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CAUSES AND CONSEQUENCES OF GLOBALIZATION IN EAST ASIA: WHAT DO THE MICRO DATA ANALYSES SHOW?

Edited by
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Acknowledgements

This report consists of the papers from one of ERIA's research working groups in Fiscal Year 2009. It has a broad mandate to conduct research on the impact of globalization on performance and/or behavior of firms, with particular with a particular focus on micro data analysis. As indicated in the first chapter of this report, a number of feature of globalization impact or firm performance are addresses so far, including productivity, exporting behavior, firm dynamics, international production networks, impact of foreign direct investment, etc. All papers presented in this report were presented in three workshops held in Jakarta over the period of August 2009 to February 2010.

We would like to express our appreciation and gratitude, first and foremost, to the members of working group who have actively contributed to outcome of the research in this fiscal year.

We are deeply indebted to Professor Shujiro Urata for his active engagement in discussion of all research papers and for his intellectual leadership. We express special thanks to Professor Fukunari Kimura, Chief Economist of ERIA, for his encouragement and support for the research project.

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EXECUTIVE SUMMARY

1. Background and Objectives

Economists have long recognized the gains from international trade. If might be fair to say that most, if not all, economists believe that globalization and economic growth are intimately related and, furthermore, that globalization has brought enormous benefits for many countries and people.

The current state of our knowledge, as well as the past diverse experiences of countries, suggest that there are still many questions, old and new, that need to be explored in order to improve our understanding of various aspects of the globalization that we are facing today, including its causes and consequences. This research project contributes to the literature by an attempt to answer some of these questions.

Most of these questions are related to the relationship between globalization on the one hand, and growth, productivity, reallocation, location of industries and firms, employment and wage inequality, market structure, etc. on the other. Developing answers to these questions is likely to be a pivotal step toward maximizing the potential benefits from globalization, as well as sharing those benefits more widely not only across countries but also across various economic agents in a country. All papers contained in this report tackle some of the questions raised above.

One of the key features of this report- micro data analysis of globalization -stems from the recognition that many of the old and new issues raised above can be addressed better by utilizing micro datasets. We also expect that micro data analysis can potentially give us much richer information on various issues of globalization, such as the exact channels through which the benefits of trade materialize the possible differential effects of trade and investment liberalization, and the existence of factors or policies that are complementary to trade and investment liberalization.

2. Key Findings and Conclusion

Some key findings and conclusions from the chapters in this report are the presented below.

Learning from the experience of Japanese FDI to developing countries, reduction in trade costs between host and home countries has different impacts on the type of foreign direct investment (FDI), and the nature of international production process leads to firms to adopt vertical FDI more than the traditionally horizontal FDI.

Trade liberalization contributes to higher growth of variety in the import of intermediate inputs which has a favorable impact on productivity growth. Moreover, trade liberalization also motives higher frequency of product switching, defined as simultaneously adding and dropping products, and this evidently improves firm efficiency. All these are the lesson from the Korean experience in the 1990s.

Three studies in this project, which elaborates the case study of the Philippines, Vietnamese, and Indian manufacturing, confirm that trade and investment liberalization leads to productivity gains. The Vietnamese study shows that the high firm entry rate in early 2000s increases industry-level productivity, while the Philippines study establishes a relationship that high effective rate of protection reduces productivity growth of some groups of firms. Productivity improvement is also observed in the Indian study. The Vietnamese study further shows that gain in productivity does not only occur at industry level, but also at firm level.

The Indian study further suggests that importance of imported goods in improving productivity suggests that firms are learning from imported and more advanced technology. This is important to note, since positive productivity gains seem to have accrued due to liberalization of the imports of intermediate inputs and capital goods.

The study that utilizes the Malaysian innovation survey finds a rather weak link between exporting and productivity in Malaysian manufacturing. Productivity is driven by capital intensity and human capital but this may not necessarily translate into export dynamism. Innovation, whether it is product or process innovation, is likely to be the key driver in exporting.

There is more evidence for the literature on the positive impact of multinationals operation in a country. Another study on the Vietnamese manufacturing reveals evidence on the existence of productivity spillovers from the presence of multinationals. It is indicated that the magnitude of the spillover effect is large for the Vietnamese case. The study nonetheless finds that the potential for the spillover effect is limited by the substantial technology and factor intensity gap between the multinationals and domestic firms.

One of the Thai country papers in this project examines the hypothesis of using imports as a market discipline mechanism. Utilizing data from the Thai manufacturing census, the study finds that that while imports have the potential to act as a market discipline, the effect on the price-cost margin appears to be different between two categories of imports. It is the importation of parts and components instead of final goods that acts as a market discipline.

Learning from the experience of China, a study in this project finds that exporters tend employ more unskilled labor than non-exporters. This is true for both Chinese exporters in the ordinary trade regime and foreign-invested exporting firms in the processing trade regime. The study further finds that that FDI is associated with a higher share of skilled labor in total employment, which supports the Feenstra-Hanson theory of outsourcing.

The study that utilizes the Indonesian manufacturing plant data observes the source of output, employment, and productivity over period 1990-2006 which comprises the sub period of before, during, and post the Asian 1997/98 crisis. The study finds that high output growth during the pre-crisis period was driven significantly by the existing firms. The trend, however, reversed in the 1996-2000 period where the source of manufacturing output growth came from new entrants. Exporting firms consistently provide more jobs than non-exporting firms, and interestingly, prior to the crisis, non-FDI firms created many more jobs compared with FDI firms. The position was reversed post-crisis with FDI firms creating more jobs than non-FDI.

The other Thai paper in this project addresses the migration issue as a form of structural adjustment process coming out as an impact of the globalization process. The empirical investigation is based on in-depth interviews with fifty firms in the industry during November 2009 and February 2010.

This study finds that not all firms opt to hire unskilled foreign workers. There are systematic differences in firm characteristics between firms who hire foreign workers and those who do not. The latter are relatively large in size (both in employment and sales), perform better, and actively undertake upgrading activities. The former are struggling to maintain their profit margins, are relatively small, and do not invest sufficiently in upgrading activities. Interestingly, hiring foreign workers is not their first response, but is a reflection of the fact that firms have yet to successfully undertake functional upgrading. Firms which are late to undertake functional upgrading are likely to hire foreign workers during their structural adjustment process. Allowing the migration of unskilled foreign workers on a temporary basis would be a win-win-win solution for labor importing and exporting countries, as well as for the migrants themselves. Nevertheless, as a condition for allowing firms to hire unskilled foreign workers, government must guard against any retarding effect on the firms' upgrading efforts.

3. Policy Implications

Some policy implications can be drawn from the findings and conclusion of all studies conducted in this project. These are summarized below.

First, trade and investment liberalization is not only a policy to raise static consumer welfare, but also a policy that promotes growth. Trade may not be a sufficient condition for strong, sustained growth, but it is a necessary one. There is pervasive evidence across the studies in this project that trade and/or investment liberalization had a positive dynamic effect on the aggregate economy studied.

Second, trade and investment liberalization should be pursued as part of a broad national growth strategy. In order to enhance the beneficial effects from trade and investment liberalization, other complementary policy ingredients seem necessary. Most studies in this project find the existence of factors—national, industry, and firm characteristics or policies—that affect the relationship between trade/investment liberalization and productivity improvement and growth.

Third, enhancing the absorptive capacity, or human capital, of domestic workers and firms might be necessary in order to gain the potential benefits from international knowledge spillovers: i.e., the advantage of backwardness. As in the study of Vietnamese manufacturing, the degree of FDI spillover is found to be positively affected by measures of the absorptive capacity of domestic firms.

Fourth, trade cost reduction should be on the policy agenda at a high priority for countries that have yet to join the international production networks. In particular, improving trade-related infrastructure is likely to be an important ingredient of policy.

Not all countries benefit from the formation of international production networks. In many developing countries, transport cost remains a key bottleneck. Lack of transport infrastructure will raise transport cost and make markets isolated. Markets that are isolated may also feature little competition, and this will worsen within-country poverty and distribution issues.

Fifth, enhancing the credibility of trade and investment reform is likely to raise the effectiveness of trade/investment liberalization. Pursuing trade and investment liberalization as part of a broad growth strategy, including other non-reversible policies, is likely to be one such strategy.

Finally, policy measures are necessary to ease the burdens of economic agents who have to make adjustments or who are on the losing side of change. This will be particularly the case when the trade or FDI involved is outsourcing-related.

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CHAPTER 1

Causes and Consequences of Globalization in East Asia: What do the Micro Data Analyses Show?

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1. Background and Objective

This report consists of the papers submitted to ERIA's research project in **Fiscal Year 2009, No 2 (Productivity Impact of Trade and Investment Liberalization)**. The research project is under the fiscal year research pillar of "Deepening Economic Integration".

This topic was one of ERIA's research themes in fiscal year 2009. The broad theme is globalization and its impacts on East Asian countries, with a particular focus on micro data analysis. As in Weinstein (2005), we understand "globalization" as referring to a process or an evolution of closer economic integration by way of increased trade, foreign investment, and immigration. Under the broad theme, country authors chose the specific topics that might be of interest in the context of their own countries. Over the past year, there have been three workshops—the proposal workshop, the midterm workshop, and the final workshop—and the papers have been revised with comments from the discussants and other participants of the workshop, as well as the editors. The papers cover not only the impact on productivity but also many other interesting aspects of globalization relevant for East Asian countries. After the workshops, we decided to give the report the following title, **"Causes and Consequences of Globalization in East Asia: What do the Micro Data Analyses Show?"**

There have been numerous studies of the causes and consequences of globalization, but we feel that the potential value added of this project comes from the *micro data analysis* on *East Asian* countries. It is true that various aspects of globalization have been previously analyzed, but analyses based on micro data are relatively scarce. There might be many micro data analyses on other regions—primarily North and South America and Europe—but not many such analyses exist for East Asian countries. East Asia is a particularly good place for examining this issue for several reasons to be discussed below.[1] This research project tries to fill this gap.

There is no doubt that economic growth is not only the single most important subject in economic science but also the main vehicle for raising the living standards of thousands of millions of people in the world. Also, economists have long recognized

[1] This project includes India, in addition to eight East Asian countries.

the gains from international trade. So, is international trade, or more broadly, globalization related to economic growth? If might be fair to say that most, if not all, economists believe that globalization and economic growth are intimately related and, furthermore, that globalization has brought enormous benefits for many countries and people. This belief seems justified if we look at the long-run historical experience of the world economy. Each of the two waves of globalization, with the first corresponding to the period from late nineteenth century to World War I and the second corresponding to the post World War II period, was accompanied by high rates of growth of the world economy, by historical standards. The inter-war years witnessed a worldwide increase in protectionism and decline in trade, as well as stagnation of economic growth.

Nevertheless, trade or globalization skepticism has also persisted over the past decades, and the debates and controversies among economists and policy makers, particularly over the relationship between trade and growth, have soared to prominence in the past decade. There are several reasons for the skepticism. First, various theoretical studies, prominently those based on endogenous growth theories, suggest that the relationship between trade or trade liberalization and growth is ambiguous at best; trade liberalization can lead to either faster or slower growth. Here, the key is whether trade liberalization facilitates international knowledge spillovers and/or whether trade liberalization increases the incentives invest in research and development (R&D) or in human capital.

Secondly, the controversies are at least partly related to the mixed empirical evidence on the trade-growth nexus. For while most important empirical studies report a positive relationship between trade and growth, criticisms have been raised with regard to the data, measurement of trade policy, empirical techniques, and model specifications. The most notable examples are the controversies on cross-country evidence on trade and growth.[2] Nevertheless, it is worthwhile to note that, while the debate on the macroeconomic effects of trade on growth is still quite open, there are a growing number of studies that find positive correlations between trade flows and international knowledge flows. These knowledge flows are crucial for the realization of

[2] See, for example, Sachs and Warner (1995) for evidence in favor of a trade-growth nexus and the criticisms raised by Rodriguez and Rodrik (1999).

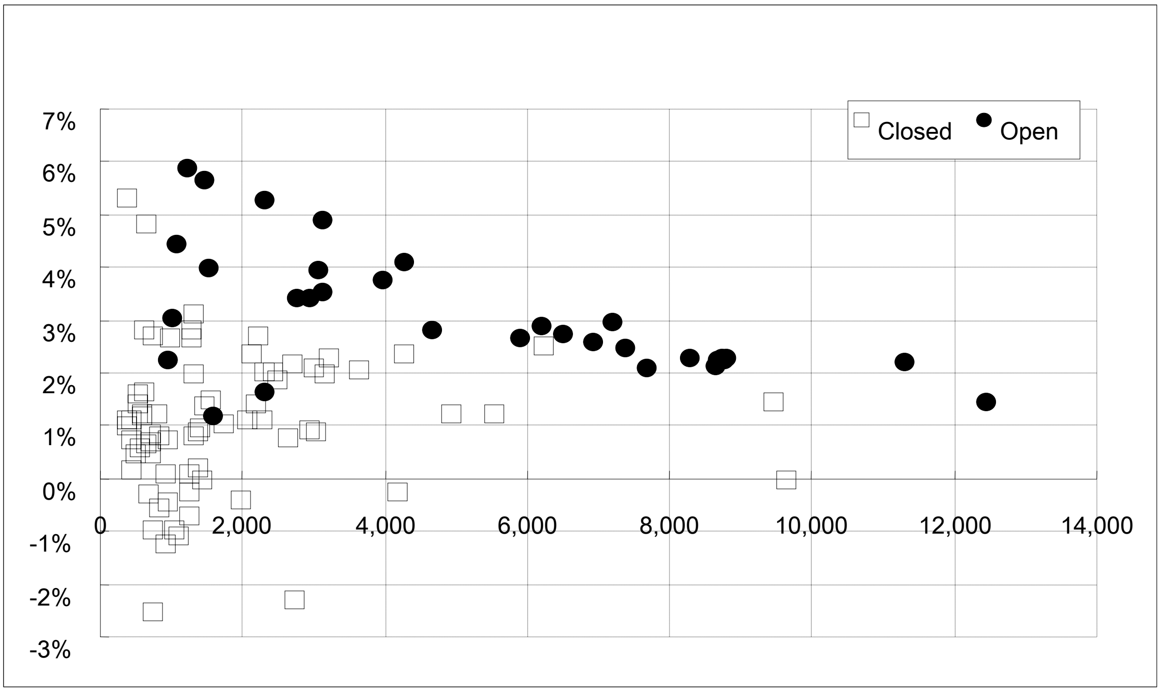
the dynamic gains from trade (Coe and Helpman, 1995 and Coe *et al.*, 1997, etc.). For example, Coe and Helpman (1995) found that technology spillovers are higher when a country imports relatively more from high rather than low-knowledge countries. In their subsequent study, Coe *et al.* (1997) reported that total factor productivity (TFP) in developing countries is positively related to the R&D in their industrial country trading partners, and that the effect is stronger when the machinery and equipment import data are used.

Thirdly, but more importantly, even if international trade or globalization brought about benefits for the world as a whole, there is a strong recognition that the benefits have not been evenly distributed, not only across countries but also across people within a country. After World War II, a reversal in protectionism started among the industrialized countries, and spread to the developing countries in the 1970s. Trade reforms were further expanded and consolidated in the 1980s and 1990s across the developing world: in South Asia, East Asia, Latin America, Eastern Europe, and, to a lesser extent, in Africa and the Middle East. Yet the results of trade reform have varied, and have sometimes fallen short of expectations (World Bank, 2005).

Indeed, the post-war growth experience is consistent not only with the beneficial effects of openness, but also with the uneven effects of trade on growth.[3] Figure 1, drawn from Sachs and Warner (1995), shows the relationship between the post-war growth rate of 84 countries and their initial income, distinguishing between "closed" and "open" countries by their own criteria. Here, the open countries are denoted by solid dots while the closed countries are denoted by blank squares. If we compare growth rates of open and closed countries, holding constant the level of initial income, the growth rates of open countries tend to be higher. Based on this finding, Sachs and Warner (1995) suggested that open countries tend to grow faster. Later, Lucas (2009) re-interpreted this figure,

[3] O'Rouke and Williamson (1999) argue that the first wave of globalization in the nineteenth century worked not only as a force of convergence but also as a force of divergence. Helpman (2004) reviews the sizeable theoretical literature and discusses the conditions under which trade works as a force of convergence or divergence.

