks

Asian-owned FBs have an increasing presence in Asia. A glance at the sample data compiled from the Bankscope that covers roughly 90 percent of the total banking assets in each country indicates that Asian-owned FBs have outnumbered their non-Asian

counterparts. Although they remain small in terms of assets and loans in some Asian economies, such as Hong Kong, the gap is no longer unbridgeable elsewhere. After years of engaging in Asian financial markets, banks from Japan, Singapore and Hong Kong have grown into internationally competitive players. Along with, most recently, China, they have been active participants in regional financial markets owing to the strong liability side of their balance sheets. More importantly, in the long term, these Asian banks have a competitive advantage in dealing with the institutional environment in their Asian neighbors. Regional economic integration, common language and proximity are just a few among the positive factors that predict the sustainable rising presence of Asian-owned FBs in Asia (Van Horen, 2007).

Table 1. Comparing Asian-Owned and Non-Asian FBs: Number, size and loans

	Number		Average assets		Average loans	
	Asian-owned	Non-Asian	Asian-owned	Non-Asian	Asian-owned	Non-Asian
China	16	10	30.26	55.36	20.65	23.55
Hong Kong	15	12	126.01	528.15	57.58	195.81
Indonesia	19	12	25.70	5.72	12.05	2.92
Malaysia	5	8	39.44	43.16	24.48	21.07
Philippines	4	3	3.05	3.07	1.57	0.52
Thailand	4	2	26.59	43.07	18.06	20.15

The active engagement of Asian banks in the regional banking system enhances the diversity of foreign ownership in Asia. Diversified foreign ownership increases stability (Clarke et al., 2001). Figure 3 reveals Asian FBs' other important feature. Although the shares of total numbers and assets in Asia dropped from 2008—with the onset of the GFC, as in Latin America—the share of total loans rose considerably in Asia, in sharp contrast with Latin America. A disaggregation of foreign banks into Asian-owned and non-Asian FBs in the sample shows that through the GFC both groups' loan extensions slowed, but in almost all Asian economies that have Asian-owned FBs the reduction in bank credit was sharper and faster in non-Asian than in Asian FBs. The preliminary evidence suggests that unlike their local and non-Asian FB counterparts, Asian FBs maintained a stable credit supply and helped stabilize the credit market during the crisis (Table 2).

Table 2. Comparing Asian-owned and non-Asian FBs' credit growth: pre-GFC and during the GFC

	Credit growth pre-GFC		Credit growth during the GFC		Change in credit growth:	
	Non-Asian	Asian-owned	Non-Asian	Asian-owned	Non-Asian	Asian-owned
China	0.26	0.19	0.03	0.10	–0.23	–0.09
Hong Kong	0.02	0.13	–0.13	0.07	–0.15	–0.06
Indonesia	0.10	0.15	–0.21	0.15	–0.31	0.00
Malaysia	0.01	0.14	–0.11	0.11	–0.12	–0.03
Philippines	0.23	–0.11	0.77	0.07	0.54	0.18
Thailand	0.19	0.15	0.01	0.00	–0.18	–0.15

4. Empirical Framework

A formal statistical analysis is employed to examine the relationship between foreign banks' local lending and credit stability. The empirical models are constructed as follows. Model 1 is a baseline model: a structure form credit growth equation. Model 2 adds interaction terms of the foreign bank dummy with all the other terms to examine whether foreign banks show different lending behavior to domestic banks and specifically whether they behaved differently during the GFC. In Model 3, foreign banks are disaggregated into Asian-owned FBs and non-Asian FBs. With domestic banks as a benchmark, the model tests the main hypothesis of whether Asian-owned FBs responded to the GFC in a manner that helped stabilize local credit markets.

Model 1

$$rcg_{ijt} = \alpha + bank_{ijt-1}'\beta + Mac_{jt}'\gamma + \delta FB_{ijt} + \theta GFC_t + u_i + u_t + \varepsilon_{jit}$$

Model 2

$$rcg_{ijt} = \tilde{\alpha} + bank_{ijt-1}'\tilde{\beta} + Mac_{jt}'\tilde{\gamma} + \tilde{\theta} GFC_t + FB_{ijt}(\tilde{\delta} + bank_{ijt-1}'\tilde{\lambda} + Mac_{jt}'\tilde{\phi} + \tilde{\eta} GFC_t) + \tilde{u}_i + \tilde{u}_t + \tilde{\varepsilon}_{jit}$$

Model 3

$$rcg_{ijt} = \hat{\alpha} + bank_{ijt-1}'\hat{\beta} + Mac_{jt}'\hat{\gamma} + \hat{\theta}GFC_t + aFB_{ijt}(\hat{\delta}^a + bank_{ijt-1}'\hat{\lambda}^a + Mac_{jt}'\hat{\phi}^a + \hat{\eta}^a GFC_t)$$
$$+ wFB_{ijt}(\hat{\delta}^w + bank_{ijt-1}'\hat{\lambda}^w + Mac_{jt}'\hat{\phi}^w + \hat{\eta}^w GFC_t) + \hat{u}_i + \hat{u}_t + \hat{\varepsilon}_{jit}$$

$\ln rc_{ijt} - \ln rc_{ijt-1}$ is the real credit growth of bank i in country j at year t; rc^d_{ijt} is real credit, calculated as the total amount of net loans extended by the bank divided by the consumer price index (CPI) in country j at year *t.* Bank variables, $bank^d_{ijt-1}$, account for a vector of bank-specific characteristics that might influence banks' credit extension. They include equity to total assets as a measure of bank solvency, liquid assets to customer and short-term funding as a measure of liquidity, return to average assets as a measure of profitability, and the logarithm of individual banks' real total assets as a measure of size, following de Haas and van Lelyveld (2005).[1] All bank variables are one-year lag to address possible endogeneity.

Foreign banks (FB_{ijt}) are identified as banks with foreign ownership holdings of no less than 50 percent. They are disaggregated into two key dummy variables—aFB_{ijt} and wFB_{ijt} respectively—to detect Asian and non-Asian FBs' varying lending behaviors.

Bank credit growth is linked closely to local business cycles and is often considered highly pro-cyclical (e.g., Bernanke and Gertler, 1989). Mac_{jt} are two macroeconomic variables that are commonly used in the literature to capture domestic business cycles.[2] One is the real GDP growth rate and the other is the inflation rate or CPI.

Another macroeconomic variable and also key variable of interest is GFC_t, a year dummy (2008 and 2009) to capture the influence of the GFC,[3] which caused a major

[1] In de Haas and van Lelyveld (2005), bank size is measured by the share of individuals' total banking assets in the total banking assets of the country in a year. Definitions of total banking assets of the country vary significantly, however, across 10 Asian countries, which results in large measurement errors from cross-country comparison. Hence, the logarithm of individuals' total banking assets is used instead.

[2] These two variables are also useful to control for individual countries' monetary policies, as these policies might affect the supply of loans from banks if banks are the main providers of funds for households or firms, which is the case in Asia (Bernanke and Gertler, 1989).

[3] The GFC is normally considered as beginning in July 2007, but was in full swing over the period 2008–09.

visible shock to Asian exports and consequently economic growth. Credit demand was depressed subsequently, which is suspected to have caused a substantial decline in credit growth.

The GFC might, however, have dissimilar impacts on Asian and Western financial systems. As the crisis originated in the US sub-prime mortgage market and spread largely into the European financial system, it put severe stress on Western banks' balance sheets and liquidity conditions, resulting in a sharp braking by these banks on credit supply both in their home markets and in foreign peripheries. Nevertheless, the impact of the GFC on the Asian financial system might be milder. Owing to a large and continuously rising deposit pool and less dependency on wholesale funding markets, Asian banks and specifically the liability side of Asian banks were less affected by the crisis. This forms the key hypothesis that Asian-owned FBs might have reacted less acutely to the GFC on credit extension. Two sets of interaction terms between aFB_{ijt} and wFB_{ijt}, and with other variables in the equation, are employed to put this hypothesis to the test. $\hat{\theta}$ and $\tilde{\theta}$ show specifically how Asian and non-Asian FBs responded differently to domestic banks and to each other to the GFC.

Model 4

$$rcg_{ijt} = \alpha + bank_{ijt-1}'\beta + \tau MMD_{ijt} + \xi G*MMD_{ijt} + Mac_{jt}'\gamma + \delta FB_{ijt} + \theta GFC_t + u_i + u_t + \varepsilon_{jit}$$

To further understand the role of the wholesale funding market in foreign bank lending in Asia and how it might have transmitted the credit turbulence from the West to Asia, the variable of money market dependence, MMD_{ijt}, is introduced into the model equation (Model 4). The variable is calculated as $-\log(1+customer\_deposits/total\_liabilites)$ to reduce the role of outliers following Raddatz (2010). A high value of MMD_{ijt} measures a high dependence on wholesale funds. The interaction term $G*MMD_{ijt}$ captures the transmission effect through the money market during the GFC.

Two-way fixed-effects panel models are adopted as a result of the Hausman test and within-group estimators are produced. The two-way error component disturbances are

u_i, denoting the unobservable individual bank effect, such as location and age, and u_t, the unobservable time effect to catch the macro-trend. ε_{ijt} is the remaining stochastic disturbance term.

5. Data

The data set employed in this study is an unbalanced panel of annual data of banks in 10 major Asian economies over the period 2000–09. Bank coverage varies across years as a result of frequent bank entry/exit as well as data availability,[4] with a maximum of 417 in 2007 and a minimum of 314 in 2002. There are, in total, 129 foreign banks covered. Major mergers and acquisitions are recorded. As merged and acquired banks often show changed lending behaviors, each acquired or merged bank is treated as a new bank to control for potential structural changes. The total number of observations is 2,774.

The main source for bank data is IBCA and Bureau van Dijk's Bankscope Database. This is a global database of banks' financial statements, which contains detailed and updated accounts for each bank in a universal format to compare banks globally. Data for all commercial banks in the 10 economies compiled in the database are extracted to construct a data set—possibly the largest in the empirical literature on Asian banking at the micro-level. The data set begins in 2001 when Asia started to show a marked increase in foreign bank presence following its region-wide regulatory reforms on foreign entry. Bankscope keeps archived data in its ownership database only from January 2003. The author extends the ownership data to 2001 based on other information sources such as bank annual reports and individual banks' history from their web sites. The ultimate owners of foreign banks are specified in the data set so the origin of foreign ownership either in Asia or non-Asian countries is distinguished.

Real GDP growth and CPI data are from the US Department of Agriculture (USDA) *International Macroeconomic Data Set*. It has consistent and comparable macro data across economies covering Taiwan and Hong Kong, whereas most of the conventional

[4] Numbers of banks covered in the data set for each year in each country are recorded in Table 1.

data sources such as the World Bank and the IFC do not. Table 3 presents a summary of variable definitions and data sources and Table 4 reports the summary statistics of variables.

Table 3. Variable Definitions and Data Sources

Variables	Definitions	Data sources
Dependent variable		
Real credit growth	Growth of real credit and real credit are the total amount of net loans divided by the consumer price index (CPI)	Net loans data from Bankscope and CPI data from US Department of Agriculture (USDA) *International Macroeconomic Data Set*
Independent variables		
Bank control variables		
Solvency	Equity to total assets	Bankscope
Liquidity	Liquid assets to customer and short-term funding	Bankscope
Profitability	Return on average assets	Bankscope
Size	Logarithm of bank real total assets	Bankscope
Foreign bank variables		
Foreign banks	Banks with foreign ownership holding no less than 50% = 1; otherwise = 0	Bankscope*
Asian-owned FBs	Foreign banks from Asian countries = 1; otherwise = 0	Bankscope
Non-Asian FBs	Foreign banks with Western countries (North America and Europe) = 1; otherwise = 0	Bankscope
Macroeconomic variables		
GDP growth	Annual growth rate of real GDP	USDA
Inflation	Percentage change in the CPI	USDA

* Bankscope keeps archived ownership data for 2003–09. The author extends the data to 2000 based on other information sources such as bank annual reports and individual banks' history from their web sites.