Figure 1. The Relationship between Openness and Growth: Sachs and Warner (1995)



and suggested that, among the set of open countries, there is a convergence. However, Lucas (2009) also notes that even among the set of open countries there are large variations in growth outcome starting from the same level of initial income; in some cases, the growth rates of open countries fall far short of those recorded by not only other open economies but also by some closed economies. Furthermore, although systematic cross-country evidence of the effect of trade on within-country income inequality is hard to find, there is a growing concern that globalization has been an important factor raising within-country inequality, not only across skill groups but also across regions.[4]

WTO (2008) succinctly summarizes the various concerns raised in this regard in the following two paragraphs.

[4] Feenstra wrote various papers suggesting that outsourcing has increased the demand for skilled labor not only in developed countries but also in developing countries.

> *"…Comparative advantage may be meaningless if the costs of shipping a product are higher than the costs of producing it. The overall gains for a country will matter little to those who lose their jobs as a result of specialization driven by trade. These people may have difficulties in taking up positions in expanding sectors because they are not adequately trained. The poor may be particularly vulnerable, since they do not have the means to ensure a smooth transition from one activity to the next.*
>
> *Industries do not spread their operations evenly across countries, but tend to concentrate in particular locations. These dynamics can be self-reinforcing, leading to agglomeration in some places and de-industrialization in others. At the same time, with reductions in transport and other trade costs, production processes can be split up into more and more individual steps. This has allowed firms in remote locations to become leaders in specialized activities and to join international production networks. Others remain outside these networks, often due to institutional, administrative and other constraints. (pp. 13. WTO 2008)"*

The current state of our knowledge, as well as the past diverse experiences of countries, suggest that there are still many questions, old and new, that need to be explored in order to improve our understanding of various aspects of the globalization that we are facing today, including its causes and consequences. Most of these questions are related to the relationship between globalization on the one hand, and growth, productivity, reallocation, location of industries and firms, employment and wage inequality, market structure, etc. on the other. Does trade and investment liberalization lead to economic growth and productivity improvement? Is there still a role for infant industry protection? Does trade and investment liberalization improve or worsen wage inequality? How does the reduction of trade cost affect the location choice of multinational firms? Does trade have a disciplining effect on domestic firms? What are the relationships between trade, innovation, and the product choices of firms? Does trade and investment liberalization have differential effects on firms and industries? If so, what are the firm, industry, and country characteristics that shape the relationship between trade/investment liberalization and various outcome variables? These are only a few examples of questions that need further scrutiny. Developing answers to these questions is likely to be a pivotal step toward maximizing the potential benefits from globalization, as well as sharing those benefits more widely not only across countries but also across various economic agents in a country. All papers contained in this report tackle some of the questions raised above.

One of the key features of this report- micro data analysis of globalization -stems from the recognition that many of the old and new issues raised above can be addressed better by utilizing micro datasets. We also expect that micro data analysis can potentially give us much richer information on various issues of globalization, such as the exact channels through which the benefits of trade materialize, the possible differential effects of trade and investment liberalization, and the existence of factors or policies that are complementary to trade and investment liberalization. In this regard, it should be noted that recent advances in theoretical and empirical studies based on firm heterogeneity have made a considerable contribution to our knowledge in this area. There have been studies, both theoretical and empirical; suggesting that even in a narrowly defined industry there is considerable heterogeneity among firms, particularly in terms of productivity. According to these studies, industry-level productivity growth can arise through the entry and exit of firms, share shifting from less productive to more productive firms, and productivity improvement in continuing firms. Building on this literature, and following an influential theoretical work by Melitz (2003), a growing number of studies, has examined the effects of trade on the process of industry productivity growth: that is, entry/exit and share shifting. In essence, his work and many of the variants of his model showed that trade and trade liberalization can enhance the productivity of the aggregate economy by reallocating resources from less to more productive firms, even when there is no change in firm level productivity. It has been argued that this effect provides another source of dynamic gains from trade, on top of conventional channels, such as scale, variety, and the pro-competitive effect (i.e. lower mark-ups), although there are others suggesting that the heterogeneous-firm-based literature does not prove the existence of “new” gains from trade. Regardless, it seems clear that the heterogeneous-firm-based literature has made a contribution to understanding more clearly the mechanism by which trade promotes productivity and growth. Some of the papers in this report take this literature as their background.

Before describing the structure of the report and the questions raised in each paper, we intend to discuss briefly why this type of micro data analysis of globalization is particularly interesting for East Asian countries. Above all, most East Asian countries are characterized by relatively open trade and investment regimes compared with other developing countries, and have experienced rapid de facto integration recently, not only among themselves but also with countries in other regions. Also, they have exhibited most dynamic growth performances for the past decades. As a consequence, the effects of globalization are likely to show up in a relatively short period of time for the dynamic countries of East Asia. If this is the case, it is a great advantage for this type of research, given the usual constraint that micro datasets are generally consistently available for only a relatively short period of time. So we expect that any proposed benefits or costs of globalization are likely to show up clearly in East Asian countries.

Another reason that East Asia is an interesting place for this type of research is that East Asia covers countries that are very heterogeneous in many respects. They differ not only in terms of level of development and size, but also of liberalization strategies and economic structures. In terms of foreign direct investment and migration flows, East Asia includes both home and host countries. These diverse country characteristics provide us with the opportunity to assess whether and how the effects of globalization differ across countries, and why.

Thirdly, East Asia is an appropriate place for analyzing the causes and consequences of the so-called “second wave of globalization”. Irwin (2005), as well as many other scholars, noted that the second wave of globalization is distinguished from the first wave in that outsourcing, or the formation of international production networks, driven by multinational firms, has rapidly expanded across the globe. In fact, it has been pointed out that the formation of international production networks has been most marked in the East Asian region. As a result, a large share of trade, particularly intra-regional trade, in East Asian countries comprises parts and components, while trade between East Asia and other regions is still dominated by finished goods. One frequently raised issue has been about the possibly differential effects of trade in parts and components, as distinguished from finished goods, on growth and income distribution in home and host countries. Although there is a large and growing literature on this issue, some of the papers of this report tackle it from a new perspective.

Finally, as is well recognized, the rise of China and its integration into the world economy is probably one of the most important economic developments in the post-war world. Over the past three decades China grew at nearly 10 percent per year, driven by the expansion of a modern, export-oriented industrial sector. Moreover the structure of China's exports has also been changing rapidly, away from low-tech labor intensive manufactures to medium- to high-tech skill intensive products. China also became the number one destination for foreign direct investment (FDI) from more advanced East Asian countries such as Korea and Japan. China's rise has had tremendous impacts through various channels not only on East Asian countries but also on the world economy as a whole. Most importantly the rapid growth of China itself, and the rapid improvement of the living standards of more than 1.3 million people, reversed the trend in world income distribution, which had been deteriorating for about 200 years since the industrial revolution. It also changed the patterns of world trade and capital flows, as well as the prices of goods and commodities. It has also deepened production fragmentation in East Asia to an unprecedented level (World Bank, 2006). So how did China's rise affect other East Asian countries? How did the formation of production networks affect China itself? Some of the papers in this report address issues that might be related to this question either directly or indirectly.

Now we briefly explain the structure the report, as well as the main questions raised in each paper. Key findings of each paper will be summarized separately below. This report consists of eleven papers on nine countries: Japan, China, Korea, Malaysia, Thailand (two papers), Philippines, Indonesia, Vietnam (two papers), and one South Asian country, India. As explained above, all papers address issues related to the causes and consequences of globalization. Specifically, nine papers examine the effects of trade and investment liberalization, although the outcome variables examined differ somewhat across the papers. One paper on Japan examines the causes, as well as consequences, of globalization, and one paper on Thailand examines the effect of cross-border labor inflows. One commonality running through the papers is that they all carry out micro data analysis. Another is that they examine whether there are any firm, industry, or country characteristics that affect the relationship between globalization and the outcome variables of interest.

The second chapter of this report, by Matsuura and Hayakawa, examines the causes underlying the rapid increase of Japanese FDI to developing countries. The research is motivated by the observation that Japanese FDI increased more rapidly for developing countries, which cannot be explained by trade cost reduction under the horizontal FDI (HFDI) theory. They raise two specific questions. Has the trade cost been reduced between Japan and other East Asian countries? Does the reduction of trade cost make firms more likely to choose vertical FDI (VFDI)?

The next five chapters examine the relationships between trade and/or investment liberalization on the one hand, and productivity, innovation, and new product introduction on the other. Chapter 3 by Choi and Hahn examines the effect of trade liberalization on plant total factor productivity growth (TFPG), and within-plant across-product reallocation behavior, in the Korean manufacturing sector. As empirical framework, they take the variety-based endogenous growth models, which suggest that the increase in intermediate input variety via trade reduces the cost of R&D, and hence induces new product introduction and TFP improvement. Specifically, they examine whether the increase in imported intermediate input variety increased plant TFPG and measures of product switching (adding to, and dropping products from a firm's product range). Although the products added by a plant are not necessarily new products from the viewpoint of the economy, new products will show up as added products at plant level.

Chapter 4 by Narjoko examines whether trade and investment liberalization in Vietnam improved industry productivity by improving resource allocation across firms within industries, taking recent theories of heterogeneous firms as the theoretical background. This paper is motivated by the observation that Vietnam underwent a rapid trade and investment liberalization during the 1990s, and experienced a massive firm entry in the 2000s. To address this issue, he asks several questions. Did trade and investment liberalization contribute to the entry of firms? Is more firm entry associated with greater industry productivity growth? Did the firm entry contribute to the growth in productivity of firms having an intermediate level of productivity, as theoretically predicted?

Chapter 5 by Aldaba examines how trade reform from the 1980s to the mid-1990s and the reversal of trade liberalization in the early 2000s affected firm productivity in the Philippines. She asks whether the trade liberalization improved firm productivity and whether the effect changed with the introduction of selective protectionism. Another interesting question she raises is whether and how the anti-export bias present in the tariff structure affects the trade-productivity nexus.

Chapter 6 by Das also asks whether liberalized trade and FDI enhanced firm productivity in India. As is well known, India has implemented massive trade and investment liberalization since the early 1990s, which has attracted attention by many authors. However, Das goes on a step further to examine extensively whether the effects differ across firms depending on various firm characteristics, such as export orientation, import dependency, and foreign ownership.

Chapter 7 by Hoang and Pham examines the spillover effect from FDI to domestic firm productivity in Vietnam. Their paper's motivation reflects Vietnam's situation, because although Vietnam's rapid growth of output and investment has been driven by foreign direct investments, there has been controversy about the role of FDI firms in enhancing the productivity of domestic firms. They are particularly interested in examining whether measures of the absorptive capacity of domestic firms, as well as the technology gap between domestic and foreign firms, affect the degree of spillover.

The question asked by Cassey's paper, which forms Chapter 8, is broadly similar to the previous chapter: what are the relationships between exporting, productivity, and innovation in the Malaysian case? However, unlike the previous chapters, he explicitly considers innovation in the analysis. His paper is motivated by the recent emphasis by policy makers on innovation *and* productivity, seeking to generate a move up the value chain ladder in manufactured exports from Malaysia. He tries to examine whether there are empirical grounds for emphasizing innovation, rather than productivity, for achieving export success.

Kopaiboon's paper, Chapter 9, in contrast to the previous chapters, examines the static and traditional gains from trade in Thailand in a new context. That is, he examines the import-as-market-discipline hypothesis under the new environment of global production networking. His point of departure is that there are reasons for expecting that being a part of a global production network puts a stronger competitive pressure on the firm involved than not belonging to such a network. He examines, in particular, whether the market-disciplining effects are different between final goods imports and parts and components imports.

The next two chapters address the impacts of globalization on labor markets. Chapter 10, Zhang's paper, examines whether FDI, as well as exporting, had the effect of increasing firms' demand for skilled labor in China. Zhang observed the most rapid globalization and, at the same time, a rapid rise in wage inequality between skilled and unskilled workers. Zhang notes the contrasting implications of trade for wage inequality from the traditional Heckscher-Ohlin theory and the outsourcing theory proposed by Feenstra and Hanson; as an unskilled-labor abundant country, China is likely to experience a reduction of wage inequality due to traditional trade (measured by exporting), while it is likely to experience a rise in wage inequality due to outsourcing (measured by FDI).

Chapter 11, by Aswicahyono and Wicaksono, asks whether the reduced job growth rate in Indonesia after the Asian crisis was related to globalization. In this regard, they start by examining the relationship between job creation and firm characteristics. Specifically, they examine how the roles of FDI and exporting firms have changed over the crisis, relative to domestic and non-exporting firms. Although they do not examine explicitly the possible "China effect", it seems to be one of their candidate explanations.

The last Chapter, by Kohpaiboon and Kulthanavit, is the only paper in this report that examines the migration issue. Their paper has as its background the debates over policy regarding unskilled foreign workers in Thailand. They focus on one specific aspect of the debate: whether the foreign unskilled workers reduce the incentive of firms to upgrade. In order to examine this issue, they construct a survey dataset on the Thai clothing industry.

2. Summary of Key Findings

Matsuura and Hayakawa in Chapter 2 hypothesize that the increase of Japanese FDI to developing countries has been comprised more of vertical FDI (VFDI) rather than horizontal FDI (HFDI). VFDI is an investment that aims at reallocating part of a production process to cheap-labor countries, and engages in vertical production process division between host and home countries.

The empirical results suggest that a reduction of trade costs between host and home countries has different impacts on HFDI and VFDI. Such a reduction attracts even firms that are not highly productive to choose vertical FDI. The results however suggest that the reduction in trade costs does not lead firms to choose HFDI. Understanding that developing countries, particularly those in the East Asia region, have experienced a substantial reduction in the costs of trading with Japan, Matsuura and Hayakawa conclude that the increase of VFDI through a reduction in trade costs has led to the surge of FDI into developing countries.

In their investigation of the relationship between product variety and productivity, Choi and Hahn in Chapter 3 show evidence that tariff liberalization occurring in Korea indeed contributed to the growth of input variety during the period studied. Their empirical investigation utilizes plant-product data for the period 1991-98. They found that plants belonging to industries with higher variety growth in imported intermediates experienced higher productivity growth. This is a robust finding, after carefully controlling for the possible endogeneity issue.

Choi and Hahn further elaborate the variety-productivity relationships by testing the relationship between the imported intermediate variety and product switching. Product switching, defined as simultaneously adding and dropping products, can be understood as a part of a continuous process of “creative destruction” within plants. Active product switching behavior can enhance the resource allocation process within firms and thereby improve their production efficiency. The empirical results turn out to support this hypothesis. They suggest that increased imported intermediate variety had a positive impact on stimulating product switching by domestic plants.

In Chapter 4, Narjoko establishes a positive relationship between firm entry and industry productivity growth in Vietnamese manufacturing. The rapid trade and investment liberalization occurring in Vietnam since the early 1990s, which has substantially reduced the cost of establishing private enterprises, and of exporting, seems to have triggered a rapid growth in the number of firms entering the country’s manufacturing and services sectors. This finding suggests a reallocation of resources across firms within Vietnamese manufacturing towards the more productive firms, and there is, as a result, a higher industry-level productivity growth.

Narjoko further examines the within-sector impact of firm entry. Plotting the change in the distribution of productivity growth over time, there is evidence that many firms have become more productive. The productivity improvements, however, vary across firms. The work shows that the entry of firms lowered the productivity of firms located at the bottom of the distribution, but increased that of firms located at the centre of the distribution. It suggests that the increase in productivity, as results of the high entry rate, only applies in firms that have already acquired some intermediate level of productivity.

In Chapter 5, Aldaba examines how trade reforms in the Philippines during the 1980s and 1990s, as well as the reversal of the reforms in the 2000s, affected firm productivity in the country. She utilizes firm-level panel data that cover manufacturing industry for the period 1996 to 2006.

Aldaba's investigation provides some evidence in support of the hypothesis that trade liberalization leads to productivity gains, and protection leads to productivity losses. This is confirmed by a negative relationship between the effective rate of protection – as a proxy of the trade-policy variable in this study – and productivity growth that occurs in the group of industries that rely on imports. The failure of the Philippines government to implement a further tariff reform program in the early 2000s, which was instead replaced by a selective protectionist policy, seems to have held back productivity improvement arising from the earlier waves of trade policy reforms. The selective protectionist policy reverses the gains from previous trade liberalization episodes and has weakened the whole process of restructuring and reshuffling resources from less to more productive firms. Hence the change in the policy tends to allow inefficient firms in the industry to survive.

Chapter 6 presents the work by Das that examines the contribution of wide ranging policy reforms governing trade and investment, on the productivity of firms in Indian manufacturing, utilizing firm-level data of Indian manufacturing over the period 2000-08 when most of the reforms took place.

Das finds that productivity improvements have occurred since 2000. The investigation further explores the important determinants of productivity improvements across different type of firms. These include imports of raw materials and capital goods, firm size, quality of employment (captured by wage rates), and imported technology (measured by royalty payments). The importance of imported goods in improving productivity suggests that firms are learning from imported and more advanced technology. This is important to note, since positive productivity gains seem to have accrued due to liberalization of the imports of intermediate inputs and capital goods.

Das' study however finds that R&D in the Indian manufacturing sector is still at a nascent stage, possibly because of inadequate emphasis laid on this dimension by the private sector. Export orientation also does not seem to improve productivity. Das interprets this finding as a pattern whereby the import-dependent firms have been oriented towards the Indian domestic market and a possible import-export link is yet to be established. In other words, it is argued that liberalizing the import side, especially of capital and intermediate inputs, has largely helped consumers in domestic markets.

In Chapter 7, Hoang and Thanh investigate the existence of FDI spillovers in Vietnamese manufacturing for the period 2003-07, utilizing the rich firm-level data of the country's industrial sector. They argue that Vietnam is a good case study, because of bold investment policy reform since the mid 1980s. Indeed, it is well noted in the literature that FDI now plays a vital role in the Vietnamese economy, having become increasingly important over time.

Hoang and Thanh find evidence of the existence of spillover effects from the foreign presence in Vietnamese manufacturing. They indicate that the magnitude of the effects is large, and they further elaborate this finding by examining how technology and factor intensity differently affect domestic and foreign firms. Their results suggest that gaps in technology and skill intensity really limit positive spillovers from the presence of foreign or multinational firms.

Lee attempts to reveal the interrelationship between exporting, productivity, and innovation in Malaysian manufacturing. His analysis is presented in Chapter 8. As noted, Lee tries to find empirical grounds for emphasizing innovation, rather than productivity, in achieving success in exporting.

Utilizing firm-level data from three waves of Malaysian innovation surveys covering the period 1997-2004, Lee finds that the link between exporting and productivity is a weak one in Malaysia. Productivity is driven by capital intensity and human capital but this may not necessarily translate into export dynamism. Innovation, whether product or process innovation, is likely to be the key driver in exporting. There is some evidence that trade liberalization can promote exporting, but such policies may be less relevant to innovating firms. Furthermore, exporters are likely to be larger firms with foreign ownership. This is consistent with the present role of FDI and large multinational companies (MNCs) in exporting activities.

Kohpaiboon, in Chapter 9, examines the hypothesis of imports as a market discipline mechanism, using census data of Thai manufacturing. In his investigation, Kohpaiboon finds that while imports have the potential to act as a market discipline, their effect on price-cost margin (or, profitability) seems to be different across two types of imports. It is imports of parts and components, rather than final goods, which act as a market discipline. The higher the proportion of imported parts, the narrower the gap between price and marginal cost, thereby promoting more efficient use of scarce resources. The study thus provides evidence of gains from opening up international trade on resource allocation, and urges further liberalization. The finding particularly highlights gains from participating in global production networks in terms of growth opportunity and resource allocation efficiency.

Zhang examines how trade and FDI affect firms' demand for skilled labor in China's manufacturing sector, utilizing the large-scale firm-level census data of the sector. His testes whether there is a relationship between the demand for skilled labor and exports, FDI, or both of these. His empirical investigation and its analysis are presented in Chapter 10.

The empirical results suggest that exporters tend to employ more unskilled workers than non-exporters. The results hold for both Chinese exporters in the ordinary trade regime and foreign invested exporting firms in the processing trade regime. Although this finding is consistent with the Heckscher–Ohlin model, it is somewhat surprising given the predictions of the trade literature on heterogeneous firms. Zhang also finds that FDI is associated with a higher share of skilled labor, and he interprets this finding as evidence in support of Feenstra and Hanson's outsourcing theory.

Chapter 11 addresses the question of whether the reduced job growth in Indonesian manufacturing after the Asian crisis was related to globalization. Aswicahyono and

Wicaksono attempt to answer this question by utilizing plant-level data of the sector for the period 1990-2006.

They find that high output growth during the pre-crisis period was driven significantly by the existing firms. The trend, however, reversed in the 1996-2000 period where the source of manufacturing output growth came from new entrants. There are, however, no significant differences in terms of ownership and market orientation. In terms of employment, they find that exporting firms consistently provide more jobs than non-exporting firms. Interestingly, prior to the crisis, non-FDI firms created many more jobs compared with FDI firms. The position was reversed post-crisis with FDI firms creating more jobs than non-FDI. Another salient feature is that both FDI and exporting firms were able to withstand the crisis better than the non-FDI, non-exporting firms.

The analysis observes a significant drop in labor productivity in non-FDI firms. In contrast, the contribution of FDI to manufacturing productivity was consistently increasing throughout the periods. The finding also reinforces the significant role of FDI in improving labor productivity over periods. The story is similar to exporting versus non-exporting firms, where the labor productivity of exporting firms also improves throughout the period.

The last chapter of this report presents the empirical investigation conducted by Kohpaiboon and Kulthanavit on the migration issue. They consider the issue as one of structural adjustments coming out as an impact of the globalization process, and they examine the issue using the Thai clothing industry as a case study. The empirical investigation is based on in-depth interviews with fifty firms in the industry during November 2009 and February 2010.

They found that not all firms opt to hire unskilled foreign workers. There are systematic differences in firm characteristics between firms who hire foreign workers and those who do not. The latter are relatively large in size (both in employment and sales), perform better, and actively undertake upgrading activities. The former are struggling to maintain their profit margins, are relatively small, and do not invest sufficiently in upgrading activities. Interestingly, hiring foreign workers is not their first response, but is a reflection of the fact that firms have yet to successfully undertake functional upgrading. While there are many kinds of upgrading (service, product and functional), Kohpaiboon and Kulthanavit's finding points the relative importance of functional upgrading for long-term and more sustainable development. Firms which are late to undertake functional upgrading are likely to hire foreign workers during their structural adjustment process. Allowing the migration of unskilled foreign workers on a temporary basis would be a win-win-win solution for labor importing and exporting countries, as well as for the migrants themselves. Nevertheless, as a condition for allowing firms to hire unskilled foreign workers, government must guard against any retarding effect on the firms' upgrading efforts.

3. Policy Implications

In this section, we discuss policy implications that can be directly drawn out from the report as a whole, as well as from the individual papers forming its chapters.

First, trade and investment liberalization is not only a policy to raise static consumer welfare, but also a policy that promotes growth. Trade may not be a sufficient condition for strong, sustained growth, but it is a necessary one.

Despite the debates and controversies on the trade-growth nexus, we find pervasive evidence across the papers in this report that trade and/or investment liberalization had a positive dynamic effect on the aggregate economy studied.

We find strong positive correlations between trade and/or investment liberalization on the one hand, and higher TFP growth (Korea, Indonesia, Philippines, India, and Vietnam) and higher rates of new product introduction (Korea) on the other.

Outsourcing-related foreign direct investment enhances the incentive to accumulate human capital by increasing the demand for skilled labor (China).

Second, trade and investment liberalization should be pursued as part of a broad national growth strategy. In order to enhance the beneficial effects from trade and investment liberalization, other complementary policy ingredients seem necessary.

In most of the papers in this report, we find the existence of factors—national, industry, and firm characteristics or policies—that affect the relationship between trade/investment liberalization and productivity improvement and growth.

Third, enhancing the absorptive capacity, or human capital, of domestic workers and firms might be necessary in order to gain the potential benefits from international knowledge spillovers: i.e., the advantage of backwardness.

The degree of FDI spillover is found to be positively affected by measures of the absorptive capacity of domestic firms (Vietnam).

Fourth, trade cost reduction should be on the policy agenda at a high priority for countries that have yet to join the international production networks. In particular, improving trade-related infrastructure is likely to be an important ingredient of policy.

Not all countries benefit from the formation of international production networks. In many developing countries, transport cost remains a key bottleneck. Lack of transport infrastructure will raise transport cost and make markets isolated. Markets that are isolated may also feature little competition, and this will worsen within-country poverty and distribution issues.

The paper on Japan shows that trade cost is an important determinant of vertical out-bound FDI.

Fifth, it is necessary to ensure that the forces of competition are at work in domestic markets. In particular, some of the dynamic gains from trade are realized through reallocation across firms and industries, and even across products within-firms. It is therefore necessary to focus on the elimination or reduction of existing regulations, such as entry regulations, strong employment protection, and business regulations based on firm size, that inhibit the reallocation of resources by market forces. In cases where there is a lack of proper institutions or markets, such as bankruptcy laws and procedure, building up these institutions or markets should be a top priority.

Papers relating to Vietnam and Korea show that gains from liberalized trade are realized through the resource reallocation channel.

Sixth, enhancing the credibility of trade and investment reform is likely to raise the effectiveness of trade/investment liberalization. Pursuing trade and investment liberalization as part of a broad growth strategy, including other non-reversible policies, is likely to be one such strategy.

The paper on the Philippines shows that trade reform can be reversed and that the reversal of trade liberalization is likely to be damaging.

Lastly, policy measures are necessary to ease the burdens of economic agents who have to make adjustments or who are on the losing side of change. This will be particularly the case when the trade or FDI involved is outsourcing-related.

The paper on China shows that outsourcing-related FDI might worsen wage inequality between skilled and unskilled workers.

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CHAPTER 2

The Role of Trade Costs in FDI Strategy in Heterogeneous Firms: Evidence from Japanese Firm-level Data

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This paper attempts to clarify the reasons for the rapid growth of FDI in developing countries, particularly East Asian countries, compared with that of FDI to developed countries. To do this, we will examine the mechanics of HFDI and VFDI, in order to shed light on the role of trade costs. Our empirical analysis by estimation of a multinomial logit model of Japanese firms' FDI choices reveals that the reduction of trade costs between host and home countries attracts even less productive VFDI firms. In contrast, it does not attract HFDI firms. Since developing countries, particularly East Asian countries, have experienced a relatively rapid decrease in trade costs with Japan, our results indicate that the increase of VFDI through trade cost reduction has led to the recent relative surge of FDIs in developing countries.

1. Introduction

Recently, foreign direct investments (FDIs) from developed countries to developing countries have experienced a remarkable increase, compared with FDIs between developed countries. Navaretti and Venables (2004) report the fact that *although FDI goes predominantly to advance countries, the share of developing countries has been rising*. They show that "the share of worldwide FDI received by the developing and transition economies jumped from 24.6% in the period 1988-93, to more than 40% in the period 1992-97". Also, in Japan, as confirmed in the next section, there have of late, been few investors in developed countries. Almost all investment goes to developing countries, particularly East Asian countries. Why have FDIs in developing countries grown so rapidly compared with those to developed countries?

In the FDI literature, many types of FDI classification have been proposed. One of the most common is horizontal FDI (HFDI). HFDI is a market-seeking investment and thus is likely to be directed towards developed countries. In order to avoid high trade costs when supplying products to the market, the HFDI firms locate their affiliates in the market country and directly supply their products from that country. In other words, it is generally acknowledged as a proximity-concentration hypothesis that firms invest in countries with large markets and substantial trade costs with their home country (Brainard, 1997). Indeed, Chen and Moore (2010) found that French firms are likely to invest in countries located geographically far from France. Therefore, a rise in trade costs will be expected to result in an increase of HFDI. However, it is obvious that trade liberalization has occurred in the world. Furthermore, incorporating firm heterogeneity in terms of productivity into the HFDI model, Helpman *et al.* (2004)

shows the presence of a sorting effect according to firms' productivity: only firms with productivity beyond a cutoff can afford to pay the entry costs involved in investing abroad, and thus are able to become multinationals. This indicates that even if trade costs do not decrease, the rise of firms' productivity leads to an increase of HFDI. As a result, except for the global productivity rise, the mechanics of HFDI do not clearly explain the recent increase of FDIs to developing countries, relative to those to developed countries.

One candidate for models attempting to clarify the reasons for the relative increase of FDIs to developing countries is the vertical FDI (VFDI) model.[1] VFDI is an investment the aim of which is to relocate a part of the production process to cheap-labor countries and to engage, insofar as their production processes are concerned, in a vertical division of labor between host and home countries. Therefore, VFDI is likely to be directed towards developing countries rather than developed countries. Furthermore, the production cost reduction by the division of labor needs to outweigh the additional cost burden incurred in linking remotely-located production blocks. The main costs are obviously trade costs between host and home countries. Thus, it is apparent that VFDI is likely to be conducted in countries with a large gap in wages and a low level of trade costs between home and host countries. Therefore, it is expected that trade cost reduction should lead to an increase of VFDI. In other words, the mechanics of VFDI seem to be consistently able to explain the recent increase of FDIs in developing countries.

This paper attempts to clarify the reasons for this relatively rapid growth of FDIs to

[1] In addition, more specific types of FDI are also proposed. In particular, to explore the mechanics of setting up multiple affiliates, FDI theories have been reconstructed in the framework of a three-country, not the traditional two-country, setting (Yeaple, 2003; Grossman *et al.,* 2006; Baltagi *et al*., 2007; Ekholm *et al*., 2007).

developing countries by examining the mechanics of HFDI and VFDI, thus shedding light on the role of trade costs. We first extend the Helpman *et al.* (2004) model so as to allow firms to choose another option, VFDI. In other words, we explicitly integrate the HFDI and VFDI models into a single framework. Subsequently, we derive some propositions regarding the relationship between trade cost reduction and firms' FDI choice. More specifically, we examine how changes in host country characteristics affect the productivity cutoffs separating firms' FDI choice. Next, we empirically examine those propositions for Japanese FDIs around the world by employing firm-level data. We estimate the multinomial logit model regarding firms' choice among three options: domestic production, HFDI, and VFDI. In the classification of HFDI and VFDI, we adopt the criterion that the HFDI affiliates are those in which the ratio of exports to total sales is above the world average by sector, and the VFDI is the inverse. As a result, our estimation reveals that the reduction of trade costs between host and home countries has different impacts between HFDI and VFDI. Their reduction attracts comparatively less productive VFDI firms in contrast to HFDI firms. Since developing countries, particularly East Asian countries, have experienced a relatively rapid decrease of trade costs with Japan, as confirmed in the next section, our findings imply that the increase of VFDI through trade cost reduction has resulted in the recent relative surge of FDIs to developing countries.

Our paper complements the recent empirical studies that examine the decision of heterogeneous firms to participate in international markets by extending the Helpman *et al*. (2004) model: Aw and Lee (2008), Yeaple (2009), and Chen and Moore (2010). Aw and Lee (2008) extend the model further still, suggesting that firms have four options: domestic production, VFDI, HFDI, and both VFDI and HFDI. Then, for Taiwanese firms, they examine the ranking of firms' productivity according to their chosen option and found it to be as follows: domestic production, VFDI to China, HFDI to the U.S., and both VFDI to China and HFDI to the U.S. Yeaple (2009) focuses on HFDI in U.S. multinational enterprises (MNEs) and demonstrates that the sorting effect in the Helpman *et al.* (2004) model extends to the scale and scope of MNEs: more productive firms have affiliates in a larger set of countries, and their affiliates are larger than those of less productive firms. Chen and Moore (2010) derive further a number of testable predictions from the Helpman *et al.* (2004) model. In particular, they focus on HFDI in France and show empirically that productivity differences among MNEs lead to differential effects of host-country attributes and consequently distinct choices of foreign production locations. Conversely, as in Chen and Moore (2010), our paper allows heterogeneous effects of host-country characteristics across firms and heterogeneous effects of firms' productivity across countries. But, in contrast to Chen and Moore (2010), we incorporate VFDI into firms' options, as in Aw and Lee (2008), though we exclude the option of both HFDI and VFDI.