Table 4. Summary Statistics, Domestic Versus Foreign Banks, 2001–09

	Real credit growth		Equity ratio		Liquidity ratio		ROAA		Size	
	D	F	D	F	D	F	D	F	D	F
China	0.24	0.14	0.24	0.14	0.24	0.61	0.74	0.71	15.46	14.21
	(0.19)	(0.45)	(0.19)	(0.45)	(0.23)	(0.77)	(0.51)	(1.47)	(1.78)	(1.55)
Hong Kong	0.07	0.06	0.07	0.06	0.98	0.57	0.64	2.36	14.56	15.13
	(0.64)	(0.21)	(0.64)	(0.21)	(1.56)	(1.01)	(0.61)	(7.60)	(2.16)	(2.50)
Indonesia	0.15	0.12	0.15	0.12	0.45	0.46	1.08	2.26	13.54	13.40
	(0.26)	(0.35)	(0.26)	(0.35)	(0.34)	(0.45)	(4.79)	(2.30)	(1.64)	(1.56)
Japan	0.08	–0.11	0.08	–0.11	0.16	0.79	0.06	0.30	16.68	14.40
	(0.29)	(0.50)	(0.29)	(0.50)	(0.63)	(1.05)	(2.05)	(4.71)	(1.36)	(2.61)
Korea	0.13	0.03	0.13	0.03	0.09	0.39	0.78	1.02	16.88	16.90
	(0.21)	(0.49)	(0.21)	(0.49)	(0.04)	(0.79)	(1.48)	(0.81)	(1.63)	(2.19)

Table 4. ***(continued)***

	Real credit growth		Equity ratio		Liquidity ratio		ROAA		Size	
	D	F	D	F	D	F	D	F	D	F
Malaysia	0.07	0.04	0.07	0.04	0.32	0.57	1.04	1.34	15.88	14.41
	(0.18)	(0.30)	(0.18)	(0.30)	(0.19)	(0.39)	(0.93)	(0.81)	(1.29)	(1.42)
Philippines	0.13	0.15	0.13	0.15	0.27	1.17	1.02	4.11	14.08	12.38
	(0.27)	(0.52)	(0.27)	(0.52)	(0.14)	(1.80)	(1.41)	(24.05)	(1.86)	(0.99)
Singapore	0.19	0.18	0.19	0.18	0.34	0.98	1.38	2.09	15.70	13.77
	(0.76)	(0.18)	(0.76)	(0.18)	(0.26)	(1.48)	(1.63)	(2.42)	(2.30)	(1.82)
Taiwan	0.06	–0.05	0.06	–0.05	0.21	0.33	–0.05	–0.17	16.19	16.44
	(0.17)	(0.42)	(0.17)	(0.42)	(0.36)	(0.18)	(1.49)	(0.73)	(1.02)	(0.43)
Thailand	0.21	0.12	0.21	0.12	0.16	0.19	0.54	0.50	15.38	14.62
	(0.37)	(0.24)	(0.37)	(0.24)	(0.18)	(0.14)	(3.59)	(0.98)	(1.84)	(1.04)
Total	0.12	0.09	0.12	0.09	0.23	0.57	0.42	1.71	15.88	14.24
	(0.29)	(0.35)	(0.29)	(0.35)	(0.52)	(0.82)	(2.26)	(6.04)	(1.83)	(1.98)

Note:

1) The first-line numbers are means and the second-line in parentheses are standard deviations.
2) Real credit growth = $\ln rc_{ijt} - \ln rc_{ijt-1}$.
3) Equity ratio = equity/total assets.
4) Liquidity = liquid assets/customer and short-term funding.
5) ROAA = net return/average assets.
6) Size = ln(total real assets).

6. Results

The full sample covers 10 major economies in Asia, accounting for one-fifth of the world's total GDP. They by no means, however, form a homogenous group; rather, they are diversified by various measures: size of the economy, level of growth, social and economic institutions, etc. Japan, Singapore, Korea and Taiwan have developed and sophisticated banking systems in the region, so non-Asian FBs are dominant in those countries and Asian-owned FBs merely exist. They form one group without the presence of Asian-owned FBs. Among the group of Asian economies that hosts Asian-owned FBs, China is unique. The state has a strong role in its banking system. Its massive fiscal stimulus package created a lending boom during the GFC. Lending from domestic and especially state banks remained strong despite the GFC. Hence, three

samples are examined separately: China, five economies that host Asian-owned FBs, and four economies that do not.

6.1. China

The general insignificance of key variables is noteworthy from the Chinese sample (Table 5). The GFC seems to have passed the Chinese credit markets without leaving a significant mark. Note that domestic banks are set as the benchmark. Both Asian-owned FBs and non-Asian FBs compare with domestic banks. As expected, aggressive lending by Chinese local banks kept credit growth strong during the GFC, which reinforced confidence in the Chinese economy. Neither Asian nor non-Asian FBs showed significantly varying patterns in credit growth compared with their Chinese counterparts.

Table 5. The China sample
(Dependent variable: credit growth—growth in real credit)

	Model 1	**Model 2**	**Model 3**
FB	.	.	
	.	.	
GFC	0.118	0.090	0.125
	(0.329)	(0.474)	(0.200)
FB*GFC		–0.001	
		(0.998)	
aFB			4.320
			(0.217)
wFB			4.834
			(0.555)
aFB*GFC			–0.182
			(0.459)
wFB*GFC			–1.780
			(0.670)
N	478	478	478
R^2	0.173	0.264	0.323
F	14.429	76.362	.[5]
p	0.000	0.000	.

Note: 1) Results are compressed to key variables to save space.
2) Regressions are estimated using two-way fixed-effects methods.
3) Robust standard errors in parentheses. Significance levels: * 10%; ** 5%; *** 1%.

[5] There is not sufficient rank to perform the F test for Model 3 when using the cluster-robust estimators. Key results remain when cluster-robust estimators are not used.

6.2. Economies that Have Asian-Owned FBs

Among the five economies that host Asian-owned FBs, it is clear that the GFC had a significantly negative impact on credit growth (Table 6). Nevertheless, positive coefficients associated with *FB*GFC* and *aFB*GFC* suggest that the Asian-owned FBs helped alleviate the tension in the credit market and counter-balanced the negative effects from the GFC stress. This pattern was not shown, however, on the side of the non-Asian FBs.

This has an important implication for credit stability. A fast credit contraction exacerbates a volatile credit market in crises, amplifying instability, whereas a slower credit reduction is able to enhance stability. This evidence suggests that Asian-owned FBs constituted a major stabilizing force in the Asian credit market during the GFC.

Table 6. The Five Economies that Have Asian-Owned FBs
(Dependent variable: credit growth—growth in real credit)

	Model 1	**Model 2**	**Model 3**
FB	–0.037	0.295	
	(0.707)	(0.524)	
GFC	–0.103***	–0.145***	–0.136***
	(0.009)	(0.000)	(0.001)
FB*GFC		0.111*	
		(0.074)	
aFB			0.462
			(0.290)
wFB			0.038
			(0.968)
aFB*GFC			0.113**
			(0.028)
wFB*GFC			0.009
			(0.955)
N	901	901	901
$\boldsymbol{R^2}$	0.088	0.103	0.138
F	6.442	17.395	64.217
p	0.000	0.000	0.000

Note: Same as Table 5; the five economies are Hong Kong, Indonesia, Malaysia, the Philippines and Thailand.

6.3. Economies that Do Not Have Asian-Owned FBs

As a counter example, the results from the sample of the four economies that do not have Asian-owned FBs confirm the above discussion (Table 7). Foreign banks—all of them non-Asian—reduced credits faster than did domestic banks. They worsened credit conditions and deteriorated credit stability during the GFC.

Table 7. The Four Economies Without Asian-Owned FBs
(Dependent variable: credit growth—growth in real credit)

	Model 1	Model 2
FB	–0.042	1.683**
	(0.268)	(0.038)
GFC	–0.027	–0.002
	(0.202)	(0.909)
FB*GFC		–0.369**
		(0.030)
N	1,466	1,463
R^2	0.341	0.377
F	21.679	29.768
p	0.000	0.000

Note: Same as Table 5; the four economies are Japan, Singapore, Korea and Taiwan.

The theoretical framework reviewed is useful to analyze the results. Multiple forces seem to have been in play in response to the GFC. First, it is widely agreed that the recent global crisis influenced Asia mainly through the trade channel, which indirectly depressed the Asian credit market. Weak consumer demand in North America and Europe resulted in a severe drop in Asian exports to these markets. Low expected returns discouraged new investment and business expansion, which led to a significant fall in credit demand, resulting in an overall reduction in credit growth in Asia.

Foreign banks, however, were subject to two additional, different types of influence: non-Asian FBs were around the epicentre of the GFC and were largely exposed to liquidity shocks back home. They quickly withdrew capital and credit from subsidiaries around the world including Asia. Nonetheless, the reason this 'common lender' effect was not explicit compared with Latin America might lie in the presence of Asian FBs.

Few Asian FBs were experiencing a credit supply shock at home—quite the opposite: the benign liquidity situation at home served as 'lender of last resort'. In addition, the retreat of some of the non-Asian FBs might have generated new

opportunities for Asian FBs to enter the market and expand their market shares in their neighboring countries, which explains their strong lending momentum and the important role in stabilizing Asian credit markets in times of stress.

6.4. Money Market Transmission

Lastly, it is suspected that credit contraction in non-Asian FBs might be a transmission effect from the global money market, which nearly collapsed during the GFC. Asian FBs have, on average, a lower level of money market dependence compared with non-Asian FBs. Table 8 shows that a higher level of money market dependence seems to have relentlessly distressed credit conditions in non-Asian FBs during the GFC, although the money market funding facilitates credit extension for FBs in general in the pre-crisis period. Apparently, money market funding is pro-cyclical and highly unstable, constituting a key element of transmission of shocks and credit instability.

Table 8. Money Market Transmission of Credit Instability
(Dependent variable: credit growth—growth in real credit)

	Domestic banks		**Foreign banks**		**Asian-owned FBs**		**Non-Asian FBs**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MMD	0.212	0.206	0.719**	0.821***	0.907***	0.898***	0.046	0.274
	(0.246)	(0.249)	(0.023)	(0.007)	(0.000)	(0.000)	(0.946)	(0.649)
GFC	–0.017	0.036	–0.135**	–0.427**	–0.107***	–0.080	–0.202	–0.912**
	(0.519)	(0.758)	(0.037)	(0.038)	(0.015)	(0.647)	(0.283)	(0.015)
G*MMD		0.085		–0.554*		0.047		–1.502***
		(0.642)		(0.083)		(0.876)		(0.010)
N	2338	2338	487	487	274	274	208	208
R^2	0.152	0.153	0.125	0.136	0.199	0.199	0.059	0.125
F	14.506	13.100	19.573	19.884	13.615	12.211	1.510	8.451
p	0.000	0.000	0.000	0.000	0.000	0.000	0.173	0.000

Note: Same as Table 5; full sample.

7. Concluding Remarks

The study sets out to understand the impact of foreign bank lending on credit stability in Asia during the Global Financial Crisis. Employing a large and the most recent banking data set for 10 major Asian economies during 2001–09, the analysis provides evidence that Asian-owned FBs played a distinctive and stabilizing role during the recent GFC compared with their non-Asian counterparts and local banks in the host countries.

Non-Asian FBs exhibited the sharpest credit contraction in Asia during the crisis. Yet the destabilizing impact did not endanger local banking systems largely because of the presence and influence of Asian-owned FBs. Statistical evidence suggests that Asian-owned FBs showed the slowest credit reduction during the crisis, which helped counterbalance the contagion effect from the GFC and stabilize the credit markets in Asia.

Preliminary evidence also suggests that the contagion effect of non-Asian FBs might have transmitted through the money market. Non-Asian FBs have a relatively higher reliance on wholesale funding whereas Asian-owned FBs finance their lending mainly by customer deposits. The GFC had a devastating effect on the global money market, which depressed the main funding source of non-Asian FBs and caused them to cut off credit sharply. In contrast, Asian-owned FBs kept their lending momentum in spite of the crisis and took the opportunity to further expand their presence and influence in Asia.

These findings have important policy implications. In brief, the study suggests that FBs did not threaten credit stability in Asia during the GFC. The reason lies in the diversity of origin of foreign banks and specifically the important stabilizing role of Asian-owned FBs. Since the beginning of the financial deregulation after the AFC, there has always been concern about its implications for banking stability, which directly links to Asian policymakers' conservatism and uncertain policies towards foreign bank entry. This study lends support to opening up to foreign banks and especially opening up to Asian-owned FBs' participation in the local banking market, which not only benefits local banks in terms of the transfer of technology and healthy

competition that many studies have demonstrated, but also reduces the risk of instability shown by this new evidence.

It is important, however, to distinguish between opening up to foreign banks' local business and cross-border lending. One of the important lessons from the AFC is that too much reliance on footloose, short-term overseas borrowing and cross-border lending might provoke credit market volatility and a banking crisis. Foreign banks' local business is of a different nature. They establish local facilities and carry out banking business under local regulations, which is a much more stable and reliable source of funding.

Lastly, encouraging Asian-owned FBs to enter the market is not only favorable but also feasible. Many Asian countries have been favoring large international banks—most of which are non-Asian FBs—over regional banks due to the former's reputation and financial expertise and technology. After the GFC, however, North American and European banks are undergoing extensive restructuring. Their influence in the Asian financial market has started to decline. In contrast, Asian-owned FBs, specifically from Singapore, Japan and Hong Kong and most recently China, have been active participants in the regional financial market owing to the strong liability side of their balance sheets. They have been a rising force and have accumulated valuable experience and expertise in foreign banking in the region. With sufficient supervision arrangements, opening to those Asian-owned FBs is expected to invigorate Asian banking systems and foster financial development.

Nevertheless, a few cautions are in order. Although Asian-owned FBs showed slow credit reduction during the GFC, the impact of stabilization should not be overstated and might be visible only in sectors in which FBs were allowed to participate because their presence and areas of business are highly regulated and restricted in Asia. At the same time, non-Asian FBs' contagion effects were not fully captured, as the study did not take into account the effects of liquidation or the complete withdrawal from the Asian market. Those impacts on credit stability are much more severe than slower credit extension. Case studies of individual US, UK and European banks' changes in shareholdings in Asian markets during the crisis might help elucidate the situation. Lastly, slow credit contraction during economic downturns is counter to the business cycle and beneficial to credit stability. Rapid and over-rapid credit growth in normal

times are not, however, always favorable. It is legitimate to worry that over-rapid credit growth might be planting the seeds of a future crisis.

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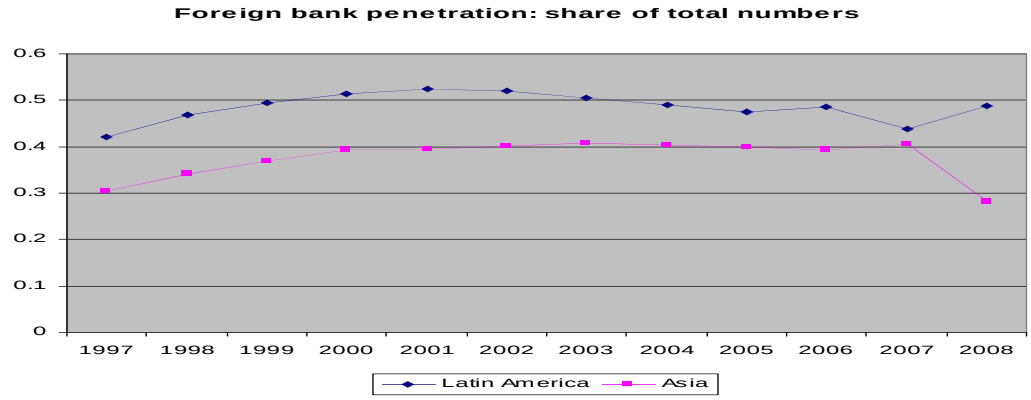
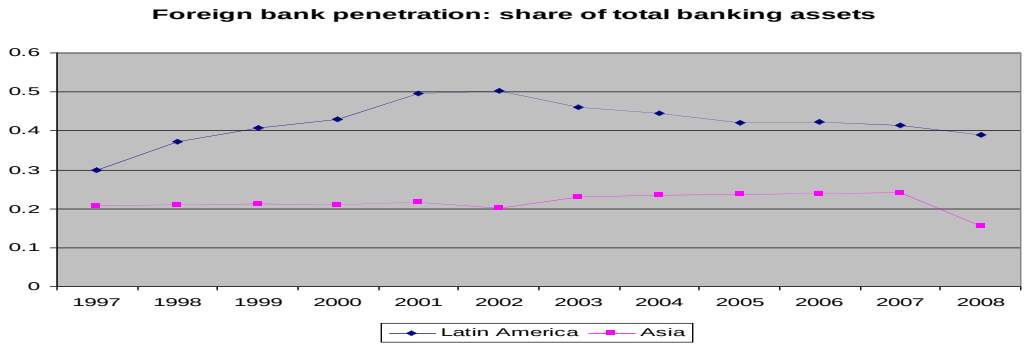
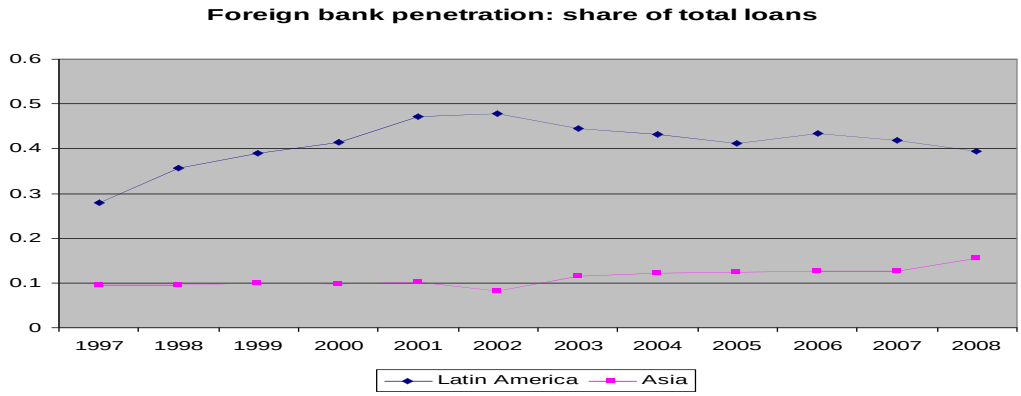
Appendix A

Figure A1. Trend of Foreign Bank Presence in Asia (1997–2008)







Source: Jeon et al. (2011).

Note: Latin America includes Argentina, Bolivia, Brazil, Chile, Colombia, Mexico, Paraguay, Mexico, Peru, Uruguay and Venezuela. Asia includes Hong Kong, Indonesia, Korea, Malaysia, the Philippines, Singapore and Thailand.

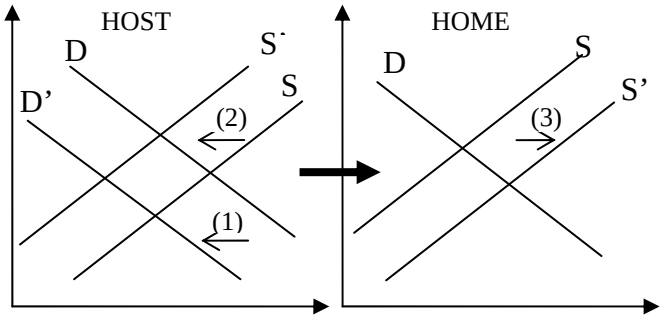
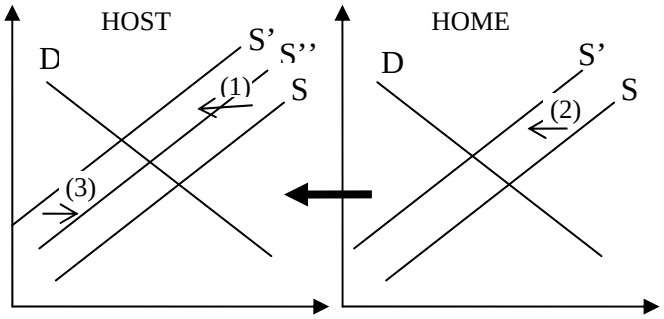
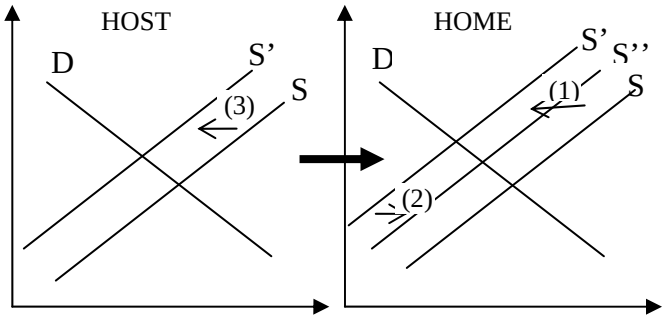
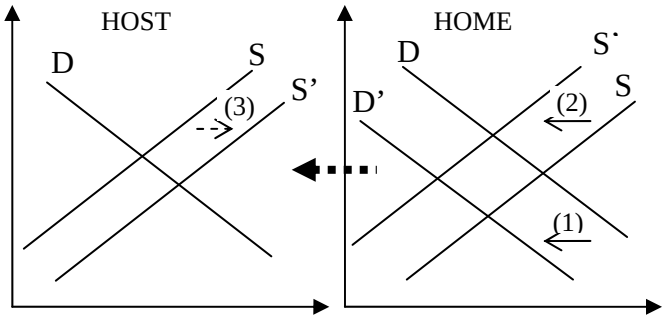
Appendix B

The Relationship Between Foreign Bank Lending and Local Credit Stability

This conceptual framework (Table B1) extends Morgan and Strahan's (2004) host-country focus by adding home-country shocks to cover all four cases. In a nutshell, identification of credit supply and demand shocks in the host and home countries is critical to predict foreign banks' implications for credit stability.

As shown in Diagram 1, a reduction in credit demand as a result of credit demand shock in HOST (country) decreases return on investment. Foreign capital and credits will flow out of HOST, amplifying decline in investment and destabilizing credit supply ('capital fly' case). Diagram 2 illustrates the case of 'lender of last resort', where a reduction in credit supply increases bank returns in HOST. Higher returns attract more credits from HOME (country) and this inflow offsets HOST credit constraints and stabilizes the credit line, as elucidated by Morgan and Strahan (2004). Similarly, the impact of home-country shocks on foreign bank lending behaviour can also be interpreted by the same framework. In the case of the 'common lender effect', supply shocks in HOME increase returns on investment. Foreign banks with parents in HOME will rip back funds from the periphery and invest in HOME. A sudden drop of credit destabilizes the credit market in HOST (Diagram 3). If demand shock hits HOME instead (the last case in Diagram 4), bank returns decline. Foreign banks with HOME origins look for investment opportunities abroad, with the location depending on expected returns. A promising HOST with higher expected returns will attract credit whereas an unpromising one will not.

Table B1. The Relationship of Foreign Bank Lending and Local Credit Stability

	Types of shocks	Rationale	Implication for credit stability
Host country	Case 1 Credit demand shock – interest rate rises – capital flows out – foreign credit falls	Diagram 1 	Destabilizing
	Case 2 Credit supply shock – interest rate falls – capital flows in –foreign credit rises	Diagram 2 	Stabilizing
Home country	Case 3 Credit supply shock –foreign capital withdraws – foreign credit falls	Diagram 3 	Destabilizing
	Case 4 Credit demand shock –foreign capital flows out –foreign credit might or might not increase in a particular host country	Diagram 4 	No particular effects

Chapter 16

Banking Structures and the Transmission of Shocks to the Real Sector

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International financial linkages—particularly disruption in the money markets—are thought to have propagated the sub-prime crisis from the United States to the rest of the world. We examine empirically the role of the money market in transmitting the Global Financial Crisis (GFC) to the East Asian economies. We take a comparative perspective by comparing Asian credit institutions with those from the European Union and Anglo-Saxon countries. We also consider the role of the money market in the transmission mechanism during the Asian Financial Crisis (AFC) of 1998. The base sample is an unbalanced panel of 7,119 credit institutions observed over 1995–2009. The findings suggest that the financial sector's dependence on wholesale funds is a more important source of vulnerability in Asian economies than in other developed economies. One policy message is that the supervisory authorities in the region therefore should keep a watchful eye on wholesale-dependent banks when financial shocks occur outside the region.

Keywords: credit crunch, financial contagion, non-core liabilities

JEL Classifications: G01, G21, G14

1. Introduction

The transmission mechanism of the sub-prime crisis from the United States to the rest of the world has spurred lively academic debates. Clearly, trade linkages with the United States played a role in transmitting the shock, but Levchenko et al. (2009) have shown that the reduction in trade volume is not sufficient in explaining the rapid slowdown in overall economic activity. This indicates that factors other than the real-sector shock must have been important in the transmission mechanism. Brunnermeier (2009) and Shin (2009), among others, point to the importance of international financial linkages, particularly the disruption in money markets. The mechanism, as articulated by Raddatz (2009), goes as follows: financial institutions worldwide have increasingly relied on wholesale funding to supplement demand deposits as a source of funds (Adrian and Shin, 2009); the short-term wholesale funds collapsed during the Global Financial Crisis (GFC), forcing banks to shrink their balance sheets by cutting back on lending.

Recent empirical studies support this *money-market transmission hypothesis*. Raddatz (2009) shows that the stock price of banks with larger dependence on wholesale funding fell faster at the time of the Lehman shock of September 2008. Corbett et al. (2010) complement this result on impacts on financial variables by presenting evidence of the *lending channel*: the GFC affected banks that were dependent on the money market more than banks that relied on customer deposits for funding.

Our paper aims to examine further the money-market transmission hypothesis in Asia. The previous study by Corbett et al. (2010) examined the relevance of the

money-market transmission hypothesis using a sample of East Asian credit institutions, emphasizing intra-regional diversities. Our current analysis differs in that we compare Asian credit institutions with those from other regions using data from the European Union and Anglo-Saxon countries. Furthermore, we examine whether a similar mechanism was at work during the Asian Financial Crisis (AFC) of 1998. In a study that compared the GFC with the Great Depression of the 1930s, Almunia et al. (2010) offer an insightful analysis on the effectiveness of macroeconomic policies. A comparison of banks' behavior during the AFC and the GFC would likewise be of interest. Conventional wisdom suggests that Asian banks typically follow the traditional mode of banking practice and that the impact of the GFC was limited due to the limitation in exposure to toxic assets (Pomerleano, 2009). We ask whether the reliance on retail deposits enabled Asian banks to withstand the current crisis compared with their peers in other countries.

For this project, we obtained the individual balance sheets of credit institutions from the Bankscope database for 1995–2009. The sample base for Asian credit institutions consists of 807 credit institutions from 10 Association of South-East Asian Nations (ASEAN) countries, plus China, Hong Kong, India, Japan, Korea and Taiwan. The European sample includes 1,325 credit institutions from 16 EU countries, including Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, Netherlands, Portugal, Spain and Sweden. Our "Anglo-Saxon" sample includes 786 credit institutions from Australia, Canada, New Zealand, the United Kingdom and the United States. The base sample thus contains 7,119 credit institutions. This sample coverage is much broader than those in the previous studies on the money-market transmission hypothesis.

In this project report, we first explore this large panel data set of credit institutions to document stylized facts about the behavior of credit institutions. Our emphasis is on cross-region comparison to highlight specificities within Asia. We then replicated Raddatz's (2010) analysis of cross-section analysis with our sample to look for evidence of the transmission through the money-market channel. Here, the levels of loans at a period after the onset of a crisis are regressed on a measure of wholesale dependence, the level of loans before the crisis, and control variables. Since our interest is in understanding the cross-country transmission of shocks, the sample to examine the GFC excludes the United States. The analysis of the AFC considers Thailand, Korea and Indonesia as epicenters (Corbett and Vine, 1999) and thus excludes them.

In summary, our sample exhibits a robust bank liability growth over the sample period before the crisis, especially after 2005. The level of liabilities remained roughly constant after 2007. While deposits are the major component of bank liabilities, there is an increasing reliance on non-core liabilities for the EU and Anglo-Saxon countries. The wholesale dependence thus has risen markedly. Asian financial institutions tended not to increase their reliance on non-core liabilities compared with the other regions. Alongside the growth in bank liabilities, aggregate loans for all regions increased rapidly after the turn of the century until 2007; the total amount of loans in US dollars more than doubled from 2001 to 2007. After the onset of the GFC, loans declined sharply for the EU and Anglo-Saxon countries, but continued to grow in Asia due to continued growth in some of the Asian countries such as China and India. A simple plot of the loan growth to wholesale dependence indicates a negative correlation during the crisis periods and no correlation during other periods. The negative correlation is stronger during the GFC than during the AFC.