The rest of this paper is organized as follows: The next section takes an overview of the distribution of Japanese FDIs. Section 3 lays out a model to motivate our empirical analysis. Empirical analyses and their results are reported in Section 4. Lastly, we conclude the paper in Section 5.

2. Transition of Japanese FDI

In this section, we will look briefly at the transition of Japanese FDI and the environment surrounding it. Table 1 reports the number of overseas affiliates by entry year, in both the machinery and automobile industries, in which most Japanese FDIs are concentrated. The data source is the *Survey of Overseas Business Activities*, an affiliate-level survey conducted by the Ministry of Economy, Trade and Industry (METI).[2] From this table, we can see that during the 1980s, Japanese MNEs invested intensively in both developed and Asian countries. In later years however, they tended to invest mostly in Asia. Particularly in the mid-1990s, most Japanese MNEs concentrated their overseas affiliates in Asia. In summary, Japanese firms have, since the 1990s, changed the main location of their overseas affiliates from developed countries to Asian ones.

[2] The aim of this survey is to obtain basic information on the activities of foreign affiliates of Japanese firms. The survey covers all Japanese foreign affiliates. The survey consists of two parts. One is the Basic Survey, which is more detailed and is carried out every 3 years. The other is the Trend Survey, which is less comprehensive and carried out between the Basic Surveys. A foreign affiliate of a Japanese firm is defined as an overseas subsidiary in which a Japanese firm holds 10% or more of the invested capital. The survey provides, for example, the establishment year of a foreign affiliate, a breakdown of its sales and purchases, its employment, cost of labor, research and development expenditures, etc.

Table 1. Overseas Affiliates' Entry Year

	Developed Countries			Asia	Others	Total
		North America	Europe			
1985	38	19	19	20	4	62
1986	78	60	18	58	8	144
1987	83	56	27	126	13	222
1988	113	78	35	96	9	218
1989	115	70	45	127	11	253
1990	105	52	53	110	10	225
1991	58	25	33	83	13	154
1992	49	23	26	99	10	158
1993	34	16	18	109	9	152
1994	52	36	16	211	11	274
1995	89	51	38	326	17	432
1996	80	54	26	191	15	286
1997	68	42	26	153	15	236
1998	58	28	30	89	15	162
1999	47	22	25	67	4	118
2000	66	48	18	82	12	160
2001	47	23	24	118	6	171
2002	31	17	14	86	5	122
2003	14	10	4	41	1	56
2004	2	1	1	20	0	22

Source: The Survey of Overseas Business Activities.

How have wages and trade costs, which should be important factors in deciding firms' investment, changed? Table 2 reports the average ratio of GDP per capita abroad to that of Japan, for which the data source is the World Development Indicator. From this table, we can see that the ratio is much lower in Asia than in North America and Europe. In other words, Asian countries have comparatively low GDP per capita. The ratio for European countries falls between the figures for North America and Asian countries. It can be seen that there have not been any significant changes in these ratios over the time frame.

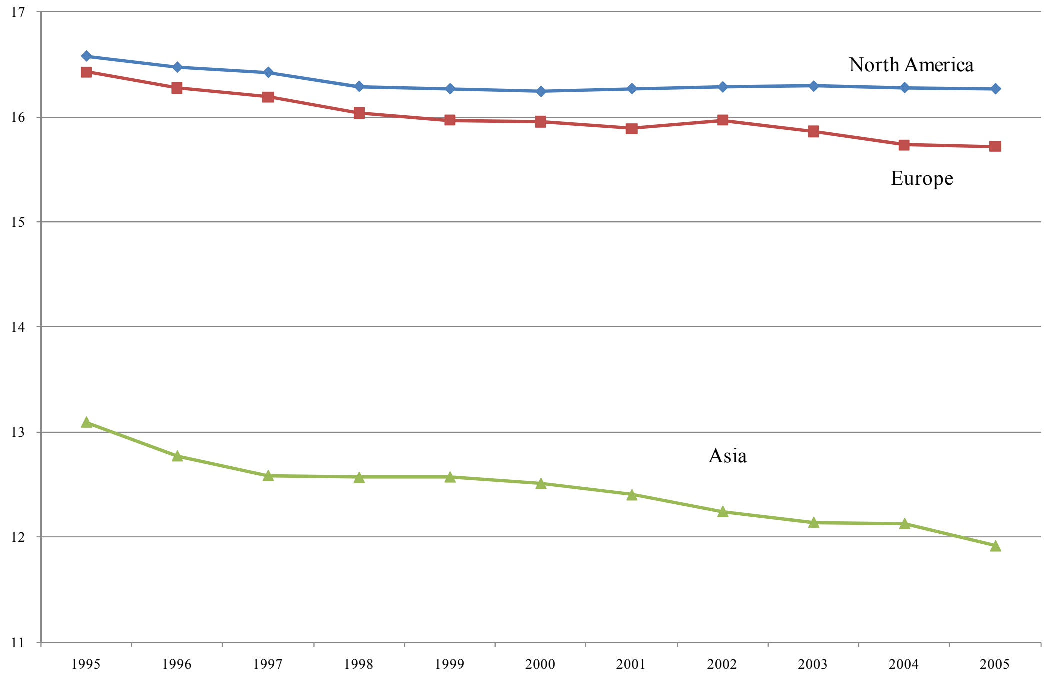
Table 2. The Average Ratio of GDP per Capita in Host Countries to GDP per Capita in Japan

	North America	Europe	Asia
1995	0.64	0.50	0.14
1996	0.73	0.56	0.16
1997	0.83	0.56	0.17
1998	0.92	0.62	0.14
1999	0.83	0.54	0.13
2000	0.79	0.45	0.13
2001	0.88	0.50	0.14
2002	0.91	0.55	0.15
2003	0.89	0.60	0.14
2004	0.85	0.61	0.14
2005	0.89	0.62	0.15

Source: World Development Indicator.

On the other hand, Figure 1 shows the changes in the average trade costs with Japan. This measure takes into account tariffs, geographical distance, and participation in the World Trade Organization (WTO), regional trade agreements, identical continental benefits, linguistic commonality, and colonial relationships. A more detailed method of estimating these measures is explained in Appendix 1. The figures show that trade costs with Japan are much lower and have experienced a more rapid decrease in Asia than in developed countries. While the former result is obviously due to the geographical proximity of Asia, the latter is based on the tariff reduction in each country and a number of countries' participation in the WTO (i.e. China and Taiwan).

Figure 1. Changes in the Average Trade Costs with Japan: by Region



Source: Authors' estimation.

Note: For the method of estimation, see Appendix 1.

3. Theoretical Frame Work

This section examines the problem of selecting an FDI pattern, i.e. HFDI or VFDI. It should be noted that the aim of this section is not to provide a general equilibrium model of multi-production-stages and multi-country operations, but simply to obtain insights into the driving forces behind firms' choices of FDI patterns in a partial equilibrium model.

3.1. Profit Functions in Each Strategy

Suppose that there are two countries: country 1 (home country) and country 2 (foreign country). In this supposition we consider finished products that are horizontally differentiated. Each of a continuum of firms manufactures a different brand with zero measure. The finished products are consumed in both countries. A representative consumer in country i have the following preference, specified as a constant elasticity of substitution function over varieties:

$$u_i = \left(\sum_{j \in R} \int x_{ji}(k)^{\frac{\sigma - 1}{\sigma}} dk \right)^{\frac{\sigma}{\sigma - 1}},$$

where R and x_{ji} are respectively the set of countries (i.e. countries 1 and 2) and the demand of country i for the product varieties produced in country j. σ is the elasticity of substitution between varieties and is assumed to be greater than unity. The brand name k is omitted from this point onwards for brevity.

Utility maximization yields:

$$x_{ji} = t^{-(\sigma - 1)} p_j^{-\sigma} A_i,$$

where p_j is the price of the variety produced in country j. $A_i \equiv P_i^{\sigma\text{-}1} Y_i$, where P_i is the price index in country i and Y_i is total income in country i. Although the demand level A is endogenous to the industry, it is treated as exogenous by producers because every producer is of negligible size relative to the size of the industry. There is ice-berg trade costs $t\,(\geq 1)$ for the shipment of products between countries 1 and 2.

The market structure of the finished goods sector can be regarded as monopolistic competition. Each firm knows its cost efficiency θ only after its entry into the market. Finished products are produced in two stages of production. The production function in each stage is kept as simple as possible in order to highlight the nature of interdependence of production stages. Our Leontief-type production structure is as follows: A first-stage product is produced inputting θ units of skilled-labor; a second-stage product is produced inputting one unit of the first-stage product and θ units of unskilled-labour. Factor prices for skilled-labor and unskilled-labor are represented by r and w. Once again, there is ice-berg trade costs t for the shipment of each-stage product between countries 1 and 2. Although firms with headquarters in country 1 do not need to pay any fixed costs if they produce both two-stage products in only country 1, they must incur plant set-up costs f if they locate plants in country 2.

We should consider the production pattern of firms with headquarters in country 1. It is assumed for the sake of simplicity that the headquarters cannot be relocated. Due to data limitation, which will be discussed later, we restrict the considerations to firms with at least one production stage in country 1. This restriction rules out the pattern of complete specialization in headquartered services at home. Our interest in the production pattern is devoted to three specific patterns: domestic production (D), VFDI (V), and HFDI (H). Domestic production indicates that firms locate both stages in the home country and supply their finished products from home to both countries. In VFDI, firms locate the first stage of production at home and the second stage abroad. Since the finished products are completed abroad, firms supply their finished products from the foreign plant to both countries. Lastly, HFDI firms locate both production stages in both countries and supply their finished products domestically.

Among these three patterns, firms choose the pattern which yields the highest total profit. Let $c^M{}_k$ be a variable cost in producing products for the country k market in the production pattern M, then respective variable costs are given by:

$$c^D{}_1 = (r_1\theta + w_1\theta)\, x_{11}, \qquad c^D{}_2 = (r_1\theta + w_1\theta)\, x_{12},$$

$$c^V{}_1 = (t\, r_1\theta + w_2\theta)\, x_{21}, \qquad c^V{}_2 = (t\, r_1\theta + w_2\theta)\, x_{22},$$

$$c^H{}_1 = (r_1\theta + w_1\theta)\, x_{11}, \qquad c^H{}_2 = (r_2\theta + w_2\theta)\, x_{22}.$$

Thus, we can express respective total profit as:

$$\pi^D = \{p_1x_{11} - (r_1\theta + w_1\theta)\, x_{11}\} + \{p_1x_{12} - (r_1\theta + w_1\theta)\, x_{12}\},$$

$$\pi^V = \{p_2x_{21} - (t\, r_1\theta + w_2\theta)\, x_{21}\} + \{p_2x_{22} - (t\, r_1\theta + w_2\theta)\, x_{22}\} - f,$$

$$\pi^H = \{p_1x_{11} - (r_1\theta + w_1\theta)\, x_{11}\} + \{p_2x_{22} - (r_2\theta + w_2\theta)\, x_{22}\} - f.$$

In each equation, the first term and the second term are operating profits obtained from home markets and foreign markets, respectively. The profit-maximizing strategy yields $p = C^M{}_k/\alpha$, where $C^M{}_k = d\ c^M{}_k/d\ x$ and $\alpha \equiv (1\text{-}\sigma)/\sigma$, so that profit functions are represented by:

$$\pi_1{}^D = (r_1+w_1)^{1\text{-}\sigma}(A_1+A_2t^{1\text{-}\sigma})\ \Theta$$

$$\pi_1{}^V = (tr_1+w_2)^{1\text{-}\sigma}(A_1t^{1\text{-}\sigma}+A_2)\ \Theta - f,$$

$$\pi_1{}^H = \{(r_1+w_1)^{1\text{-}\sigma}A_1 + (r_2+w_2)^{1\text{-}\sigma}A_2\}\ \Theta - f.$$

where $\Theta \equiv (1\text{-}\alpha)\ \alpha^{\alpha\text{-}1}\theta^{1\text{-}\sigma}$. We call Θ the productivity measure. Since $\sigma > 1$, the smaller the cost efficiency θ is, the larger the measure Θ is.

3.2. FDI Choice

This subsection examines which production pattern the firms in country 1 choose according to their productivity levels. Let S_i^M to be a slope of the profit function of country i's firm in production type M then the three slopes are represented by:

$$S_1^D = (r_1+w_1)^{1-\sigma}(A_1+A_2t^{1-\sigma}),$$

$$S_1^V = (tr_1+w_2)^{1-\sigma}(A_1t^{1-\sigma}+A_2),$$

$$S_1^H = (r_1+w_1)^{1-\sigma}A_1+(r_2+w_2)^{1-\sigma}A_2.$$

For simplicity, it is assumed that $w_1 \geq w_2$ and $r_2 \geq r_1$, which indicate that country 1 (the home country) has higher wages for unskilled labor while country 2 (the potential host country) has higher wages for skilled labor.

Assumption 1: *$w_1 = a\, w_2$ and $r_2 = b\, r_1$, where $a \geq 1$ and $b \geq 1$.*

Furthermore, we assume that the home country has as large or larger demand than any potential host country.

Assumption 2: $A_1 \geq A_2$.

Our assumption of identical plant set-up costs between VFDI and HFDI assures that firms choosing VFDI and those choosing HFDI do not coexist. In other words, in our model setting, firms tend to choose between VFDI and Domestic or between HFDI and Domestic production patterns. In this subsection, we present only theoretical results. For more details, see Appendix 2.

We can confirm the well-documented conditions for the dominance of each FDI. First, we consider how the differences in wages affect the choice of production type. Given trade costs between countries, the greater the differences in wages for unskilled-labor (i.e. the lower the wages for unskilled-labor abroad), the steeper slope is likely to be in vertical FDI (S_1^V) compared with domestic production (S_1^D) (Corollary 2). In contrast, the smaller the differences in wages for skilled-labor (i.e. the lower the wages for skilled-labor abroad), the steeper slope is likely to be in horizontal FDI

(S_1^Hcompared with domestic production (S_1^D) (Corollary 8). Both horizontal and vertical FDI firms have an identical and negative interception point because they must incur fixed set-up costs f for the plant in country 2. As a result, a profit line in each production type can be drawn as in figures 2 and 3. Figure 2 shows the productivity-cutoff which divides firms between into domestic and vertical FDI categories, in the case of large differences in wages. It indicates that more productive firms choose vertical FDI while less productive firms concentrate on domestic production. On the other hand, in the case of small differences in wages for skilled-labor, productive firms opt for horizontal FDI while those which are less productive select domestic production (Figure 3).

Figure 2. Medium Trade Cost and Large Wage Differentials

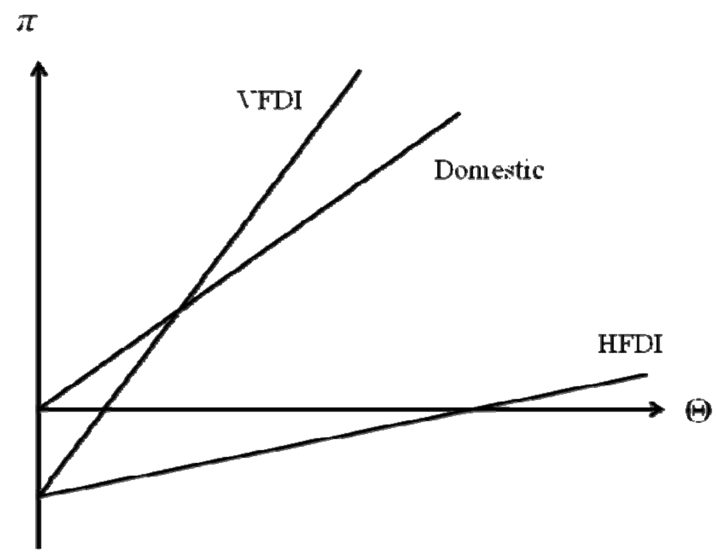
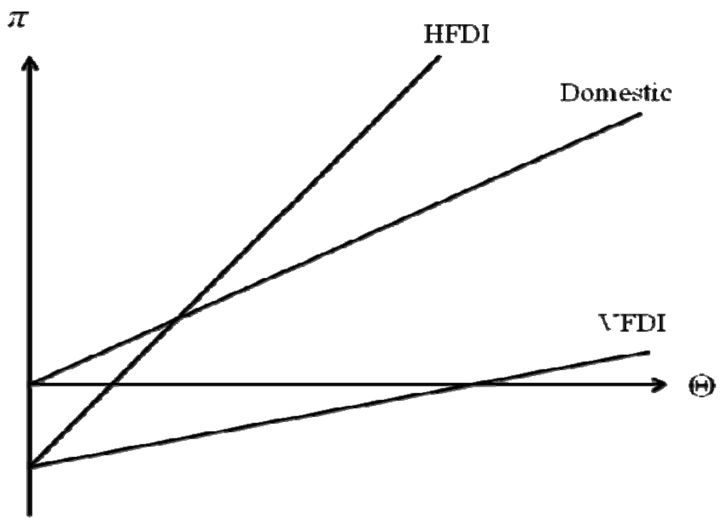


Figure 3. Medium Trade Cost and Small Wage Differentials



Secondly, we take the differences in wages for both types of labor as a given. Then, the lower the trade costs between countries, the greater the likelihood of the slope in vertical FDI (S_1^V) being steeper than that of domestic production (S_1^D) (Corollary 3). In contrast, the larger the trade costs, the greater the likelihood there is of the slope in horizontal FDI (S_1^H) going beyond that of domestic production (S_1^D) (Corollary 9). Thus, we can again draw two figures, 3 and 4, according to the magnitude of trade costs. In the case of low trade costs, more productive firms choose vertical FDI while less productive firms focus on domestic production (Figure 4). On the other hand, in the case of high trade costs, more productive firms choose horizontal FDI while less productive ones focus on domestic production (Figure 5). The above-described patterns in both wage gaps and trade costs for each FDI type have already been well-documented.

Figure 4. Medium Wage Differentials and Low Trade Cost

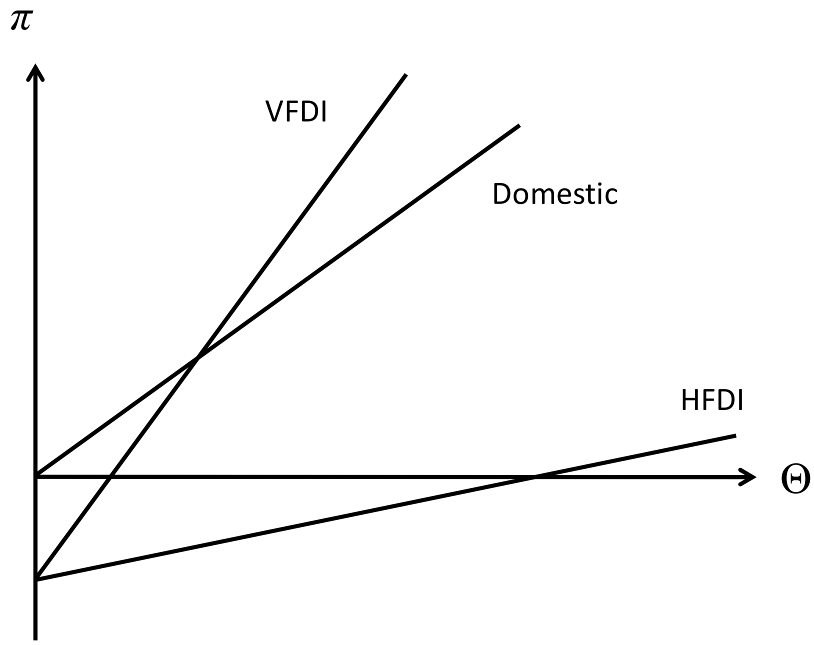
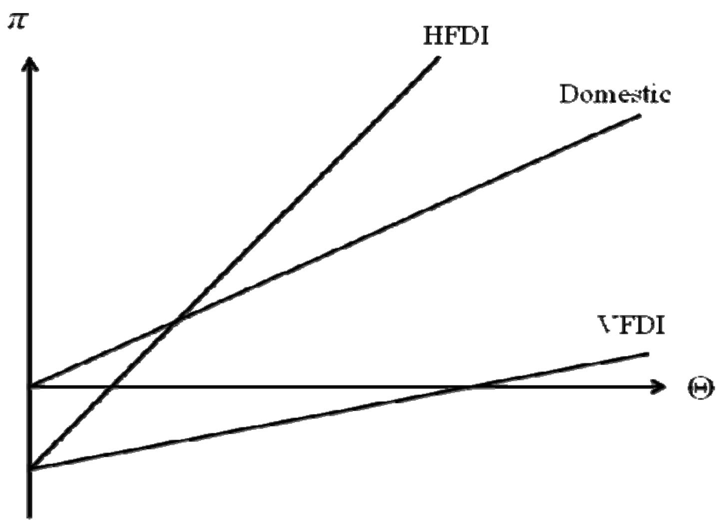


Figure 5. Medium Wage Differentials and High Trade Cost



Next, we consider how the above cutoffs change according to host country characteristics. As shown above, VFDI is likely to be chosen in the case of low trade costs and large gaps in wages (i.e. lower wages for unskilled-labor abroad). Then, a further reduction in trade costs (Corollary 4), fixed costs (Corollary 5), or wages (Corollary 7) or a market-size expansion (Corollary 6) in foreign countries reduces the cutoff which divides firms into domestic and VFDI categories. In other words, these changes in potential host countries succeed in attracting even less productive firms in a form of VFDI. On the other hand, HFDI is likely to be chosen in cases where gaps in wages are small and trade costs are high (i.e. lower wages for skilled-labor abroad). Then, except for trade-cost reduction, similar kinds of changes in host country characteristics also lead to the attraction of a form of HFDI by less productive firms (Corollaries 10 and 11). In short, the reduction in fixed entry costs or wages or a market-size expansion in foreign countries further attracts less productive firms, to a form of VFDI in the case of low trade costs and large gaps in wages and in a form of HFDI in the case of high trade costs and small gaps in wages. However, while trade cost reduction attracts less productive firms to a form of VFDI, it requires HFDI firms to be more productive. As a result, some HFDI firms with relatively low productivity exit. We will empirically examine this contrast in trade cost reduction in the following section.

4. Empirical Analysis

In this section, we first explain our empirical method of examining firms' FDI choices. Next, some empirical issues are discussed, and finally, the estimation results are reported.

4.1. Empirical Method

We estimate the multinomial logit model for firms' decisions on investing. The use of such a discrete choice model is appropriate because our model has multiple choices (i.e. Domestic, HFDI, and VFDI), and firms in the model choose the one with the highest profit margins. Let Y_{if} be a random variable that indicates the choice made by firm f in country i: 0 = Domestic, 1 = Horizontal FDI, 2 = Vertical FDI. A firm f in country i has characteristics $\boldsymbol{x}_{if}$, which do not vary across choices and are specific to the individual. This is the second reason for the use of the multinomial logit model. The overseas location of firms can be drawn from the *Survey of Overseas Business Activities*. If we assume that all disturbances are independent and identically distributed in the form of type I extreme value distribution, the probability that it chooses option j can be shown as:

$$\mathrm{Prob}(Y_{if} = j \mid x_{if}) = \frac{e^{x_{if}\beta_j}}{\sum_{k=0}^{2} e^{x_{if}\beta_k}}, \qquad j = 0, 1, 2, \boldsymbol{\beta}_0 = \mathbf{0}.$$

$\boldsymbol{\beta}_j$ is a vector of coefficients to be estimated using the maximum likelihood estimation technique. Time script t is dropped for the sake of brevity, although it should be noted that our sample years are 1995-2006.

Our explanatory variables based on the theoretical framework in the previous section are as follows: we introduce firms' total factor productivity (TFP) as the measurement of their productivity. The firm-level data for its calculation are drawn from METI's *Results of the Basic Survey of Japanese Business Structure and Activities*.[3] From this data we estimate the TFP index following Caves *et al.* (1982, 1983) and Good

[3] This survey was first conducted in 1991, then again in 1994, and annually thereafter. The survey covers all firms, both manufacturing and non-manufacturing, with more than 50 employees and capitalized at more than 30 million yen.

et al. (1983). The TFP index is calculated as follows:

$$TFP_{it} = \left(\ln Q_{it} - \overline{\ln Q_t}\right) - \sum_{f=1}^{F} \frac{1}{2}\left(s_{ift} + \overline{s_{ft}}\right)\left(\ln X_{ift} + \overline{\ln X_{ft}}\right) + \sum_{s=1}^{t}\left(\overline{\ln Q_s} - \overline{\ln Q_{s-t}}\right) - \sum_{s=1}^{t}\sum_{f=1}^{F} \frac{1}{2}\left(\overline{s_{fs}} + \overline{s_{fs-1}}\right)\left(\overline{\ln X_{fs}} - \overline{\ln X_{fs-1}}\right) \quad ,$$

where Q_{it}, s_{ift} and X_{ift} denote the shipments of firm *i* in year *t*, the cost share of input *f* for firm *i* in year *t*, and input of factor *f* for firm *i* in year *t*, respectively. The inputs are labor, capital, and intermediates. Variables with an upper bar denote the industry average for that variable. We define a hypothetical (representative) firm for each year and industry. Its input and output are calculated as the geometric means of the input and output of all establishments in the industry. The first two terms on the right-hand side of the equation denote the cross-sectional TFP index based on the Theil-Tornqvist specification for each firm and year relative to the hypothetical establishment. Since the cross-sectional TFP indexes for *t* and *t*-1 are not comparable, we adjust the cross-sectional TFP index with the TFP growth rate of the hypothetical firm, which is represented by the third and fourth terms in the equation.

We interact several country-specific variables to firms' TFP in order to examine the heterogeneous effects of host country characteristics across firms. The first one is related to labor costs. In the previous section, we categorized labor into skilled and unskilled. However, since this is somewhat difficult to achieve through empirical analysis, we simply introduce and compare the ratio of GDP per capita in the host country to that of Japan. The lower ratio is linked to firms' probability of choosing both HFDI and VFDI. Second, the role of the market size in possible host countries is examined by introducing the market potential measure which is proposed by Harris (1954), i.e., sum of distance-weighted GDP. The data on bilateral distance and GDP are from the CEPII website and the World Development Indicator. Third, we introduce countries' credibility index to control, to some extent, the elements associated with plant set-up costs. The index is drawn from "Institutional Investor" and is the aggregate of bankers' evaluation of risk of default. The higher the index, the smaller the risk of default in the country. Fourth, as a proxy for trade costs, we use the following two measures: geographical distance from Japan and the estimate of trade costs with Japan (the same as were used in section 2). Finally, we introduce sector and year dummy variables.

4.2. Empirical Issues

Before reporting estimation results, there are three points that should be borne in mind: First, as in section 2, we focus on the machinery and automobile industries. These industries consist of the following six sectors: household electrical appliances, electronic data processing machines, communications equipment, electronic parts and devices, miscellaneous electrical machinery equipment, and motor vehicles, parts and accessories. Additionally, this focus may enable us to control various kinds of industry heterogeneity in our empirical estimates.

The second is how to differentiate between overseas affiliates opting for HFDI and those choosing VFDI. In fact, there are a number of ways to do this. Among them, this paper sheds light on the main sales destinations in affiliates. Since the aim of HFDI is to supply products within the market country, the main sales destination is the host country in the case of HFDI affiliates. On the other hand, it is not necessarily the host country in the case of VFDI. Thus, we define an HFDI affiliate as an affiliate whose share of exports in total sales is greater than the sectoral average in all sampled affiliates, which is not the case with VFDI affiliates. As a result, the share of VFDI affiliates is reported in Table 3. In line with our expectations in the introductory section, affiliates in Asia are more likely to fall into the category of VFDI than those in developed countries. However, it might also be worth noting that nearly half of the affiliates are of the HFDI type even in Asia and that affiliates in the automobile sector are less likely to be of the VFDI type compared with those in the machinery industry.

Table 3. The Share of VFDI-type Affiliates

	North America	Europe	Asia
1995			
Household electric appliances	0.083	0.333	0.607
Electronic data processing machines	0.282	0.176	0.586
Communication equipment	0.255	0.196	0.573
Electronic parts and devices	0.300	0.185	0.477
Miscellaneous electrical machinery equipment	0.268	0.206	0.504
Motor vehicles, parts and accessories	0.203	0.276	0.318
2000			
Household electric appliances	0.100	0.125	0.521
Electronic data processing machines	0.270	0.129	0.596
Communication equipment	0.192	0.260	0.550
Electronic parts and devices	0.317	0.205	0.581
Miscellaneous electrical machinery equipment	0.197	0.152	0.528
Motor vehicles, parts and accessories	0.206	0.210	0.383
2004			
Household electric appliances	0.143	0.067	0.542
Electronic data processing machines	0.345	0.348	0.568
Communication equipment	0.196	0.167	0.583
Electronic parts and devices	0.261	0.111	0.528
Miscellaneous electrical machinery equipment	0.265	0.182	0.495
Motor vehicles, parts and accessories	0.213	0.270	0.382

Source: Authors' calculation based on the Survey of Overseas Business Activities.

The third issue is consistency between the theoretical and empirical frameworks. In the theoretical framework, given one candidate for the host country (it should be remembered that our model is a two-country setting), firms choose their operation type from among three models. On the other hand, firms are faced with many candidates for investment and may additionally have to decide whether or not to invest in *each* country. We did not extend the theoretical model to such a many-country setting in order to avoid various kinds of interaction among overseas affiliates. For example, the first VFDI affiliate in a country may stop supplying to the home country after setting up the second VFDI affiliate in another country closer to the home country. As a result, in order to ensure as much consistency between the empirical model and our theoretical framework as possible, we restrict investing firms to "first investors": firms who have never had overseas affiliates in the focus sector at time *t*-1. Such firms would not take interaction among affiliates into consideration. Furthermore, sample firms are restricted only to those who became involved in exporting activities at time *t*-1.

4.3. Empirical Results

In this subsection, we report our estimation results. Basic statistics for the estimation sample are provided in Table 4, and the estimation results can be found in Table 5. Column (I) reports the case of introducing geographical distance as a proxy for trade costs, and column (II) introduces our estimates of trade costs.

Table 4. Basic Statistics

	Mean	S.D.	p25	p75
FDI type	0.00	0.03	0.00	0.00
TFP	1.08	0.20	0.95	1.22
* GDP per capita ratio	-1.70	1.53	-2.59	-0.39
* Distance	9.63	1.93	8.39	10.87
* Credibility	66.40	27.09	45.32	85.80
* Market Potential	30.26	5.77	26.56	34.01
* Trade Cost	16.59	4.47	13.90	19.30

Table 5. Results of Multinomial Logit

	(I)		(II)	
	HFDI	VFDI	HFDI	VFDI
TFP	8.239	12.414	6.102	8.173
	[1.14]	[1.11]	[0.92]	[0.78]
* GDP per capita ratio	-0.834	-0.602	-0.885	-0.695
	[-4.59]***	[-3.03]***	[-5.28]***	[-3.81]***
* Distance	-0.236	-0.706		
	[-0.94]	[-2.49]**		
* Credibility	0.089	0.022	0.089	0.022
	[5.50]***	[1.71]*	[5.48]***	[1.72]*
* Market Potential	-0.466	-0.327	-0.447	-0.305
	[-1.91]*	[-0.89]	[-1.83]*	[-0.83]
* Trade Cost			-0.038	-0.174
			[-0.67]	[-2.88]***
Year Dummy	YES	YES	YES	YES
Sector Dummy	YES	YES	YES	YES
Observations	154,596		154,596	
Log likelihood	-747		-746	

* p<0.1, ** p<0.05, *** p<0.01

Notes: z-ratios are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

The estimation results are as follows: The coefficients for TFP are positive although insignificant in both types of FDI. These insignificant results might be due to the inclusion of many interaction terms with country-specific variables, i.e. multi-colinearity in the equation. Indeed, Chen and Moore (2010) also obtain an insignificant result in the equations due to the interaction terms. The negatively significant results in GDP per capita ratio in both types of FDI are consistent with our expectations, indicating that even less productive firms can invest in countries where lower wages are the norm. Such firms' entry becomes a form of VFDI in the case of host countries with low-waged unskilled labor and a form of HFDI in the case of host countries with low-waged, skilled labor. The Country Credibility Index has significant positive coefficients, which are also in line with our expectations. Productive firms are more likely than less productive firms to invest in countries with higher default risks, which will be related to fixed-entry costs. The market potential variable is inaccurate and produces insignificant results. This might be due to the high correlation between Market Potential and the GDP per capita ratio.