The regression analysis confirmed the validity of the money-market transmission hypothesis for the GFC. A model that allows for heterogeneous effects across regions showed a curious pattern: among high wholesale-dependent credit institutions, the GFC had a strong effect in Asia but not in other regions, despite Asia's lower overall wholesale dependence and continued growth in credit provision. This pattern suggests that the large drop in credit for the EU and Anglo-Saxon countries (which excludes the United States for being the GFC epicenter) might have been largely driven by the decline in investment demand by firms in those regions. The stronger effects for Asia suggest flight-to-quality effects: for a given level of wholesale dependence, the impacts of the wholesale market collapse were larger for Asian credit institutions because of higher average country risks in the Asian region that exacerbated the ability of credit institutions in the region to attract funds. This result for Asia is consistent with the finding in Corbett et al. (2010) that shows a statistically significant link between wholesale dependence and loan growth, especially for Korea.

During the AFC, this transmission channel—on average for all regions—was not important. This discrepancy with the result from the GFC suggests that the regional nature of the AFC left credit institutions in the EU and Anglo-Saxon countries unscarred. Indeed, a model that allows for heterogeneous effects across regions showed the AFC had a strong effect in Asia but not in other regions. That is, credit institutions in Asia (excluding those from Thailand, Korea and Indonesia) with high wholesale dependence reduced loans more rapidly during the AFC.

A further investigation should be conducted to ascertain the finding on heterogeneous impacts. To draw a policy implication, the finding suggests that the financial sector's dependence on wholesale funds is a more important source of

vulnerability in Asian economies than in other developed economies. Therefore the supervisory authorities in the region should keep a watchful eye on wholesale-dependent banks when financial shocks occur outside the region.

The rest of this project report is organized as follows. We first describe the construction of the data set and report the results of preliminary examination. We then describe an empirical approach and report the results. The final section concludes.

2. Data

We initially obtained bank-level data for 9,163 existing as well as discontinued credit institutions from Asia, Europe and Anglo-Saxon countries from Bureau Van Dijk's Bankscope. We included discontinued credit institutions in the sample because our analysis requires estimating the impacts of the AFC, and an estimation based on a survivor sample would likely be biased due to the sample selection process. The sample coverage is determined by the coverage in Bankscope and our access rights, so it is not all the credit institutions from those regions.[1]

The coverage of credit institutions in Bankscope has undergone some changes. As a result, the number of credit institutions occasionally exhibits large discontinuous rises. For example, the increase in the number of Asian credit institutions in 1998 is due entirely to an expanded coverage of Japanese cooperative banks in Bankscope. Another discontinuity is found for the European Union—especially for Italy and Spain—in 2005. To maintain consistency in the sample, we dropped all Japanese

[1] Our initial sample of US financial institutions includes 1,012 banks.

cooperatives. We also dropped credit institutions that Bankscope started covering after 2005 for all regions. This deletion left 7,119 credit institutions in the base sample. Table 1 shows the number of operating credit institutions in the sample. An "operating bank" is defined as a bank with non-missing information on operating profits. On average, 57 percent of credit institutions are in operation each year out of all samples of credit institutions.

Table 1. The Number of Operating Credit Institutions in the Sample by Region

YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Av.	Coverage
ASIA	558	584	565	556	551	550	538	540	566	612	565	596	609	582	511	566	48%
ANGLO	853	862	847	803	872	824	812	780	747	719	678	687	665	638	590	758	53%
EU ex UK	2,760	2,875	2,928	3,072	3,014	2,875	2,839	2,693	2,569	2,547	2,497	2,559	2,599	2,513	2,248	2,706	60%
TOTAL	4,171	4,321	4,340	4,431	4,437	4,249	4,189	4,013	3,882	3,878	3,740	3,842	3,873	3,733	3,349	4,030	57%

Source: The original source is Bureau Van Dijk's Bankscope.

Note: Authors' tabulation of operating credit institutions in the base sample. An "operating bank" is defined as a bank with non-missing information on operating profits. "Coverage" refers to the ratio of an average number of credit institutions in operation each year to a number of credit institutions in the base sample. "Asia" includes 16 Asian countries and economies. "Anglo" includes five Anglo-Saxon countries. "EU ex UK" includes 16 EU countries.

Table 2 tabulates the number of credit institutions in the base sample by country and by type. The sample of Asian credit institutions includes 1,177 institutions from 16 economies including 10 ASEAN countries plus China, Hong Kong, India, Japan, Korea and Taiwan. The sample of Anglo-Saxon credit institutions includes 1,440 institutions from Australia, Canada, New Zealand, the United Kingdom and the United States. The sample of European credit institutions includes 4,502 institutions from 16 EU nations including Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, Netherlands, Portugal, Spain and Sweden. Commercial banks are represented the most (N = 2,918), followed by cooperative banks (N = 1,868) and then by savings banks (N = 1,332).

Table 2. The Base Sample of Credit Institutions by Country/Economy and Specialization

Country Name	Commercial Banks	Cooperative Banks	Investment Banks	Islamic Banks	Other Non Banking Credit Institution	Real Estate & Mortgage Banks	Savings Banks	Specialized Govt. Credit Institutions	Total
ASIA									
BRUNEI DARUSSALAM	2	0	0	2	0	0	0	0	4
CAMBODIA	10	0	0	0	0	0	0	0	10
CHINA-PEOPLE'S REP.	128	3	6	0	1	0	1	2	141
HONG KONG	49	0	41	0	2	0	0	0	92
INDIA	78	8	17	0	0	2	0	8	113
INDONESIA	107	0	4	1	0	0	0	0	112
JAPAN	179	0	58	0	3	0	1	6	247
KOREA REP. OF	32	2	43	0	2	0	2	3	84
LAOS	5	0	0	0	0	0	0	0	5
MALAYSIA	53	1	24	12	1	0	0	5	96
MYANMAR UNION OF	4	0	0	0	0	0	0	0	4
PHILIPPINES	28	0	1	0	1	0	3	2	35
SINGAPORE	26	0	31	1	2	1	1	0	62
TAIWAN	47	1	24	0	1	0	1	2	76
THAILAND	22	0	28	0	1	0	1	4	56
VIETNAM	37	0	1	0	0	0	0	2	40
SUBTOTAL	**807**	**15**	**278**	**16**	**14**	**3**	**10**	**34**	**1,177**
ANGLO-SAXON									
AUSTRALIA	38	1	18	0	3	10	0	4	74
CANADA	18	4	7	0	1	1	1	0	32
NEW ZEALAND	11	0	2	0	1	2	0	0	16
UNITED KINGDOM	181	0	57	4	8	59	7	1	317
USA	538	6	60	0	0	12	370	15	1,001
SUBTOTAL	**786**	**11**	**144**	**4**	**13**	**84**	**378**	**20**	**1,440**
EU ex UK									
AUSTRIA	96	113	5	0	3	15	95	3	330
BELGIUM	78	13	5	0	1	3	20	3	123
CYPRUS	23	2	2	0	0	0	1	0	28
DENMARK	67	7	2	0	2	10	56	2	146
FINLAND	11	0	0	0	0	3	2	4	20
FRANCE	289	123	15	0	27	27	43	16	540
GERMANY	272	1,407	12	0	9	74	609	35	2,418
GREECE	19	1	3	0	0	1	1	1	26
IRELAND	34	0	5	0	0	9	1	0	49
ITALY	107	156	9	0	13	1	22	12	320
LUXEMBOURG	148	2	3	0	1	0	1	0	155
MALTA	13	0	1	0	0	0	1	1	16
NETHERLANDS	57	1	1	0	1	7	3	2	72
PORTUGAL	27	2	6	0	3	1	2	1	42
SPAIN	55	14	2	0	2	2	10	4	89
SWEDEN	29	1	5	0	1	10	77	5	128
SUBTOTAL	**1,325**	**1,842**	**76**	**0**	**63**	**163**	**944**	**89**	**4,502**
TOTAL	**2,918**	**1,868**	**498**	**20**	**90**	**250**	**1,332**	**143**	**7,119**

Source: Authors' computation of the base sample drawn from Bankscope.

Since we examine growth in loans at the individual bank level, one concern is that mergers and acquisitions (M&As) compromise the consistency of a panel unit. We account for M&As as follows: we first tabulated the information on M&As in the "bank history" section contained in Bankscope, and then split a unit if M&As are recorded.

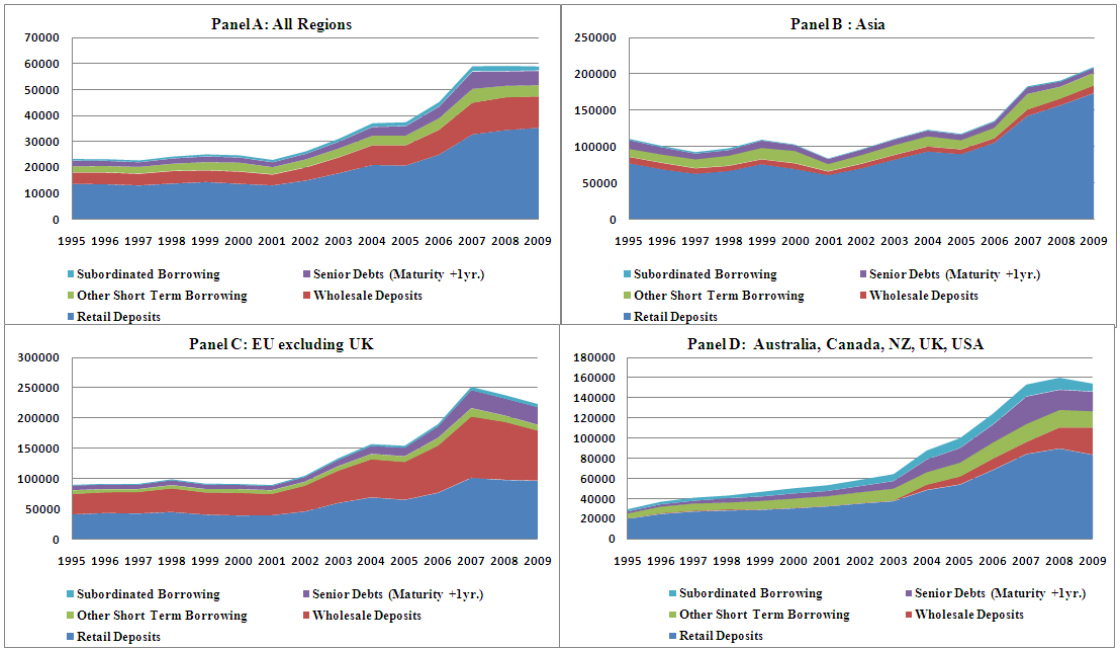
That is, we treat a surviving bank as two different panel units before and after a merger. A non-surviving bank in the data ceases to exist after a merger. The data with this treatment of M&As led to 10,704 units.

We obtained unconsolidated financial statements in the universal banking format, so that balance-sheet items are comparable across countries. The data are in current US dollars.

3. Preliminary Examinations

Panel A in Figure 1 shows the changes in the composition of bank liabilities, aggregated over the base sample, from 1995 to 2009. The unit in Panel A is in trillions of US dollars. Overall, bank liabilities grew over the sample period—especially rapidly after 2005, but remained roughly constant after 2007. Deposits from customers and credit institutions are the major component of bank liabilities. Raddatz (2010) defines the dependency ratio as 1 minus the ratio of deposits to total liabilities, and documents an increase in dependency since 2003. Our sample—which includes US credit institutions, unlike Raddatz (2010)—also exhibits an increasing reliance on non-core liabilities (other short-term borrowings, senior debt maturing after one year, and subordinated borrowing), but this rise in non-core liabilities is not as stark as in his sample.

Figure 1. The Composition of Bank Liabilities from 1995 to 2009



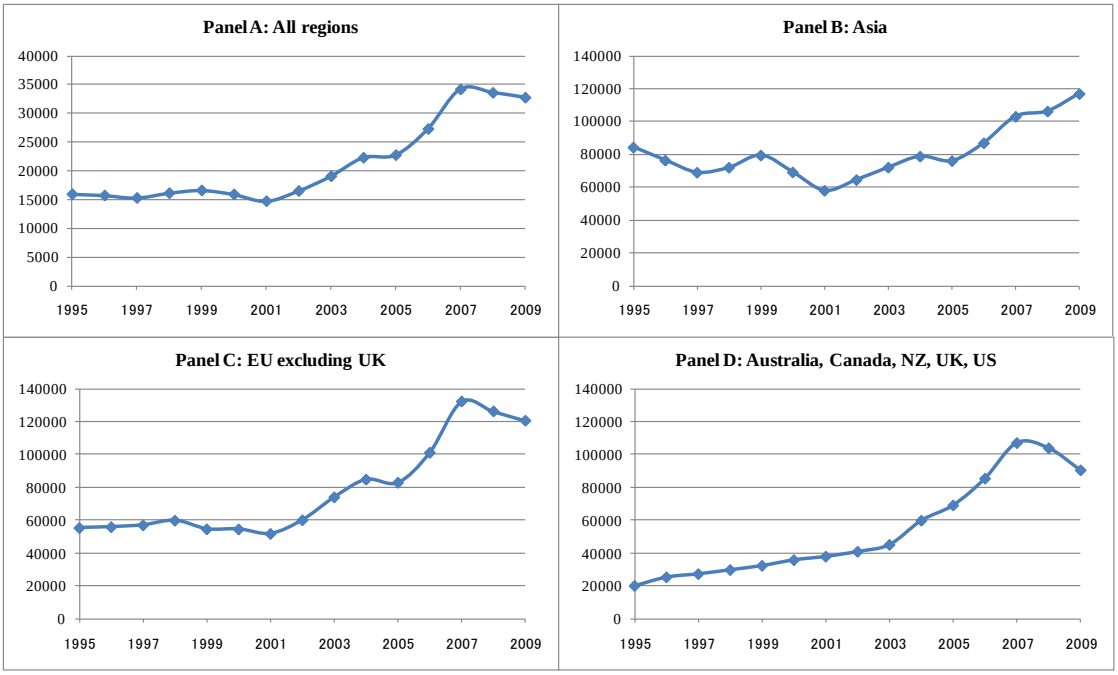
Note: All financial figures are aggregated over credit institutions in the base sample. The unit in Panel A is in trillions of US dollars. The unit in Panels B, C and D is in 100 billions of US dollars.

Panels B, C and D show the composition of liabilities over the three regions (Asia, European Union and Anglo-Saxon). The unit is in 100 billions of US dollars. After 2007, overall liabilities increased in Asia, moderately fell in the Anglo-Saxon countries, and fell fastest in the European Union. Of all regions, the Anglo-Saxon countries have the highest composition of non-core liabilities followed by the European Union and Asia. Comparing the non-core liabilities in the European Union with Asia, the European Union tends to rely on senior debt with maturity of more than one year, whereas Asia tends to rely on other short-term borrowings, including the money market.

Figure 2 describes the overall behavior of the amount of aggregated bank loans. "Loans" are net loans, which is gross loans minus loan loss reserves. Panel A aggregates the sample credit institutions from all regions. It reveals rapid growth in

credit: the total amount more than doubled from 2001 to 2007. As we saw earlier, credit institutions financed this rapid growth in loans with both non-core liabilities and deposits. Loans fell after the onset of the GFC. Panel B shows bank loans in Asia, which behave differently from the overall pattern. Bank loans in Asia continue to grow despite the GFC. The robust growth in China is a factor behind this growth. The patterns for EU and Anglo-Saxon countries are close to the aggregated figure. Recall that the composition of non-core deposits was higher in EU and Anglo-Saxon countries. At face value, the declines in loans for the last two regions lend support to the conjecture that non-core liabilities were the transmission channel of the financial shock.

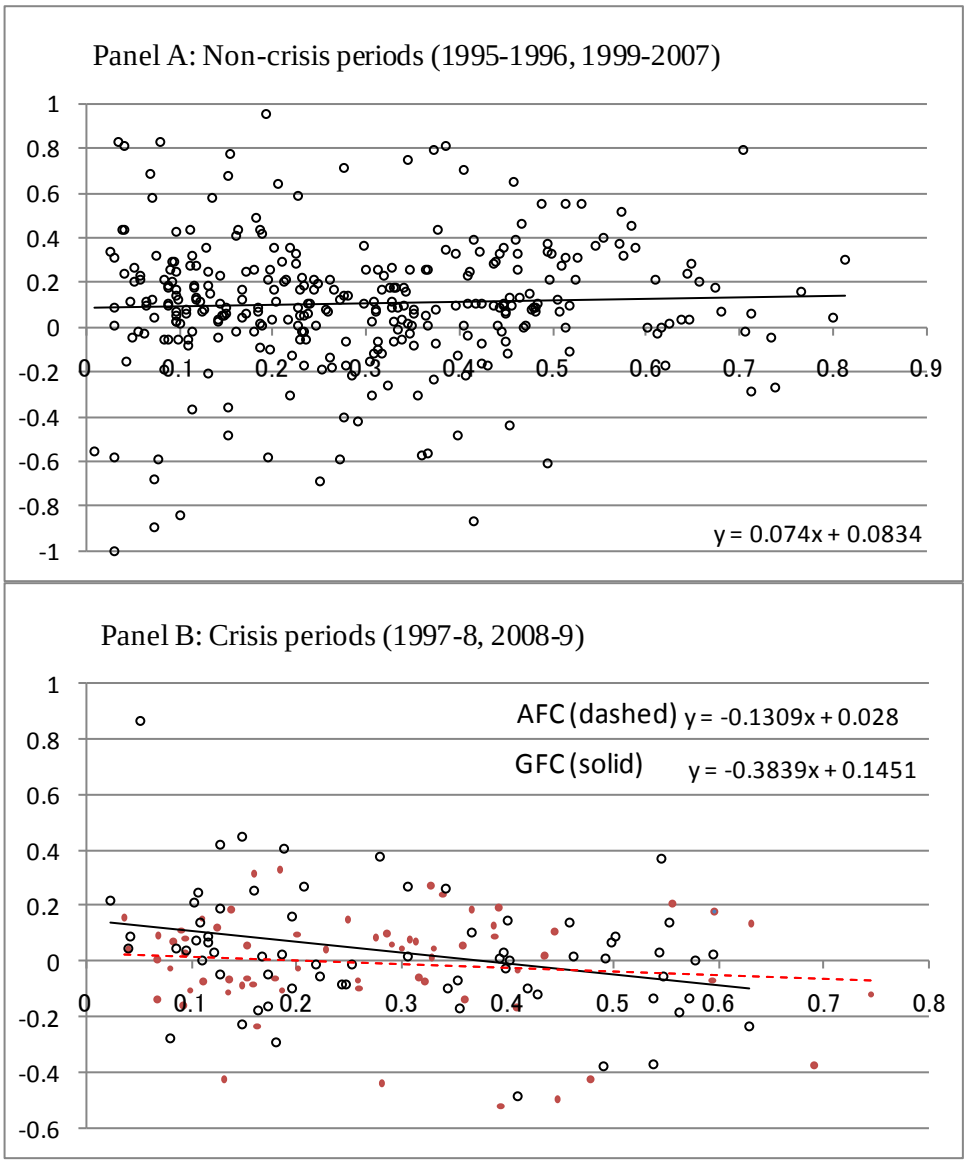
Figure 2. The Aggregated Bank Loans by Region



Note: Total amounts of net loans (gross loans minus loan loss reserves) of the base sample credit institutions by relevant regions. The unit in Panel A is in trillions of US dollars. The unit in Panels B, C and D is in 100 billions of US dollars.

Figure 3 presents a preliminary look. The figure plots loan growth on the y-axis against lagged wholesale dependencies on the x-axis. Both loan growth and wholesale dependence are computed by aggregating relevant balance-sheet items of the base sample credit institutions over country and time. Each "dot" thus represents the country–year (weighted) average of those variables. Negative net loans are not used in computation. The figure is based on all countries except Brunei and Myanmar that exhibited unusually fast loan growth. Loan growth of more than 100 percent is also excluded because of small cross-year differences in the coverage. Panel A is for "non-crisis" periods (1995–96 and 1999–2007). Some loan growth is still large even with the aforementioned selection, possibly due to changes in sample coverage in small countries. The pattern reveals no systematic relationship between two variables. If anything, the coefficient from a simple regression is 0.074, suggesting a positive relationship between wholesale dependence and growth of loans when business is as usual. The coefficient is not statistically significant.

Figure 3. The Correlation Between Loan Growth and Lagged Wholesale Dependencies



Note: Both loan growth and wholesale dependence are computed by aggregating relevant balance-sheet items of the base sample credit institutions over country and time. In Panel B, clear and filled dots represent observations from the GFC and the AFC respectively.

Panel B is for the two "crisis" periods (1997–98 and 2008–09). The filled dots are for the AFC and the clear dots are for the GFC. Here, the correlation seems to be negative, and the regression coefficient from a simple regression on a two-crisis combined sample is –0.257 and is statistically significant (not presented). Excluding

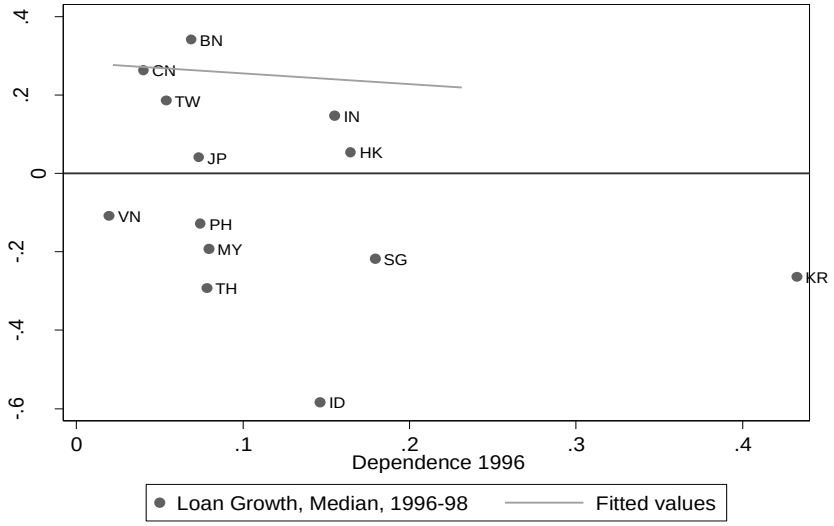
an outlier, Laos, does not affect the significance level, though the coefficient falls to –0.210. While a few countries exhibit large declines in loans during the AFC (Australia, Thailand, Indonesia and the United Kingdom), the relationship between the two variables is not apparent and the regression coefficient of –0.13 is not significant. During the GFC, in contrast, the variable exhibits a strong correlation of –0.38 and is statistically significant. Thus, a simple examination suggests that wholesale dependence mattered more during the GFC, perhaps due to the global nature of the crisis and also due to the increasing integration of financial markets across the regions. It would appear, however, too hasty to dismiss the wholesale market channel in the AFC since the regional, rather than global, nature of the crisis might have had a limited impact on countries outside Asia.

To focus on Asia, Figure 4 plots median growth in net loans of individual credit institutions for each country against averages of pre-crisis wholesale dependence of individual credit institutions. In Panel A for the AFC, pre-crisis is taken to be 1996, and the y-axis shows loan growth over 1996–98. Laos, Myanmar and Cambodia are not in this plot because they lack sufficient data. The epicenter countries—Indonesia, Korea and Thailand—are more severely affected in terms of the decline in loans. Notably, Korea is highly dependent on wholesale funding and also experiences a large loan decline. The fitted line to this sample of 13 countries has a negative slope of –0.873. While not statistically significant, this suggests that the dependence on wholesale funding could have been a potential source of vulnerability then as it was during the GFC. Panel B is for the GFC, where the pre-crisis period is taken to be 2007, and the y-axis shows loan growth over 2007–09. Myanmar is not in this plot because of data unavailability. Wholesale dependence had visibly declined in Korea,

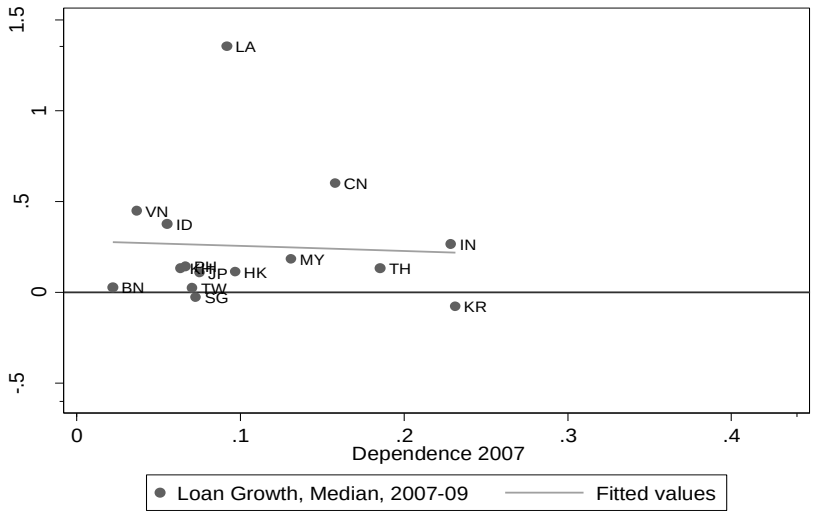
suggesting that Korean credit institutions might have become more cautious after the AFC and started to manage risks more carefully.

Figure 4. The Correlation Between Loan Growth and Wholesale Dependence in Asia

Panel A. The Asian Financial Crisis



Panel B. The Global Financial Crisis



Note: Median growth in net loans of individual credit institutions for each country against averages of pre-crisis wholesale dependence of individual credit institutions.

4. Empirical Analysis

Our goal is to examine the transmission of the GFC and the AFC through the money-market channel on bank lending behavior. We adopt a modified version of Raddatz's (2010) cross-section regression analysis. Our aims here are twofold: first is to check the robustness of findings in Raddatz (2010) with respect to a different sample, to a sample extended to 2009, and to specification checks; second is to examine possible heterogeneity across regions not considered in his study. Our version considers the following empirical model:

$$\ln(Loans_{i,c,t}) = \varphi_c + \beta_1 \ln(loans_{i,c,t-1}) + \beta_2 X_{i,c,t-1} + \gamma W_{i,c} + \varepsilon_{i,c,t}, \quad (1)$$

where $\ln(loans_{i,c,t})$ represents total loans in log of bank i from country c at time t. Time t is a crisis period. φ_c is a country fixed effect. $loans_{i,c,t-1}$ is the total loans from a period before the crisis, included to capture the dependence in the level of lending activities across time.[2] $X_{i,c,t-1}$ is a vector of bank i balance-sheet variables before the crisis and other controls. We have considered total assets in log, cost-to-income ratio in log, return on average assets, interbank ratios, and net interest margins. Control variables include country dummies to capture country-specific loan growth, and specialization dummies to capture the common impacts of crisis on, for example, investment banks. $\varepsilon_{i,c,t}$ is a random error term. $W_{i,c}$ is our measure of wholesale funds dependence for bank i from country c. Raddatz (2010) uses a logarithmic transformation for the wholesale dependent variable to reduce noise and we follow his procedure: -log(1+total-customer-deposits/total-fundings). The parameter of interest is γ. If wholesale fund-dependent credit institutions reduced lending relatively faster, we would expect γ to be negative and significant.