The coefficients for trade cost-related variables, i.e. Distance and Trade Cost, are insignificant in the case of HFDI and significantly negative in the case of VFDI. The results in VFDI are consistent with our theoretical prediction: even less productive firms can choose vertical FDI in countries with lower trade costs with Japan. Thus, we can say that continuing trade liberalization further increases Japanese vertical FDI. On the other hand, the results with regard to HFDI may be unexpected. One possible reason is that, as mentioned in Chen and Moore (2010), our trade cost measurement is also partly related to fixed-entry costs. For example, long distance leads to increased monitoring costs for firms. Since the low fixed costs encourage firms to conduct HFDI, the trade costs exhibit opposing forces in the case of HFDI. As a result, our insignificant results in trade costs may indicate that such forces are balanced. However, we can, at the very least, say that HFDI does not have a significantly negative association with trade costs with Japan.

5. Concluding Remarks

This paper has attempted to clarify the reasons for the relatively rapid growth of FDIs in developing countries by examining the mechanics of HFDI and VFDI in order to shed light on the role of trade costs. We first extend the Helpman *et al.* (2004) model so as to allow firms to choose another option, i.e. VFDI, and derive some propositions regarding the relationship between trade cost reduction and firms' FDI choices. Next, we have empirically examined these propositions in relation to Japanese FDIs around the world by estimating the multinomial logit model of firms' choices among three options: domestic production, HFDI, and VFDI. As a result, our estimation reveals that the reduction of trade costs between host and home countries is impacted differently depending on which form of investment firms choose: HFDI or VFDI. Their reduction attracts less productive VFDI firms but does not attract HFDI firms. Since developing countries, particularly East Asian countries, have experienced a relatively rapid decrease in trade costs with Japan, we conclude that the increase of VFDI through the trade cost reduction has led to the recent relative surge of FDIs in developing countries.

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Appendix 1. Estimation of Bilateral Trade Costs

This appendix provides explanations of how we estimate the bilateral trade costs. Our theoretical background lies in Anderson and van Wincoop (2003). Under the usual assumptions (e.g., CES utility function), they derive the following gravity equation (equation 9 on page 175):

$$x_{ij} = \frac{y_i y_j}{y^W}\left(\frac{\tau_{ij}}{\Pi_i P_j}\right)^{1-\sigma}, \qquad \text{(A.1)}$$

where

$$\Pi_i \equiv \left(\sum_j \left(\tau_{ij}/P_j\right)^{1-\sigma}\theta_j\right)^{1/(1-\sigma)},\ \ P_j \equiv \left(\sum_i \left(\tau_{ij}/\Pi_i\right)^{1-\sigma}\theta_i\right)^{1/(1-\sigma)}, \text{and}\ \ \theta_j \equiv y_j / y^W .$$

x_{ij}, y_i, τ_{ij}, and y^W are the nominal value exports from countries i to j, total income of country i, iceberg trade costs from countries i to j, and world nominal income, respectively. σ denotes the elasticity of substitution among varieties. Taking logs in equation (A.1), we obtain:

$$\ln x_{ij}^t = \ln y_t^W + \ln y_i^t + \ln y_j^t + (1-\sigma)\tau_{ij}^t + (\sigma-1)\ln\Pi_i^t + (\sigma-1)\ln P_j^t . \qquad \text{(A.2)}$$

In this equation, we add time script t.

In this paper, we specify the trade cost function as:

$$\begin{aligned}\tau_{ij}^t = &\left(1+tariff_j^t\right)\cdot Dist_{ij}^{\alpha_1}\cdot\exp\left(\alpha_2 WTO_{ij}^t\right)\cdot\exp\left(\alpha_3 RTA_{ij}^t\right)\cdot\exp\left(\alpha_4 Continent_{ij}\right)\\ &\cdot\exp\left(\alpha_5 Language_{ij}\right)\cdot\exp\left(\alpha_6 Colony_{ij}\right)\end{aligned} . \qquad \text{(A.3)}$$

Dist is geographical distance between trading partners. *RTA* is a binary variable taking unity if trading partners conclude on regional trade agreements (RTAs) and zero otherwise. *tariff* is the weighted average of most favored nation (MFN) rates (100**tariff*%). *Language* is a linguistic dummy variable that takes one if the same language is spoken by at least 9% of the population in both countries. Colony is a binary variable which takes one if an importer (an exporter) was ever a colonizer of an exporter (importer) and zero otherwise. WTO is a binary variable which takes one if both exporter and importer are members of the World Trade Organization (WTO) and zero otherwise.

Introducing this trade cost function into equation (A.2) and taking logs, we obtain:

$$\begin{aligned}\ln x_{ij}^t &= \ln y_t^W + \ln y_i^t + \ln y_j^t + (1-\sigma)\ln\left(1 + tariff_j^t\right) + (1-\sigma)\alpha_1 \ln Dist_{ij} \\ &+ (1-\sigma)\alpha_2 WTO_{ij}^t + (1-\sigma)\alpha_3 RTA_{ij}^t + (1-\sigma)\alpha_4 Continent_{ij} + (\sigma-1)\ln\Pi_i^t + (\sigma-1)\ln P_j^t\end{aligned}.$$

This can be rewritten as:

$$\begin{aligned}\ln x_{ij}^t &= \beta_0 + \beta_1 \ln y_i^t + \beta_2 \ln y_j^t + \gamma_0 \ln\left(1 + tariff_j^t\right) + \gamma_1 \ln Dist_{ij} + \gamma_2 WTO_{ij}^t \\ &+ \gamma_3 RTA_{ij}^t + \gamma_4 Continent_{ij} + \gamma_5 Language_{ij} + \gamma_6 Colony_{ij} + \beta_3 \ln\Pi_j^t + \beta_4 \ln P_j^t\end{aligned}. \qquad \text{(A.4)}$$

Because γ_0=1-σ, α_i=γ_i/γ_0 for i ={1,2,3,4,5,6}. Thus, obtaining the consistent estimators of γ_i for i ={0,1,2,3,4,5,6}, we can calculate bilateral trade costs τ_{ij}, based on equation (A.3).

We estimate (A.4) after introducing an error term. Our estimation procedures are as follows: First, we obtain the consistent estimators of γ_i for i ={1,2,3,4,5,6} by estimating:

$$\begin{aligned}\ln x_{ij}^t = \gamma_1 \ln Dist_{ij} + \gamma_2 WTO_{ij}^t + \gamma_3 RTA_{ij}^t + \gamma_4 Continent_{ij} \\ + \gamma_5 Language_{ij} + \gamma_6 Colony_{ij} + u_j^t + u_i^t + \varepsilon_{ij}^t\end{aligned} \qquad \text{(A.5)}$$

As is well-documented in the gravity literature, data on Π and P are difficult to obtain.

Thus, in order to avoid suffering from an omitted variables bias, we control their effects on trade by introducing importer-year and exporter-year dummy variables. Then, we need to drop total incomes and tariffs because they are not pair-specific variables. This model is called “Model I” in this paper.

The second step is to estimate γ_0. This is done by estimating the following:

$$\ln x_{ij}^t = \beta_1 \ln y_i^t + \beta_2 \ln y_j^t + \gamma_0 \ln\left(1 + tariff_j^t\right) + \gamma_2 WTO_{ij}^t + \gamma_3 RTA_{ij}^t + u_{ij} + u^t + \varepsilon_{ij}^t . \quad \text{(A.6)}$$

Although this estimation controls all time-invariant pair effects in addition to time effects, it fails to precisely control the effects of Π and *P*. Since the variable *tariff* is time-variant importer-specific, it is impossible to obtain its coefficient under the estimation controlling the effects of Π and *P* unless we adopt other methods, e.g. non-linear estimation in Anderson and van Wincoop (2003). But we believe that the bias resulting from omitting Π and *P* becomes less serious if we introduce both pair-fixed effects and time-fixed effects. This model is called “Model II”.

Our data cover 82 countries worldwide. Data on international trade values (code 7 in SITC rev.2) have been obtained from the UN Comtrade. RTA and WTO dummies are constructed by using lists of RTAs and of WTO member countries provided on the WTO website. Our RTA dummy is based on RTAs not only under the GATT Article XXIV but also under the Enabling Clause for developing countries. *tariff* is obtained from the UNCTAD Handbook of Statistics Online (code 7 in SITC rev.2). The source of geographical distance and other dummy variables is the CEPII website.

The OLS results of the estimation for Models I and II are reported in Table A1. We find that coefficients for all variables are estimated to be significant and have expected signs. In particular, the coefficient for (1+*tariff*) is -6.037, implying that the elasticity of substitution is 7.037. Head and Ries (2001) and Hanson (2005) obtained estimates of σ ranged between 7 and 11 and between 5 and 8, respectively, and Anderson and van Wincoop (2004) conclude that it is likely to be in the range of 5 to 10. Thus, we can say that our estimate is a reasonable value. By using these estimates of γ_i into equation (A.3), we are able to calculate the bilateral trade costs.

Table A1. OLS Results

	Model I			Model II		
	Coefficient		Robust SE	Coefficient		Robust SE
Ex GDP	1.502	***	0.067			
Im GDP	1.816	***	0.069			
Dist				-1.864	***	0.028
1 + tariff	-6.037	***	0.430			
WTO	0.158	**	0.076	0.471	***	0.139
RTA	0.879	***	0.120	0.244	***	0.039
Continent				0.114	**	0.048
Language				1.308	***	0.045
Colony				0.968	***	0.097
Observations	79,704			79,704		
Adj R^2	0.7854			0.7838		

Note: ***, ** and * shows 1%, 5% and 10% significance, respectively.

Last, we point out the advantage of our method of estimating trade costs over other methods. Our primary purpose is to obtain *country-pair-specific* (asymmetric) trade costs. In this sense, we cannot adopt the method/specification employed in McCallum (1995), Feenstra (2002), and Anderson and van Wincoop (2003) because their method requires us to employ data on transactions among sub-national level regions such as provinces. Since our sample is targeted throughout the world, it is not possible to obtain such data. Also, Head and Mayer (2000) propose the "log odds ratio" method, which requires national-level transaction data but provides only *importer-specific* trade costs. Furthermore, it might be expected that we take the residuals of regression as trade costs. That is, the following equation is first estimated:

$$\ln x_{ij}^{t} = \beta_0 + \beta_1 \ln y_i^t + \beta_2 \ln y_j^t + \varepsilon_{ij}^t,$$

then the difference between actual bilateral trade values and fitted bilateral trade values is calculated. Such a difference is certainly country-pair-specific, but it includes the effects of Π and *P* in addition to various other elements. However, if we introduce importer-year and exporter-year dummy variables in order to control them, the residuals turn out not to include importer-specific border barriers, which are unlikely to be negligible. On the other hand, our method also has a shortcoming: Our estimator can cover trade cost components that are included in the trade cost function, i.e. (A.3). For example, the effects of customs efficiency are not taken into account. Thus, we can say that our method prefers capturing some of the most important components of trade costs to including trade cost unrelated elements or even omitting some important components.

Appendix 2. Slope of Profit Function

In this appendix, we examine differences in slopes of profit function among production types.

A2.1. Domestic Vs. VFDI

The condition that the slope in VFDI is greater than the slope in domestic production is as follows:

$$S_1^V > S_1^D \Leftrightarrow r_1 < \frac{(Ba-1)w_2}{t-B}, \quad B \equiv \left(\frac{A_1 + A_2 t^{1-\sigma}}{A_1 t^{1-\sigma} + A_2} \right)^{\frac{1}{1-\sigma}}.$$

Assumption 2 gives us the following corollary.

Corollary 1: $0 < B \leq 1$.

Proof. It is obvious that $B > 0$. $(A_1+A_2t^{1-\sigma})$ - $(A_1t^{1-\sigma}+A_2) = (A_1-A_2)(1-t^{1-\sigma})$. Since $1 \geq t^{1-\sigma}$, $A_1+A_2t^{1-\sigma} > A_1t^{1-\sigma}+A_2$ with Assumption 2. Then, since $\sigma > 1$, $B \leq 1$. ■

We define function $g(a,t)$:

$$g(a,t) = \frac{(Ba-1)w_2}{t-B}.$$

Then, we can easily show (remember that $t \geq 1$):

$$\frac{\partial g(a,t)}{\partial a} = \frac{Bw_2}{t-B} > 0, \quad g(1,t) = \frac{(B-1)w_1}{t-B} < 0.$$

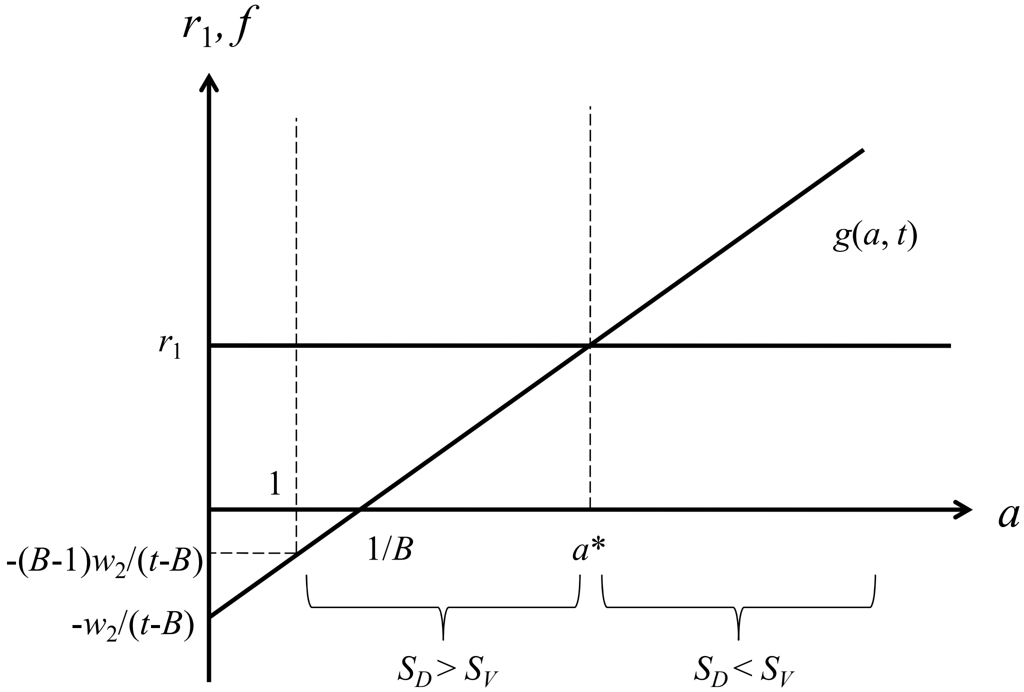
Also,

$$r_1 = \frac{(Ba^*-1)w_2}{t-B} \Leftrightarrow a^* = \frac{(t-B)r_1 + w_2}{Bw_2} > \frac{1}{B}.$$

By employing these relationships and results, we can draw Figure A1 and obtain the following result:

Corollary 2: *If $a \geq a^*$, then $S_1^V \geq S_1^D$. Otherwise, $S_1^V < S_1^D$.*