[2] We have estimated the model in difference, rather than in level. The result is the same. This alternative is equivalent to restricting the coefficient on lagged loans in equation (1) to 1. Here we report the general specification.

We estimate a cross-section regression using this model on the 2009 data for the GFC, taking the pre-crisis period as 2007. The model for the AFC is estimated for the 1998 data, taking 1996 as a pre-crisis period.

5. Results

Table 3 presents the estimate of model (1). Columns 1–4 show the estimates for the GFC. In the examination of the GFC, financial institutions from the United States are excluded from the estimation. Column 1 presents the results that pool across all regions. The coefficient on the wholesale dependence is negative and significant at the 10 percent level. This estimate implies that, other things held constant, a bank with a higher wholesale dependence (0.1) of one standard deviation reduced its lending by 0.6 percentage points on average. To examine regional differences, we interacted the dependence measure with geographical regions (columns 2–4). The base category is the European Union excluding the United Kingdom, so that the coefficients on the interaction terms represent the difference in the money-market effects between Asia/Anglo-Saxon countries and the European Union. We already include country dummies so region dummies are redundant and are not included. The coefficient on the wholesale dependence then represents the effects for the European Union. The results indicate non-significant coefficients for EU and Anglo-Saxon countries. The interaction term for Asia has a large and significantly negative coefficient (column 2), suggesting that the result from the whole sample was driven by Asia. This result is robust to inclusion of balance-sheet variables, as column 3 shows, but becomes marginally insignificant, with a p-value of 10.6 percent, after allowing for clustering of standard errors within each country (column 4).

Table 3. Regression Analysis

Table Z
Approach (1)
(Dependent variable Log of Loans)

	GFC(2009)				AFC(1998)				PLACEBO(1996)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
MM Dep	-0.066+	-0.008	0.016	0.016	-0.043	0.045	0.077	0.077	-0.049	0.042	0.043	0.043
	(0.035)	(0.04)	(0.047)	(0.046)	(0.041)	(0.047)	0.052	0.052	(0.037)	(0.042)	(0.050)	(0.040)
Asia		-0.337**	-0.254**	-0.254		-0.479**	-0.540**	-0.540**		-0.058	-0.096	-0.096
		(0.085)	(0.103)	(0.153)		(0.105)	(0.109)	(0.120)		(0.095)	(0.133)	(0.235)
Anglo ex US		0.157	0.060	0.060		-0.112	-0.309	-0.309		0.228+	0.518**	0.518**
		(0.143)	(0.157)	(0.107)		(0.163)	(0.193)	(0.186)		(0.138)	(0.195)	(0.056)
Additional Controls												
Intial Size	0.006	0.004	0.007	0.007	-0.004	-0.004	0.006	0.006	0.028	0.028	0.034	0.034
	(0.006)	(0.006)	(0.007)	(0.011)	(0.008)	(0.008)	(0.009)	(0.014)	(0.007)	(0.007)	(0.009)	(0.012)
Intial Loans	0.999**	0.999**	0.996**	0.996**	1.000**	1.000**	0.996**	0.996**	0.974**	0.974**	0.967**	0.967**
	(0.006)	(0.006)	(0.007)	(0.010)	(0.008)	(0.008)	(0.009)	(0.015)	(0.007)	(0.007)	(0.008)	(0.011)
Initial Net cost to income ratio			-0.006	-0.006			0.007	0.007			-0.003	-0.003
			(0.012)	(0.022)			(0.014)	(0.015)			(0.012)	(0.023)
Intial ROAA			0.015*	0.015*			0.035**	0.035**			0.014**	0.014+
			(0.005)	(0.005)			(0.005)	(0.007)			(0.004)	(0.007)
Initial Interbank ratio			0.000	0.000			0.000	0.000			-0.000*	-0.000*
			(0.000)	(0.000)			(0.000)	(0.000)			(0.000)	(0.000)
Intial Net Interest Margin			0.004	0.004			0.004	0.004			0.004	0.004
			(0.003)	(0.003)			(0.003)	(0.007)			(0.003)	(0.004)
Constant	0.164*	0.279**	0.253*	0.253*	0.109+	-0.110	-0.281**	-0.281**	0.466**	0.426**	0.390**	0.390+
	(0.056)	(0.083)	(0.107)	(0.116)	(0.062)	(0.077)	(0.109)	(0.089)	(0.058)	(0.075)	(0.107)	(0.209)
Observations	2220	2220	1974	1974	2566	2566	2349	2349	2345	2345	2075	2075
Adj R-squared	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99

Note: MM Dep is the wholesale dependence defined as: -log(1+total-customer-deposits/total-fundings), following Raddatz (2010). Initial size is measured as two-period lagged of (log) total assets. Initial loans are measured as two-period lagged of (log) net loans. The regression includes country dummies, and specialization-type dummies. Robust standard errors in parentheses. Significance levels: + 10%; * 5%; ** 1%.

Columns 5–8 show the results for the AFC. This time, financial institutions from Korea, Indonesia and Thailand are excluded from the estimation. The coefficient on the wholesale dependence is negative but insignificant for the pooled analysis (column 5). To examine regional differences, once again, we interacted the dependence

measure with geographical regions taking the European Union excluding the United Kingdom as the base sample (columns 6–8). EU and Anglo-Saxon countries have insignificant coefficients. Asia in contrast has a large and significantly negative coefficient (column 6). This result is robust to inclusion of balance-sheet variables, as column 7 shows, and to clustering of standard errors within each country (column 8).

Taken as a whole, the results from this analysis suggest the possible importance of the money-market channel in Asia for both episodes of crisis but less so for European and Anglo-Saxon countries, including US credit institutions.

6. Sensitivity Analysis

To see if this is an artifact of the analytical framework, we estimated the model on 2006 data as a placebo test. If the results were driven by the estimation procedure, we should also observe significant and large negative coefficients for Asia. Columns 9–12 show the result of the placebo test. The coefficients for Asia are negative but insignificant for all specifications. The Anglo-Saxon countries have a positive and high coefficient on wholesale dependence (column 10). This result is robust to the inclusion of additional controls (column 11) as well as to clustering of standard errors within each country (column 12). This estimate implies that, other things held constant, an Anglo-Saxon bank with a 1 standard deviation point higher wholesale dependence on average had a 5 percentage point faster loan growth than its European peer over 2004–06. This suggests the importance of non-core deposits in expanding loans in Anglo-Saxon countries prior to the GFC.

We have considered an extension to this sensitivity analysis. In brief, we pooled

the crisis and non-crisis periods and implemented a difference-in-difference analysis. The objective was to see if, controlling for an average loan growth of money-market-dependent banks prior to the GFC, the dependence on the money market was still associated with a lower growth rate in loans during the crisis. We have found similar results. For brevity, the estimation results are not reported here.

We have also considered an alternative analysis that focused on abnormal changes in loans. If the money market mattered during the GFC, the dependent banks should experience a larger shortfall in loan growth relative to an expected level of growth. In this analysis, we first estimated for each bank deviations from expected loan growth in 2007–08 and 2008–09. The estimated deviations ("abnormal growth/contraction") were then regressed on the dependence measure. Once again, we have found results suggesting that the impacts of dependence were felt more severely in Asia. Once again, the estimation results are not reported here for brevity.

7. Conclusion

This report examined the money-market transmission hypothesis in Asia during the GFC and the AFC. The data are based on the individual balance sheets of credit institutions from the Bankscope database for 1995–2009. The base sample included 7,119 credit institutions from Asian, EU and Anglo-Saxon countries. We first explored the large panel data set of credit institutions to document stylized facts about the behavior of credit institutions during crises. We then estimated a cross-section model relating the levels of loans at a period after the onset of a crisis to a measure of wholesale dependence, controlling for pre-crisis loan levels, bank characteristics and

financial performance. The regression analysis, with a restriction on homogenous regional effects, showed that on average credit institutions with high wholesale dependence reduced lending during the GFC but not during the AFC. A model that relaxed the homogeneity restriction suggested that money-market transmission was at work in Asia but not in other regions during both the AFC and the GFC.

The finding on the overall importance of the money-market channel is in agreement with prior studies. While further work needs be done to ascertain this conclusion and to verify the results on heterogeneous effects across regions—particularly the large estimated impact for Asian credit institutions—there is an important message to supervisors and policymakers in Asia that the region might be particularly susceptible to the impact of large changes in conditions in wholesale markets for bank liquidity. New international rules that encourage banks to maintain liquidity in other forms might therefore have particular relevance to Asia.

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Chapter 17

Financial Crisis and Effects of Bank Regulation on Bank Performance in Key Asian Countries

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This paper studies the effects of bank regulation on the efficiency of banks in the Asian countries Indonesia, Malaysia, the Philippines, Singapore, Thailand and Vietnam. The study covers nearly 600 banks from 1990 to 2008 and accounts for individual bank characteristics, bank regulatory measures, differences of bank ownership, and institutional differences. The paper adopts different measures of bank efficiency such as returns on average assets (ROAA) and returns on average equity (ROAE) to study the impact of regulation on bank efficiency. These two measures are expected to capture the types of risk that the banks are adopting in terms of traditional and off-balance-sheet activities to increase their profitability. The ROAA reflects the return on average assets and this is expected to increase with regulations such as higher capital requirements that enable firms to allocate their investments towards more productive and less risky assets (Berger, 1995; Demirguc-Kunt and Huizinga, 1999). In contrast, ROAE is expected to fall with more regulation such as higher capital

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requirements that tend to create deadweight loss to capital and hence reduce the profit on equity (Berger, 1995). It is also likely that regulation of the off-balance-sheet activities of banks will have more impact on ROAE in terms of reducing the excessive risk-taking activities of banks. The results indicate that higher capital requirements in terms of a higher total equity to total assets ratio seem to improve bank performance (ROAA), which is in line with managing the risk-taking activities of banks in line with the recommendations in the Basel II Accord (BIS, 2006). We also found private-sector monitoring of information tends to improve bank performance.

Keywords: banking efficiency, regulation, supervision, off balance sheet

JEL Classifications: G18, G21, G28

1. Introduction

As economies liberalize their financial sectors to increase competition and efficiency in the global market, financial institutions are also assuming greater risk in their operations. Efficient banks are able to diversify their activities and channel funds effectively to economically viable activities in the economy, thereby providing greater stability for the economy. In fact, the efficiency of banks is crucial in riding the volatility in the global market and maintaining the stability of the financial markets (Berger et al., 1993; Schaeck et al., 2009. In turn, a competitive environment is expected to increase risk-taking activities as banks are forced to adopt non-traditional banking activities to maintain their share in the financial markets (Edward and Mishkin, 1995). This increases the regulatory concerns that too much competition in the financial market could lead to excessive risk-taking behaviour, leading to instability in the financial markets.

The 2007 Global Financial Crisis (GFC) is a good example of excessive off-balance-sheet activities of banks leading to a financial and global crisis. The traditional banking model was replaced with an "originate and distribute" banking model where loans are pooled, tranched and then resold via securitization (Brunnermeier, 2009). There was an unprecedented credit expansion in financial innovations that would supposedly make the banking system more stable by transferring risk to those most able to bear it. To offload the risk, banks repackaged these loans and passed them to other financial investors through structured products often referred to as collateralized debt obligations (CDOs). Financial-market regulations play an important role in maintaining the balance between competition and risk-taking activities in the financial sector, thereby affecting the efficiency of the financial institutions.

This paper studies the determinants of bank performance in the Asian region. In particular, the paper analyzes the sources of bank performance in Indonesia, Malaysia, the Philippines, Singapore, Thailand and Vietnam. The study covers nearly 600 banks

from 1994 to 2008. The study adopts two measures of bank performance as dependent variables: returns on average assets (ROAA) and returns on average equity (ROAE). These two measures are expected to capture the types of risk that the banks are adopting in terms of traditional and off-balance-sheet activities to increase their profitability. The rate of return on average assets (ROAA) measures the overall profitability of the banks and the efficiency of banking operations. The ROAA reflects the return on average assets and this is expected to increase with regulations such as higher capital requirements that enable firms to allocate their investments towards more productive and less-risky assets (Ben Naceur and Goated, 2008; Demirguc-Kunt and Huizinga, 1999; Saunders and Schumacher, 2000). In contrast, the rate of return on average equity (ROAE) captures the returns to shareholders of the bank, reflecting the risk-taking activities of the banks such as off-balance-sheet activities. The impact of regulation on ROAE is expected to be different in terms of regulating the risk-taking activities of banks. For example, ROAE is expected to fall with more regulation such as higher capital requirements that tend to create deadweight loss to capital and hence reduce the profit on equity (Berger, 1995). It is likely that regulation of the off-balance-sheet activities of banks will have more impact on ROAE in terms of reducing the excessive risk-taking activities of banks.

The study is expected to improve the institutional, regulatory and supervisory framework of financial institutions in the region by identifying factors that could contribute to their efficiency, thereby strengthening the banking system. Since bank regulation tends to reduce competition and excessive risk taking in the financial market, it will also reduce innovative activities in the sector. Recent studies also highlight, however, the positive impact of regulations on banking activities in terms of increased market monitoring and a better-quality contracting environment, both of which have positive impacts on bank performance (Gonzales, 2009). In this paper, we study the impact of bank regulation and supervision on bank efficiency using factors such as the level of bank regulation on the activities that generate non-interest income, the intensity

of private monitoring (bank supervision), and the index on the intensity of official supervision by the central bank.

The paper also studies the impact on bank performance of regulating financial markets, in terms of opening up the financial sector for foreign participation and foreign ownership. The impact of financial-market liberalization is particularly important in the case of the Southeast Asian financial sector after the Asian Financial Crisis (AFC). It might also be important to study the impact of foreign participation on the productive performance of banks in the long term. A recent study by Kose et al. (2009 also shows that financial openness has a robust positive impact on total factor productivity (TFP) growth in the domestic economy. In conjunction, Xu (2010) provides strong empirical evidence that foreign entry is supportive of a more competitive and efficient banking industry in China.

This study also examines the impact of off-balance-sheet activities of banks on their efficiency, since banks are increasingly using off-balance-sheet activities in pursuit of higher profits and satisfying the increase in consumer demand for non-banking products. These off-balance-sheet activities could lead to excessive risk taking, thereby affecting the efficiency of banks.

The study also contributes to the understanding of misallocation of funds by banks due to moral-hazard issues, since banks might use their state-level influence and guarantees to divert funds to unproductive activities (Radelet and Sachs, 1998). To capture the moral-hazard issues in the productive performance of banks, we used equity to asset ratios and corporate linkages to the bank in terms of bank ownership of subsidiaries or corporate ownership of banks.

There are several key policy implications from the paper. The results indicate that an increase in capital requirements tends to improve bank performance in terms of higher returns on average assets (ROAA). This clearly indicates that banks tend to diversify and manage their risk better with higher capital requirements. Higher capital requirements in terms of a higher total equity to total assets ratio seem to improve bank

performance, which is in line with managing the risk-taking activities of the bank in line with the recommendations of the Basel II Accord (BIS, 2006). We also found private-sector monitoring of financial activities seems to have a positive impact on the performance of banks. Given the diverse stages of growth and development in the region, the supervisory role of central banks is crucial, but the results of the paper highlight the importance of private-sector monitoring as a better risk-management tool compared with bank regulation and supervision.

The paper is organized as follows. Section 2 discusses the methodology. Section 3 presents the construction of the data. The results are presented in Section 4. Section 5 concludes.

2. Empirical Methodology

The paper adopts a panel data framework to study the determinants of bank efficiency. The regression equation is given as:

$$Bank\text{-}Perf_{it} = \alpha_0 + \alpha_1 Fin_{it} + \alpha_2 Reg_{it} + \alpha_3 Types_{it} + \alpha_4 Bank\text{-}Perf_{it-1} + \mu_I + \theta_t + \varepsilon_{it}, \quad (1)$$

where $Bank\text{-}Perf_{it}$ is the bank performance measure of bank i in year t; Fin_{it} is the set of specific characteristics of bank i at year t; Reg_{it} is the set of bank regulatory and supervision variables; $Types_{it}$ captures the bank types; θ_t are dummies to capture any unobserved bank-invariant time effects not included in the regression; u_i are unobservable bank-specific effects that vary across the banks but are constant over time; and ε_{it} are white-noise error terms. We adopt three alternative measures of bank performance: cost of intermediation, operating performance and bank profitability.

We use fixed effects and random effects to estimate equation (1). It is very likely that there are endogeneity problems in equation (1) in terms of reverse causation, as bank regulation and supervision might be responding to the efficiencies of the bank. Thus, failure to account for the simultaneity problems might lead to biased estimation and coefficients. To address this problem, we adopt the two-stage least square fixed-effects (FE2SLS) and two-stage least square random-effects (RE2SLS) estimators as provided by Baltagi (2001). Both FE2SLS and RE2SLS are expected to control for the presence of unobservable bank-specific effects and the potential endogeneity of bank efficiency.

3. Data and Construction of Variables

3.1. Data

The main bank-level data for the study are obtained from the Bankscope Database, including bank-level information to estimate bank efficiency. All data used are expressed in 1996 US dollar terms and consolidated bank balance-sheet and income-statement data will be used whenever available. The construction of regulatory and supervisory variables is based on Barth et al. (2004, 2006) and the World Bank's Bank Regulation and Supervision Database. The full description of the data is given in Table A1 in the Appendix.

3.2. Variables

3.2.1. Bank Performance Measure

To measure bank performance, we adopted two different measures of bank profitability: 1) return on average assets (ROAA) measured as net income divided by average total assets; and 2) return on average equity (ROAE) measured as net income

divided by average total equity. The rate of return on average assets measures the overall profitability of the banks and the efficiency of banking operations. In contrast, the rate of return on average equity captures the returns to shareholders of the bank, reflecting the risk-taking activities of the banks such as off-balance-sheet activities.

3.2.2. Bank Regulation and Supervision

The study used three key regulatory and supervisory variables. Bank regulations restricting activities that generate non-interest income are given as RESTRICT. The average RESTRICT measures indicate if bank activities in the securities, insurance and real estate markets, as well as bank ownership and control of non-financial firms, are unrestricted, permitted, restricted or prohibited. Higher values indicate more restrictions on bank activities and non-financial ownership and control.

The bank supervision variables are represented by the intensity of private monitoring (MONITOR) and official supervision of banks (OFFICIAL). Both these variables were derived as given in Barth et al. (2004, 2006). The MONITOR index contains information regarding the external auditing of banks, the ratings by international agencies, the availability of an explicit deposit insurance scheme, and the disclosure of risk-management procedures to the public. The OFFICIAL index provides information regarding the extent to which regulators have the authority to take regulatory actions. Higher values for MONITOR and OFFICIAL indicate greater private oversight and more official supervisory power respectively.

3.2.3. Specific Characteristics of Financial Institutions

We used several variables to capture specific banking activities that could directly affect the productive performance of banks. Several studies have highlighted the importance of capital requirements in reducing the risk-taking activities of banks. To capture the effect of capital requirements, we introduced the total equity to total assets

ratio (TE_TA) in our study. In order to capture liquidity effects, we used the loan loss reserve to total loans ratio (LOANLR_GL), the liquid assets to total assets ratio (LA_TA), and the non-earning assets to total asset ratio (NEA_A). To account for the off-balance-sheet activities of banks, we used the off-balance-sheet to total assets ratio (OFFBAL_A).

The impact of foreign ownership and partnership on bank performance is given by a dummy variable, FOREIGN, which represents majority foreign ownership of more than 50 percent equity. We also indicate if the bank is a public bank (PUBLIC) if the government has more than 25 percent ownership. To capture the moral-hazard issues related to bank ownership of subsidiaries or corporate ownership of banks, we introduce the dummy variable SUBSIDIARY that indicates if the bank is a subsidiary or if it has a subsidiary. We also introduce dummy variables to capture the types of banking activities.

4. Results: Determinants of bank performance

The results of the panel study are given in Tables 1–4. In Tables 1 and 2, we report the bank performance estimations of ROAA and ROAE using the fixed-effect (FE) and random-effect (RE) specifications respectively. To account for bank-specific effects and endogeneity issues in our estimation, we adopted the two-stage least square estimation for fixed-effect (FE2SLS) and random-effect (RE2SLS) specification proposed by Baltagi (2001). We used the liquid assets to total bank deposits and borrowing ratio, the employment share of the banks, and types of banks as instrumental variables in the estimation. The results of FE2SLS and RE2SLS estimation are reported in Tables 3 and 4. The results of our study are very consistent across both the fixed-effect (FE) and random-effect (RE) specifications.

4.1. Specific Bank Characteristics

It is interesting to note that bank-specific characteristics have an important impact on the performance of banks as measured by the return on average equity, ROAA. TE_TA, the capital requirement variable, is positive and statistically significant, which indicates that an increase in the capital requirements of banks tends to improve their performance. This suggests that banks might experience better risk management if they assume greater ownership of their activities. This result is in line with the recent recommendation by the Basel II Accord to increase capital requirements to manage the risk-taking activities of banks (BIS, 2006). The estimation based on FE2SLS and RE2SLS indicates that the impact of TE_TA on bank performance measured by ROAA is much stronger and more robust (see Tables 3 and 4).

Table 1. Determinants of Bank Performance Based on Rate of Return on Average Assets (ROAA) in Selected Southeast Asian Banks

	FE(1)	FE(2)	RE(1)	RE(2)
TE_TA	4.207** (2.200)	4.147** (2.470)	4.892** (2.240)	4.927** (2.480)
LOANLR_GL	–8.511* (–1.700)	–8.667* (1.701)	–9.241* (1.720)	–9.246* (–1.720)
LA_TA	0.254 (0.410)	0.215 (0.340)	1.107 (0.870)	1.021 (0.980)
NEA_A	–0.871 (–1.040)	-	–0.256 (–01.60)	-
OFFBAL_A	–0.002 (–0.030)	0.006 (0.100)	–0.027 (–0.350)	–0.027 (–0.370)
FOREIGN	0.528** (2.720)	0.415* (1.840)	0.350* (1.710)	0.345* (1.720)
PUBLIC	–0.020 (–0.009)	–0.142 (–0.080)	–0.103 (–0.440)	–0.104 (–0.450)
SUBSIDIARY	0.445** (2.250)	0.455** (2.030)	0.689** (2.700)	0.697** (2.680)
RESTRICT	–0.277 (0.849)	–0.278 (–0.920)	–0.358 (–1.510)	–0.343 (1.220)
MONITOR	0.61 (1.350)	0.532* (1.750)	0.598 (1.130)	0.505** (1.940)
OFFICIAL	0.173 (0.430)	0.235 (0.630)	–0.062 (–0.130)	–0.040 (–0.110)
Commercial banks	0.277 (0.330)	0.232 (0.300)	1.120** (2.360)	1.114** (2.530)
Investment banks	0.1493 (0.670)	0.453 (0.070)	1.340** (2.660)	1.337** (2.630)
Finance and securities companies	0.826 (0.940)	0.830 (0.850)	1.750** (3.150)	1.757** (3.160)
Savings banks	0.320	0.320	1.129*	1.130*

	(0.820)	(0.900)	(1.700)	(1.650)
Holding finance companies	–0.911 (–0.110)	–0.114 (–0.140)	0.789 (1.460)	0.784 (1.470)
Government savings banks	1.065 (1.290)	1.030 (1.310)	2.046** (4.930)	2.049** (4.970)
Islamic banks	–1.285 (–0.780)	–1.330 (–0.850)	–0.390 (–0.930)	–0.409 (–0.410)
Others	1.560* (1.740)	1.570* (–1.720)	1.689** (2.940)	1.705** (3.000)
Constant	–3.710 (–0.820)	1.791*** (5.080)	–1.020 (–0.160)	–1.198 (–0.210)
Country dummies	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes
R-square	0.112	0.118	0.108	0.110
Observations	1,359	1,359	1,359	1,359

Note: Statistical significance levels: * 10 percent; ** 5 percent; *** 1 percent. t-statistics in parentheses; FE = fixed effects; RE = random effects.

Table 2. Determinants of Bank Performance Based on Rate of Return on Average Equity (ROAE) in Selected Southeast Asian Banks

	FE(1)	FE(2)	RE(1)	RE(2)
TE_TA	11.850 (0.990)	10.730 (0.580)	22.640 (0.880)	21.820 (0.870)
LOANLR_GL	–1.390*** (–9.250)	–1.410** (–2.520)	–1.420** (–2.480)	–1.420** (–2.480)
LA_TA	6.240 (0.690)	5.204 (0.700)	19.220 (1.230)	17.940 (1.240)
NEA_A	–11.220 (–0.920)	-	–3.850 (–0.430)	-
OFFBAL_A	0.961** (1.910)	1.108** (2.360)	0.535 (0.910)	0.584 (1.100)
FOREIGN	2.640 (0.760)	2.423 (0.720)	1.384 (0.470)	1.311 (0.450)
PUBLIC	0.347 (0.110)	0.341 (0.100)	0.894 (0.250)	0.881 (0.450)
SUBSIDIARY	4.728 (1.240)	4.857 (1.260)	8.840** (1.990)	8.824** (1.990)
RESTRICT	–4.471 (–1.030)	–3.713 (–1.010)	–5.490 (–1.220)	–5.264 (–1.214)
MONITOR	12.604** (2.180)	11.242** (2.430)	11.74** (2.130)	11.280** (2.760)
OFFICIAL	2.408 (0.409)	3.220 (0.740)	–0.950 (–0.150)	–0.650 (–0.110)
Commercial banks	–2.221 (–0.600)	–2.800 (–0.820)	9.565** (2.050)	9.481** (1.950)
Investment banks	3.660 (0.980)	3.160 (0.870)	14.890** (2.660)	14.850** (2.620)
Finance and securities companies	8.180* (1.850)	–6.050* (–1.840)	21.500** (3.350)	21.453** (3.370)
Savings banks	0.890 (0.550)	0.950 (0.600)	16.460** (2.560)	16.530** (2.620)
Holding finance companies	–5.740 (–1.150)	–6.050 (–1.220)	6.591 (1.340)	6.612 (1.370)
Government savings banks	17.280** (3.120)	17.089** (3.290)	30.590** (3.450)	30.646** (3.470)
Islamic banks	–7.580 (–1.320)	–8.169 (–1.500)	5.570 (1.200)	5.418 (1.140)
Others	–12.910** (1.950)	–13.200** (–2.100)	13.900** (3.050)	14.050** (3.320)

Constant	–66.000 (1.400)	–72.620 (1.100)	–27.310 (–0.310)	–30.030 (–0.350)
Country dummies	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes
R-square	0.114	0.116	0.112	0.115
Observations	1,359	1,359	1,359	1,359

Note: Statistical significance levels: * 10 percent; ** 5 percent; *** 1 percent. t-statistics in parentheses; FE = fixed effects; RE = random effects.