Figure A1. The Relationship between S_1^V and S_1^D: The Role of *a*



On the other hand, the condition can be also rewritten as:

$$S_1^V > S_1^D \Leftrightarrow 1 + \left(\frac{r_1}{w_2} \right) t < \left(a + \frac{r_1}{w_2} \right) B .$$

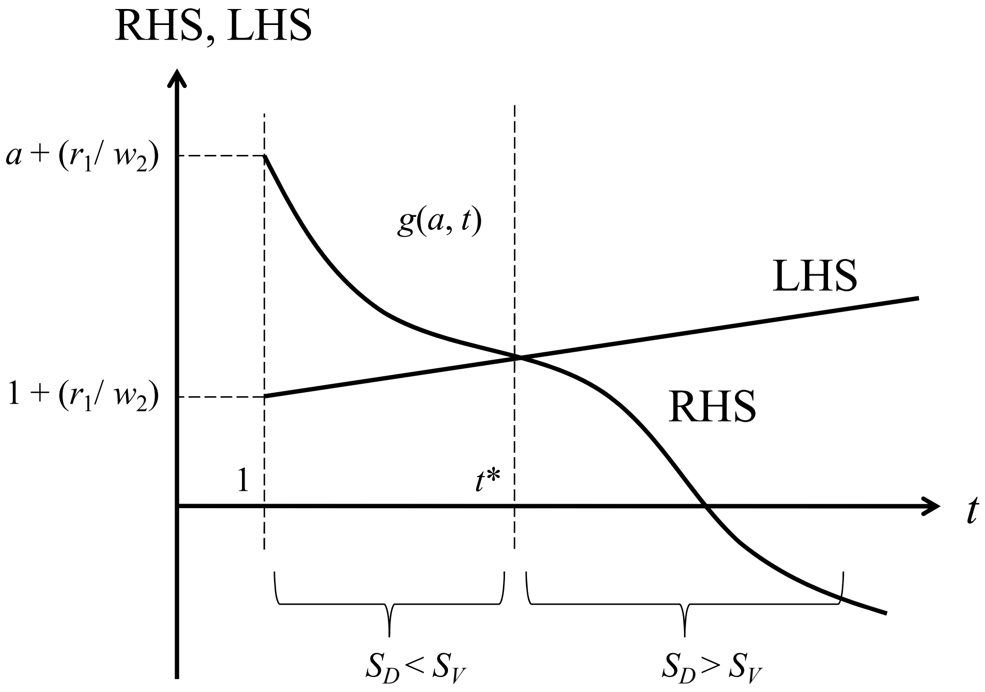
Due to assumption 2, we have:

$$\frac{\partial B}{\partial t} = -t^{-\sigma} \left(A_1 + A_2 t^{1-\sigma} \right)^{\frac{\sigma}{1-\sigma}} \left(A_1 t^{1-\sigma} + A_2 \right)^{\frac{2-\sigma}{1-\sigma}} \left(A_1 + A_2 \right) \left(A_1 - A_2 \right) < 0 .$$

Using the sign of this derivative, we can draw the above condition as in Figure A2 and find t so that RHS = LHS, which is denoted by t^*. As a result, we obtain the following result:

Corollary 3: *If $t \leq t^*$, then $S_1^V \geq S_1^D$. Otherwise, $S_1^V < S_1^D$.*

Figure A2. The Relationship between S_1^V and S_1^D: the Role of t



Last, let Θ_k^{VD} be the productivity in which Domestic and VFDI have equal profits for firms in country k. Its derivatives with respect to various parameters are examined. The derivative with respect to trade cost is as follows:

$$\frac{\partial \Theta_1^{VD}}{\partial t} = \frac{f(1-\sigma)}{\left(S_1^V - S_1^D\right)^2}\left\{t^{-\sigma}\left[\left(tr_1 + w_2\right)^{1-\sigma} A_1 - \left(r_1 + w_1\right)^{1-\sigma} A_2\right] + r_1\left(tr_1 + w_2\right)^{1-\sigma}\left(A_1 t^{1-\sigma} + A_2\right)\right\}.$$

With the Assumption 2,

$$\left(tr_1 + w_2\right)^{1-\sigma} A_1 - \left(r_1 + w_1\right)^{1-\sigma} A_2 \geq \left[\left(tr_1 + w_2\right)^{1-\sigma} - \left(r_1 + w_1\right)^{1-\sigma}\right] A_2.$$

As a result, the sufficient condition for the positive derivative can be written as:

Corollary 4: $(t-1)r_1 < (a-1)w_2 \Rightarrow \dfrac{\partial\left(\Theta_1^V - \Theta_1^D\right)}{\partial t} > 0.$

Its derivative with respect to fixed entry cost is given by:

$$\frac{\partial \Theta_1^{VD}}{\partial f} = \frac{1}{S_1^V - S_1^D}.$$

Due to the corollaries 2 and 3, we obtain:

Corollary 5: *If $a \geq a^*$ or $t \leq t^*$, then $\partial\Theta_1{}^{VD}/\partial f > 0$.*

With respect to the size of foreign market,

$$\frac{\partial \Theta_1^{VD}}{\partial A_2} = \frac{f}{\left(S_1^V - S_1^D\right)^2}\left[\left(tr_1 + taw_2\right)^{1-\sigma} - \left(tr_1 + w_2\right)^{1-\sigma}\right]$$

The following corollary is obtained:

Corollary 6: *If $ta \leq 1$, then $\partial\Theta_1{}^{VD}/\partial A_2 \geq 0$. Otherwise, $\partial\Theta_1{}^{VD}/\partial A_2 < 0$.*

The derivatives with respect to the other parameters are summarized as:

Corollary 7: $\dfrac{\partial \Theta_1^{VD}}{\partial a} = \dfrac{f(1-\sigma)w_2\left(r_1 + aw_2\right)^{-\sigma}\left(A_1 + A_2 t^{1-\sigma}\right)}{\left(S_1^V - S_1^D\right)^2} < 0, \qquad \dfrac{\partial \Theta_1^{VD}}{\partial b} = 0.$

A2.2. Domestic vs. HFDI

The condition that the slope in HFDI is greater than the slope in domestic production can be simplified as follows:

$$(tr_1 - r_2) + (tw_1 - w_2) > 0.$$

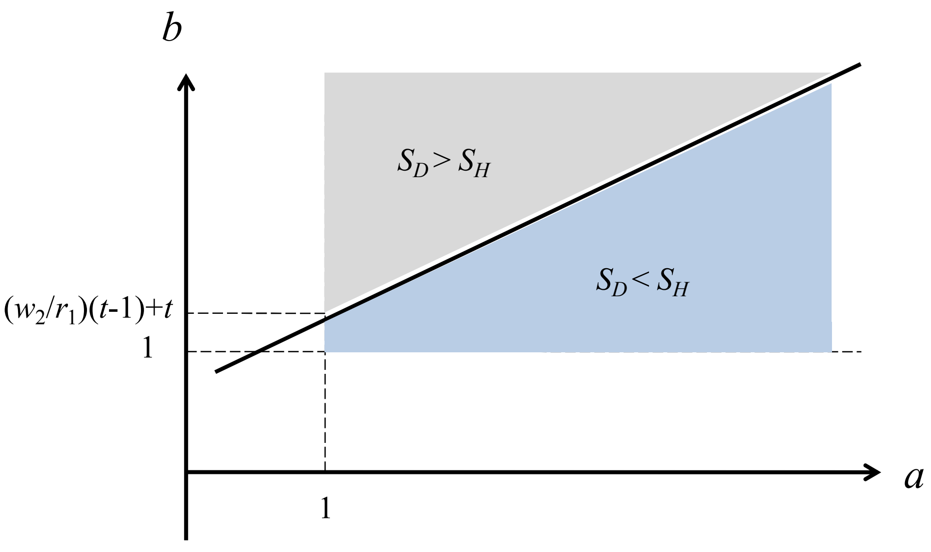
This condition can be expressed as follows:

Corollary 8: $b < \left(\frac{w_2 t}{r_1}\right) a + \left(t - \frac{w_2}{r_1}\right) \Leftrightarrow S_1^H > S_1^D$.

Corollary 9: $t > \frac{r_2 + w_2}{r_1 + w_1} \Leftrightarrow S_1^H > S_1^D$

Figure A3 shows corollary 8, meaning that, given the trade costs, the smaller the gap in wages for skilled labor, the more likely the slope in HFDI is to be greater than the slope in Domestic. Corollary 9 indicates that, given wages for skilled and unskilled labor, larger trade costs also lead to a similar relationship of.

Figure A3. The Relationship between S_1^H and S_1^D: the Role of a and b



Let Θ_k^{HD} be the productivity in which Domestic and HFDI yield equal profits for firms in country *k*. Its derivatives with respect to fixed entry cost and the size of foreign market are given by:

$$\frac{\partial \Theta_1^{HD}}{\partial f} = \frac{1}{S_1^H - S_1^D}, \qquad \frac{\partial \Theta_1^{HD}}{\partial A_2} = \frac{f}{\left(S_1^V - S_1^D\right)^2}\left[t^{1-\sigma}\left(r_1 + w_1\right)^{1-\sigma} - \left(r_2 + w_2\right)^{1-\sigma}\right]$$

Since the latter becomes negative if $t > (r_2+w_2)/(r_1+w_1)$, with corollaries 8 and 9, these two derivatives can be summarized as follows.

Corollary 10: $S_1^H > S_1^D \Leftrightarrow \dfrac{\partial \Theta_1^{HD}}{\partial f} > 0 \Leftrightarrow \dfrac{\partial \Theta_1^{HD}}{\partial A_2} < 0.$

The derivatives with respect to the other parameters are summarized as:

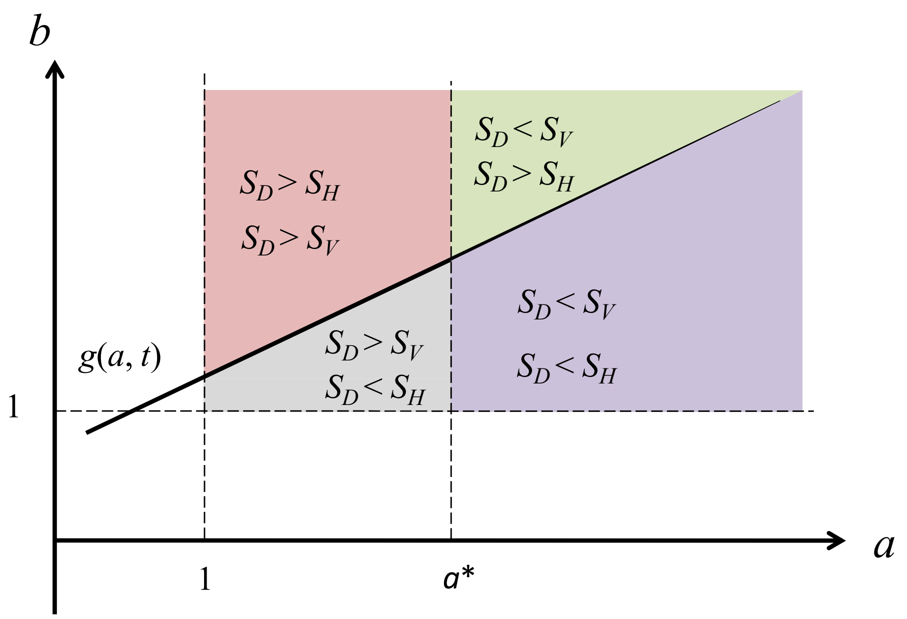
Corollary 11: $\dfrac{\partial \Theta_1^{HD}}{\partial t} = \dfrac{-f(\sigma-1)(r_1+w_1)^{1-\sigma} A_2 t^{-\sigma}}{\left(S_1^V - S_1^D\right)^2} < 0,$

$$\frac{\partial \Theta_1^{HD}}{\partial a} = \frac{f(1-\sigma) w_2 A_2 t^{1-\sigma}\left(r_1 + a w_2\right)^{-\sigma}}{\left(S_1^H - S_1^D\right)^2} < 0, \quad \frac{\partial \Theta_1^{HD}}{\partial b} = \frac{f(\sigma-1) r_1 A_2 \left(b r_1 + w_2\right)^{-\sigma}}{\left(S_1^H - S_1^D\right)^2} > 0.$$

A2.3. VFDI VS. HFDI

Our assumption of identical plant set-up costs between VFDI and HFDI assures that firms choosing VFDI and those choosing HFDI do not coexist. In other words, in our model setting, firms select their production patterns from a choice of either VFDI or Domestic or between HFDI and Domestic. If we assume the different plant set-up costs between these two FDIs, however, we can show that by integrating Figures A1 and A3 there are situations in which firms choosing VFDI, HFDI, and Domestic production patterns can coexist. From Figure A4, we can see that there are combinations of a and b in which $S_1^H > S_1^D$ and $S_1^V > S_1^D$. For example, if $S_1^H > S_1^V$ in these combinations, by assuming that plant set-up costs are cheaper in VFDI than HFDI, firms with high levels of productivity choose HFDI, those with medium levels choose VFDI, and those with low levels choose Domestic. To avoid these ambiguous results, we assume identical plant set-up costs between VFDI and HFDI.

Figure A4. The Relationship between S_1^V, S_1^H, and S_1^D: the Role of *a* and *b*



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CHAPTER 3

The Effects of Imported Intermediate Varieties on Plant Total Factor Productivity and Product Switching: Evidence from Korean Manufacturing

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By utilizing previously unexplored plant-product data on Korean manufacturing, and detailed import data during 1991~1998, this paper empirically investigates the role of imported intermediate varieties. Specifically, we investigated whether greater access to imported intermediate varieties enhanced plant total factor productivity and product switching behavior. First, as consistent with previous empirical studies using macro- and micro-data, we find that a plant that belongs to industries with higher imported intermediate variety growth experienced higher productivity growth. Secondly and perhaps more importantly, our empirical results suggest that increased imported intermediate varieties had a positive impact on stimulating the product-switching behavior of domestic plants. Since product-switching behavior (that is, simultaneously adding and dropping products) could be understood as a part of the continual process of "creative destruction" within plants, this result suggest that imported intermediate variety growth may be one of the channels through which resource reallocation within firms can be enhanced. Taking into account the fact that 68% of Korean plants (77% when weighted by shipments) are both adding and dropping products during our sample period, this finding is of greater empirical importance. Additionally, unlike a previous study for India, we found that imported intermediate variety growth has reduced the product scope (that is, the number of products) of domestic plants. Although this finding is not inconsistent with our finding related to product switching behavior, this suggests that imported intermediate variety growth may have different implications for industrial countries and developing countries.

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1. Introduction

There is wide agreement among trade and growth economists that international trade is one of the major conduits for knowledge spillovers across countries. Based on the endogenous growth models developed by Romer (1990) and Aghion and Howitt (1992), Grossman and Helpman (1991) and Rivera-Batiz and Romer (1991) extended these frameworks into an open-economy context. In these macroeconomic models, international trade both in final goods and intermediate goods affects domestic productivity and economic growth through knowledge spillovers. For example, R&D activities or technology innovation abroad create new intermediate goods that are different from or better than existing ones and by importing these new intermediate goods, domestic producers can improve their production efficiency. Many empirical studies have found some evidence for this knowledge spillover effect through international trade by using either country-level data (Coe and Helpman, 1995) or industry-level data (Keller , 2002).

In recent years, developments in trade theory suggest that understanding the plant-level response to trade liberalization is crucial in understanding its impact on aggregate productivity and welfare (e.g., Melitz, 2003 and Bernard *et al.,* 2003). This theoretical development has prompted intense empirical scrutiny in examining the effect of imported intermediate goods on productivity with micro-level data.[1] All of these empirical studies, however, considered only the price effect of trade liberalization (i.e., cheaper imported intermediates due to tariff reduction) and few of them takes into

[1] The plant-level or firm-level analyses that emphasized the role of imported intermediate goods include Amiti and Konings (2007) for Indonesia, Kasahara and Rodrigue (2008) for Chile and Halpern *et al.* (2009) for Hungary.

account the variety growth effect of imported intermediate.[2] Feenstra (1994, 1999) has developed an empirically feasible methodology to measure input variety growth and has theoretically shown that greater input varieties can have a direct impact on total factor productivity. Thus, if domestic producers are able to access to greater imported intermediate varieties (due to trade liberalization) then we may expect that their productivity will be improved. This is the first hypothesis we would like to test in our empirical analysis, using Korean manufacturing data.