Table 3. Determinants of Bank Performance Based on Rate of Return on Average Assets (ROAA) Using IV Estimation in Selected Southeast Asian Banks

	FE2SLS		RE2SLS	
	(1)	(2)	(3)	(4)
TE_TA	6.675*** (3.880)	6.474** (4.720)	7.475** (4.020)	7.550** (3.850)
LOANLR_GL	–11.420* (–1.710)	–1.478** (–2.800)	–11.428** (–2.070)	–11.475* (–1.850)
LA_TA	0.677 (0.76)	0.480 (0.990)	1.435 (1.200)	1.161 (1.060)
NEA_A	–0.645 (–0.430)	-	0.021 (0.200)	-
OFFBAL_A	0.049* (1.740)	0.052* (1.700)	0.022 (0.380)	0.047 (1.220)
FOREIGN	0.435** (2.040)	0.418** (2.320)	0.349** (2.060)	0.529** (2.490)
PUBLIC	0.091 (0.410)	0.014 (0.440)	0.125 (0.5900)	0.228 (0.730)
SUBSIDIARY	0.313** (1.850)	0.317* (1.690)	0.652** (2.810)	0.570** (4.180)
RESTRICT	–0.166 (0.620)	–0.125 (–0.490)	–0.254* (–1.860)	–0.263** (–2.060)
MONITOR	0.591 (1.450)	0.540 (1.400)	0.475 (1.450)	0.592** (2.010)
OFFICIAL	0.198 (0.590)	0.253 (0.770)	–0.010 (–0.070)	–0.025 (–0.150)
Commercial banks	–1.040** (–2.700)	–1.088** (–4.400)	–0.954** (–1.990)	–1.388** (–2.750)
Investment banks	–0.830* (–1.830)	–0.879** (–2.450)	–0.846 (–1.400)	–1.270** (–2.080)
Finance and securities companies	–0.391 (–0.970)	–0.424 (–1.230)	–0.200 (–0.390)	–0.689 (–1.260)
Savings banks	0.439 (0.320)	0.445 (0.360)	1.033 (0.860)	0.394 (0.310)
Holding finance companies	–1.431** (–3.980)	–1.463** (–4.800)	–1.313** (–2.460)	–1.740** (–3.110)
Government savings banks	–0.295 (0.450)	–0.319 (–0.829)	–0.037 (–0.070)	–0.524 (–1.030)
Islamic banks	–0.822*** (3.050)	–0.896** (–2.650)	–0.815 (–1.320)	–1.068** (–1.940)
Others	–2.044** (–4.310)	–2.080** (–4.200)	–1.890** (–3.070)	–2.290** (–3.610)
Constant	–3.869 (–0.700)	–4.121 (–0.950)	–4.220 (–0.390)	–3.920 (–0.891)
Country dummies	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes
R-square	0.154	0.152	0.159	0.152
Observations	1,220	1,220	1,220	1,220

Note: Statistical significance levels: * 10 percent; ** 5 percent; *** 1 percent. t-statistics in parentheses; FE2SLS = two-stage least square fixed effects; RE2SLS = two-stage least square random effects (Baltagi, 2001).

Table 4. Determinants of Bank Performance Based on Rate of Return on Average Equity (ROAE) Using IV Estimation in Selected Southeast Asian Banks

	FE2SLS		RE2SLS	
	(1)	(2)	(3)	(4)
TE_TA	34.100 (1.22)	26.870 (1.170)	43.250 (1.430)	40.688 (1.250)
LOANLR_GL	–1.226* (–1.670)	–1.240* (–1.730)	–1.255* (–1.750)	–1.210* (–1.890)
LA_TA	13.060 (1.020)	6.369 (0.750)	24.730 (1.380)	16.320 (0.990)
NEA_A	–23.030* (–1.770)	-	–13.830* (–1.650)	-
OFFBAL_A	1.268** (2.320)	1.530** (2.430)	0.928** (2.170)	1.465** (2.560)
FOREIGN	3.340 (1.020)	2.720 (1.000)	1.980 (0.660)	4.190* (0.990)
PUBLIC	4.412 (1.060)	0.095 (0.280)	1.134 (0.260)	2.670 (0.560)
SUBSIDIARY	0.822 (0.230)	4.550 (1.280)	9.440** (2.360)	8.170** (2.620)
RESTRICT	–5.170 (–1.290)	–3.067 (–1.000)	–6.490*** (–3.140)	–6.150*** (–3.050)
MONITOR	14.440*** (2.550)	11.320** (2.120)	12.940*** (3.100)	12.825*** (3.050)
OFFICIAL	1.200 (0.250)	3.182 (0.700)	1.940 (0.890)	1.460 (0.630)
Commercial banks	–8.710** (–2.340)	–10.390*** (–2.930)	–6.643** (–1.990)	–13.533** (2.170)
Investment banks	–5.420 (–1.280)	–7.180* (–1.710)	–4.560 (–0.620)	–11.582 (–1.490)
Finance and securities companies	2.140 (0.5310)	1.200 (0.300)	6.110 (0.880)	1.147 (0.220)
Savings banks	–4.980 (–0.590)	–4.710 (0.050)	5.770 (0.640)	3.291 (0.380)
Holding finance companies	–12.660** (2.300)	–13.980** (–2.650)	–10.010* (–1.650)	–16.670** (–2.510)
Government savings banks	8.250 (0.940)	7.410 (1.140)	12.613* (1.650)	5.230 (0.780)
Islamic banks	–6.170 (0.670)	–8.880** (1.930)	–4.550 (–0.520)	–9.840 (–1.490)
Others	–19.002** (–2.620)	–22.410*** (–3.890)	–16.040*** (–2.990)	–22.520*** (–3.650)
Constant	–53.300 (–0.570)	–69.090 (–1.800)	–68.000 (–1.020)	–88.100 (–1.160)
Country dummies	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes
R-square	0.100	0.110	0.110	0.100
Observations	1,220	1,220	1,220	1,220

Note: Statistical significance levels: * 10 percent; ** 5 percent; *** 1 percent. t-statistics in parentheses; FE2SLS = two-stage least square fixed effects; RE2SLS = two-stage least square random effects (Baltagi, 2001).

The estimation based on average equity, ROAE, indicates, however, that the capital-requirement variable is not statistically significant. This is also quite robust with the FE2LS and RE2LS, which indicate that imposing a higher equity share on the banks tends to have some impact on the returns to shareholders of the bank.

The variables capturing the bank liquidity effects are not statistically significant and negative for both ROAA and ROAE. The non-earning assets to total assets ratio (NEA_A) is statistically significant in Table 2 using ROAE and not ROAA. In fact, it is very robust for the FE2LS and RE2LS. The higher bank liquidity affects the bank profitability but it does manage the liquidity risk of the banks. The negative impact clearly identifies the importance of non-earning assets to the profitability for shareholders. The ratio of liquid assets to total assets is not, however, statistically significant in our estimation.

We also noticed that the loan loss reserve to gross loans ratio (LOANLR_GL) is negative and statistically significant in FE2SLS and RE2SlS estimations as indicated in Tables 3 and 4. The provisions for more reserves to protect loan losses and more liquid assets tend to reduce the profitability of banks and the impact is greater on ROAA.

The off-balance-sheet effect of banks (OFFBAL_A) is positive and statistically significant for the estimation with return on equity, ROAE. This reflects that shareholders have a greater incentive to undertake more risk with off-balance-sheet activities to maintain high returns on their equities. This result is also robust to the FE2SLS and RE2SLS estimations. The positive coefficient of off-balance-sheet activities indicates that managing the non-traditional activities of banks will lead to positive outcomes on managing the risk-taking activities of the banks.

Foreign participation and ownership in the financial sector tend to yield positive outcomes on overall banking performance, as indicated by the positive and statistically significant coefficient for the FOREIGN variable in the ROAA estimation. Again, the result is robust to the 2SLS estimations given in Table 4, indicating that financial openness to foreign investment and competition does improve bank performance. We

do not, however, observe any impact of foreign ownership on bank performance using the return on equity, ROAE.

Banks that are subsidiaries and banks taking ownership of companies tend to increase bank performance and efficiency, as indicated by the positive coefficient of the SUBSIDIARY variable for both ROAA and ROAE estimations. This result is statistically significant at the 5 percent level and robust to FE2SLS and RE2SLS estimations. This clearly indicates that mergers and acquisitions by banks do have a positive impact on their rate of returns, although there could be moral-hazard issues if banks take ownership of companies and if banks are bought out by corporations. Thus, there are again some trade-offs in balancing competition and risk taking with the overall stability of the financial markets.

The results indicate that the types of banking activities have different impacts on the efficiency of banks in Southeast Asia and thus diversification of banking activities is important to maintain banking performance and efficiency. Commercial savings banks and holding finance companies tend to have lower impacts on banking efficiency.

4.2. Bank Regulation and Supervision

The results for the banking regulation and supervision variables of RESTRICT (restrictions on activities that generate non-interest income) and MONITOR (intensity of private monitoring) are statistically significant and robust. The OFFICIAL (index of official supervision) variable, however, is not statistically significant in our estimation.

The MONITOR variable in our study is positive and statistically significant at the 1 percent level for the ROAE estimation. This result is very robust in our FE2SLS and RE2SLS specifications. This result indicates that monitoring is an effective tool to manage the risk-taking activities of the banks, and that it also has a positive impact on the return on equities. Compared with monitoring, the RESTRICT variable is negative and reduces the returns on equities. This suggests that restricting activities for non-interest income is a very strong tool that directly affects the activities of the banks and

also provides a disincentive to bank investment. It is likely that more developed and well-diversified financial markets will rely heavily on the private sector to provide more information on the activities of the banks to depositors and potential investors. Thus it might be productive to provide more information and monitor the activities of the banks.

The above results suggest that the regulatory role of central banks in the region is crucial in maintaining bank efficiency and stability in the financial sector. Monitoring the balance-sheet activities of banks tends to improve the productive performance of banks in our sample. Although the bank supervisory variable of OFFICIAL is not statistically significant in our estimations, it is important as the transparency of supervisory functions of the central bank produces positive outcomes for the banks and improves their efficiency.

5. Conclusion

This paper studied the determinants of bank performance in Southeast Asia using individual bank data from 1994 to 2008. The study carefully controlled for endogeneity issues by adopting the two-stage least square estimation of fixed and random effects as provided by Baltagi (2001). The results indicate that increases in capital requirements tend to improve bank performance in terms of higher returns on average assets (ROAA). This clearly indicates that banks tend to diversify and manage their risk better with higher capital requirements. Higher capital requirements in terms of a higher total equity to total assets ratio seems to improve bank performance, which is in line with managing the risk-taking activities of banks. This result is in line with the recommendations in the Basel II Accord (BIS, 2006), which suggest that capital requirements could mitigate the credit and operational risk of banks by shifting the risk-

taking activities to the managers and owners of banks. Recently, the Council of International Relations (2009) also suggested that capital requirements could be used as an effective tool to discipline the risk-taking activities of large banks. To manage the risk of larger banks, they should have higher capital requirements than smaller banks if all other factors are equal. Furthermore, capital requirements linked to risk-sensitive assets and short-term debt could effectively discipline the risk-taking activities of the banks. Thus, capital requirements should be higher for banks that have risk-sensitive assets and finance their operations with short-term debt.

The results of this paper also highlight certain key activities that could be valuable to policymakers in improving banking efficiency and stability in the financial markets. The results indicate that increases in capital requirements tend to improve bank performance in terms of higher returns on average assets (ROAA). This clearly indicates that banks tend to diversify and manage their risk better with higher capital requirements. Higher capital requirements in terms of a higher total equity to total assets ratio seem to improve bank performance, which is in line with managing the risk-taking activities of banks. This result is in line with the recommendations of the Basel II Accord (BIS, 2006). This is an important result in light of the GFC precipitated by the financial innovation activities of banks, which unbundled their risky loans through derivative and structured products such as collateralized debt obligations (CDOs), leading to excessive risk in the market. Thus, it is crucial to manage the risk associated with different types of off-balance-sheet and financial innovation activities as the financial markets in the Southeast Asian region develop, since non-traditional activities have a direct impact on the returns on equity.

It is also interesting to observe from the results that corporate linkages and mergers of banks tend to increase bank profitability. Based on experience from the AFC, these moral-hazard linkages between corporations and banks have to be carefully monitored and these relationships made transparent to ensure the stability of financial markets. Although there has been greater monitoring of such linkages since the AFC, such

linkages still exist in the Southeast Asian region and require continued monitoring by central banks.

Private-sector monitoring of financial activities also seems to have a positive impact on the performance of banks. Given the diverse stages of growth and development in the region, the supervisory role of central banks is crucial, but the results of the paper highlight the importance of private-sector monitoring as a better risk-management tool compared with bank regulation and supervision. In particular, central bank restrictions on the risky activities of banks tend to reduce bank profitability, highlighting the importance of a better system of monitoring and supervising the risk-sensitive activities of banks.

The results of the paper also have important implications for liberalizing the financial sector by increasing foreign ownership and participation in the financial sector. The results indicate that there are positive impacts on bank performance from foreign ownership and participation. Thus, the financial openness of the financial markets will be important for their development and regional integration.

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Appendix

Table A2. Description of Variables

Period	1994–2008
Country	**Coverage of number of banks**
Indonesia	129
Malaysia	131
Singapore	110
Thailand	73
The Philippines	83
Vietnam	43
Description	**Variables**
Total equity/total assets	TE_TA
Loan loss reserve/gross loans	LOANLR_GL
Liquid assets/total assets	LA_TA
Non-earning assets/assets	NEA_A
Off balance sheet/assets	OFFBAL_A
Majority foreign owned	FOREIGN
Public bank (> 25% govt ownership)	PUBLIC
Subsidiary or has subsidiary	SUBSIDIARY
Bank regulation and supervision	
Bank regulation: restrictions on activities that generate non-interest income	RESTRICT
Bank supervision: intensity of private monitoring	MONITOR
Bank supervision: official supervision	OFFICIAL
Return on average assets	ROAA
Return on average equity	ROAE