While the nexus between greater access to imported intermediate varieties and domestic productivity is of great importance on its own, this paper is also interested in more dynamic effect of trade liberalization through intermediate imports: the product switching behavior of domestic plants. Recently, Bernard *et al.* (2006, hereafter BRS, 2006) investigated this product switching (i.e., product adding and product dropping) behavior of US firms using firm-product data and they argued that, through product switching, the reassignment of resources takes place within surviving firms. They showed that 45% of US firms (accounting for 81% of US shipments) are both adding and dropping at least one product at the same time during 1972 ~ 1997.[3]

In explaining this observed phenomenon, they emphasized the interactions of firm and product attributes. For example, firm shocks such as the accumulation of R&D knowledge or the substitution of one management team for another may have an uneven effect across products. As a result, it is possible for the firms to add those products

[2] Goldberg *et al.* (2010) is the only exception. By using Indian data during 1990s they examined whether greater access to new intermediate imports has increased the number of products manufactured by firms.

[3] Korean plant-product data used in this paper shows a very similar pattern: 68.0% of firms (accounting for 76.9% of shipments) are both adding and dropping products during 1990~1998. More detailed analyses of product switching as well as economy-wide product creation and destruction in Korea with focus on exporting plants were conducted in a separate paper by Hahn (2010)

whose relative profitability has risen and at the same time to drop those products whose relative profitability has fallen (i.e., both product adding and dropping could take place within the firm at the same time). This active product switching behavior can enhance the resource reallocation process within the firm and thereby improve the firm's production efficiency.

Although they did not consider international trade explicitly in explaining product switching behavior, we think that imported intermediate variety growth can play an important role as well.[4] If a newly imported intermediate variety can enhance the relative profitability of some specific products and reduce that of other products, it is possible for domestic producers to reallocate their resources into more profitable products through product switching.[5] This constitutes our second hypothesis: whether and to what extent imported intermediate variety growth can explain the process of product switching within Korean manufacturing data. Because we believe that plant product switching (that is, both product adding and product dropping) behavior can be considered as a part of the continual process of "creative destruction" within plants, we think that this dynamic gain from new intermediate imports, if it exists, is of great empirical importance.

In sum, by utilizing previously unexplored plant-product data on Korean manufacturing and detailed import data during 1991~1998, this paper empirically investigates the above two hypotheses: whether increased access to new intermediate

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[4] In another paper (BRS, 2009), the theoretical relation between trade liberalization and product switching behavior and its empirical validity for US was analyzed. But in that paper, the focus was the trade liberalization in the export market (that is, the Canadian market) and its effect on the product switching behavior of exporting firms (that is, US firms).

[5] New imported intermediate variety is not a firm-product-specific but product-specific shock. Although BRS (2006) emphasized firm-product-specific shocks in explaining US data, theoretically the product-specific shock as well can explain simultaneous adding and dropping behavior within firms. See BRS (2006) Section 5.1.

goods through imports had an impact on (i) plant productivity and (ii) product switching behavior. Although there are many empirical studies on the former as discussed above, to our knowledge there exists no study that investigated the latter.

During our sample period in 1991~1998, the Korean government implemented the second tariff reduction plan (Table 1). The average tariff rate in Korea was reduced from 20.6% in 1984 to 16.9% in 1988 by the first tariff reduction plan and through the second tariff reduction plan it was further reduced to 6.2% in 1994.[6] After the completion of this second tariff plan, Korea's import tariff saw little further change. This tariff reduction pattern could be seen in our data as well (Figure 1). In these figures, we see a sharp reduction of import tariffs during the early 1990s and afterwards the tariff rate stabilized. Then the natural question would be whether this tariff reduction during our sample period induced greater access to import variety? The simple fixed-effect model estimations in Table 2 show that, at least in the case of imported intermediate goods, the variety growth was related to tariff reduction especially during our sample period.[7]

Table 1. Trend of Tariff Rate in Korea (unit: %)

	1983	1st Tariff Reduction Plan		2nd Tariff Reduction Plan					1997	1999	2000
		1984	1988	1989	1990 ~1991	1992	1993	1994			
All	22.6	20.6	16.9	11.2	9.7	8.4	7.1	6.2	6.3	6.4	6.4
Raw Material	11.9	10.6	9.5	3.9	3.9	3.3	3.2	2.8	2.6	2.5	2.5
Intermediate	21.5	18.7	17.1	11.7	10.7	9.3	7.8	7.0	6.9	6.8	6.8
Final	26.4	24.7	18.9	13.3	11.2	9.4	7.9	7.1	6.8	7.0	7.0

Source: Chung and Ryu (2004).

6 See Chung and Ryu (2004) for more details about the backgrounds of these tariff reduction plans.

7 As we will explain in the next section, greater imported variety is represented by lower values of the dependent variables of these regressions. Thus the positive sign of the coefficient means that as tariff rate is decreased the imported variety growth is greater.

Figure 1. Tariff Rates on Imported Goods

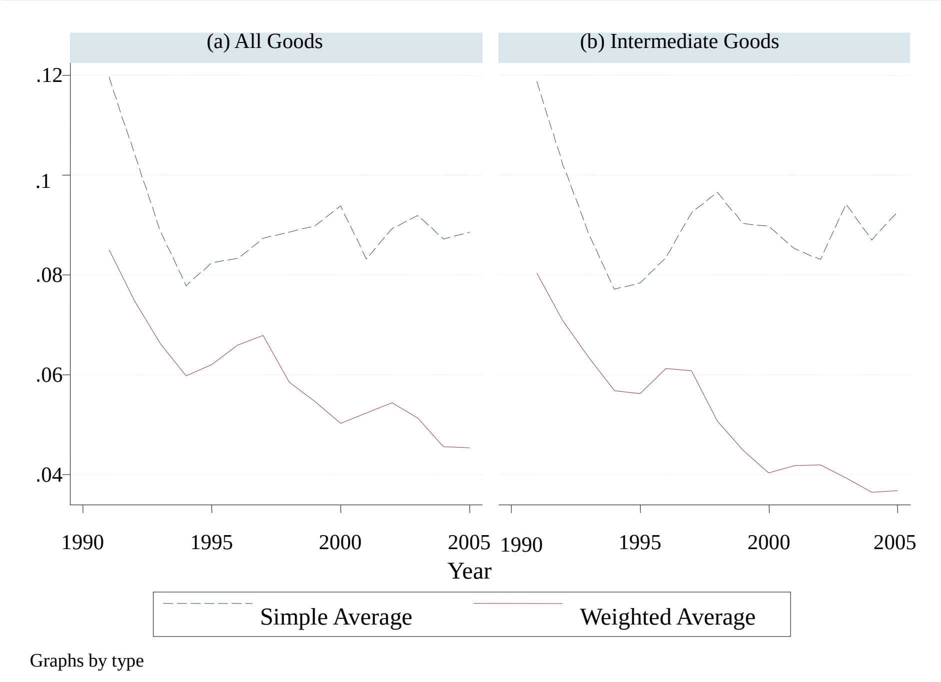

Table 2. Regression of Imported Varieties on Tariff Rate Change

Variables	Fixed Effect Estimation
(a) Variety Change of All Imported Goods: 1991~2005	
Tariff Change	0.010 (0.006)
Observation	1,525
R-Squared	0.014
(b) Variety Change of Imported Intermediate Goods: 1991~2005	
Tariff Change	0.016* (0.009)
Observation	1,243
R-Squared	0.019
(c) Variety Change of All Imported Goods: 1991~1998	
Tariff Change	0.046** (0.023)
Observation	557
R-Squared	0.020
(d) Variety Change of Imported Intermediate Goods: 19991~1998	
Tariff Change	0.115** (0.049)
Observation	452
R-Squared	0.035

Note: Heteroscedasticity-consistent robust standard errors are in parentheses. *, **, and *** denote that the estimated coefficients are significant at 10%, 5% and 1% level, respectively.

Our work is related to several strands of previous literature, beside the aforementioned ones. First, from the methodological perspective in measuring imported intermediate varieties, this paper is related to the theoretical and empirical studies such as Feenstra (1994) and Broda and Weinstein (2006a). They provided the methodology to measure imported varieties or intermediate input varieties at the level of each good or at the aggregated level in a monopolistic competition setting as in Krugman (1979). By using this methodology, Broda and Weinstein (2004, 2006a) directly estimated the impact of increased *imported variety* on aggregate welfare for the case of 20 countries during 1972~1997 and the US during 1972~2001. In these works, they showed that the globalization process has led to an increase of imported varieties which in turn reduced the import prices. This reduction of import prices due to the increase of import varieties represented the main source of gains from variety import.[8] We adopt this methodology in measuring imported intermediate varieties in our analysis.

Secondly, our work is directly related to a recent empirical work by Goldberg *et al.* (2010, henceforth GKPT, 2010). In this study, they investigated whether increased access to new imported intermediate varieties enabled firms to expand their *domestic product scope* (measured by the number of products manufactured by the firm).[9] Using Indian data in the 1990s, they found that there was an expansion of domestic product scope driven by increases in newly available imported input. While examining the domestic product scope can give us its own important implications, we think that analyzing product switching behavior rather than domestic product scope would be more relevant, considering the situation in Korea where a creative destruction

[8] Other studies that estimated the impact of imported variety on overall welfare include Arkolakis *et al.* (2008) for Costa Rica and Mohler and Seitz (2009) for 27 EU countries.

[9] In measuring imported intermediate varieties, they also used the methodology developed by Feenstra (1994) and Broda and Weinstein (2006a).

process through adding and dropping within plants prevails.[10]

Finally, our study is also related to the literature on direct tests of the endogenous growth model, where increased intermediate input variety improves productivity. Two more empirical studies are noteworthy. Feenstra *et al.* (1999) used industry level data from Korea and Taiwan; they showed that changes in *domestic input variety* have a positive and significant effect on total factor productivity.[11] On the other hand, in GKPT (2010) the effect of *imported input variety* was estimated to have a positive impact on total factor productivity in India, although their main interest lies on the impact on domestic product scope.

The rest of the paper is organized as follows. Section 2 presents our empirical framework where methodologies regarding the measurement of imported intermediate varieties and the product switching rate will be discussed including our regression specifications. Section 3 describes the data that are used in the paper. Section 4 discusses our empirical results and Section 5 concludes.

2. Empirical Framework

2.1. Measuring Imported Intermediate Varieties: Feenstra Price Index

In answering the research questions posited above, we first need to measure imported varieties. In doing so, we closely follow the methodologies developed by

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[10] Suppose that due to newly available intermediate imports, a firm adds one product and at the same time drops another by reallocating resources more efficiently. In this situation, the measure of domestic product scope will be zero despite the existence of dynamic gains from intermediate imports, while our measure on product switching can capture this effect.

[11] Due to the limitation of the data, Feenstra *et al.* (1999) used export variety instead of domestic product variety in their work.

Feenstra (1994) and its applications in Broda and Weinstein (2006a). Feenstra (1994) showed that for any good *m* that continuously exists in two periods, the conventional import price index can be modified to account for the role of new import varieties as long as there exists some overlap in the varieties available between two periods, which has the following form.[12]

$$P_{mt}^{E} = P_{mt}^{C}\Lambda_{mt} \tag{1}$$

where P_{mt}^{E} is the exact price index of imported good *m* at time *t* when new (or extinct) varieties are taken into account, P_{mt}^{C} the conventional import price index and Λ_{mt} imported variety index (or lambda ratio in the literature). In turn, Feenstra (1994) showed that the conventional import price index and the imported variety index can be calculated by the following formula:

$$P_{mt}^{C} = \prod_{v \in I_m} \left(\frac{p_{mvt}}{p_{mvt-1}} \right)^{w_{mvt}} \tag{2}$$

$$\Lambda_{mt} = \left(\frac{\lambda_{mt}}{\lambda_{mt-1}} \right)^{\frac{1}{\sigma_m - 1}} \tag{3}$$

$$\text{where } \lambda_{mt} = \frac{\sum_{v \in I_m} p_{mvt} M_{mvt}}{\sum_{v \in I_{mt}} p_{mvt} M_{mvt}} \text{ and } \lambda_{mt-1} = \frac{\sum_{v \in I_m} p_{mvt-1} M_{mvt-1}}{\sum_{v \in I_{mt-1}} p_{mvt-1} M_{mvt-1}}$$

The conventional import price index (equation (2)) is the geometric mean of price changes (*p*) in individual variety (denoted by subscript *v*) weighted by ideal log-change

[12] The fact that only continuously produced goods in both periods can be taken into account is one of the limitations of Feenstra's methodology. This is because the impact of truly new good on an economy is presumably far greater than that of new variety. Thus, how to incorporate the impact of new (or extinct) good is thus important issue but beyond the scope of this paper. We leave this issue for future research.

weights (w_{mvt}).[13] This index can be calculated only when the specific variety exist in both periods (i.e., when $v \in I_m$ where I_m is the set of variety existing in both periods). Looking at the numerator of the imported variety index (equation (3)), λ_{mt} is the fraction of expenditure in the varieties that are available in both periods (i.e., $v \in I_m$) relative to the entire set of varieties available only in period *t* (i.e., $v \in I_{mt}$). This means that the higher the expenditure share of new varieties, the lower is λ_{mt} and the smaller is the exact price index relative to the conventional price index.[14] Thus, Λ_{mt} captures the gains from newly available imported variety.

Following the convention in the previous literature, an imported good (*m*) is defined according to HS (Harmonized System) codes and for each imported good a variety (*v*) is defined as the import of that good from a particular country. That is, it is assumed that for each HS category, imports are treated as differentiated across countries of supply (as in Armington (1969)).

Based upon the formula of the exact import price index for each imported good described above (equations (1)-(3)), Broda and Weinsten (2006a) developed the methodology on how to derive the aggregate exact import price index. That is, as long as two goods are available in two periods, the aggregate exact import price index with variety change is given by

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[13] These weights are computed as follows. $w_{mvt} = \dfrac{(s_{mvt} - s_{mvt-1})/(\ln s_{mvt} - \ln s_{mvt-1})}{\sum_{v \in M} \left[(s_{mvt} - s_{mvt-1})/(\ln s_{mvt} - \ln s_{mvt-1})\right]}$ where $s_{mvt} = \dfrac{p_{mvt} M_{mvt}}{\sum_{v \in M} p_{mvt} M_{mvt}}$.

[14] In order to calculate Λ_{mt}, we need to have the estimate of elasticity of substitution between varieties of each imported good. Broda and Weinstein (2006b) estimated these elasticities at HS 3-digit level for 73 countries including Korea. In our empirical study, we directly adopted these estimates.

$$
\begin{aligned}
P_t^E &= P_t^C \Lambda_t \\
&= \prod_{m \in M} \left(P_{mt}^C\right)^{w_{mt}} \prod_{m \in M} \left(\Lambda_{mt}\right)^{w_{mt}} \\
&= \prod_{m \in M} \left(P_{mt}^E\right)^{w_{mt}}
\end{aligned} \tag{4}
$$

where P_t^E, P_t^C and Λ_t denote aggregate exact price index, aggregate conventional price index and aggregate variety index for the set of all imported goods (*M*). The third equality in (4) implies that the aggregate exact price index is the geometric mean of the exact price index of each imported good (P_{mt}^E) where the weights (w_{mt}) are log-change ideal weights.[15]

If *M* is defined as the set of all imported goods, then equation (4) provides the decomposition of the aggregate exact price index into the aggregate conventional price index and the aggregate variety index. If *M* is defined as a narrower set of imported goods, for example the set of imported intermediate goods, then we can measure the exact price index and its two components of imported intermediate goods in the same way.

2.2. Measuring the Product Switching Rate

Suppose that two initially identical plants (plants A and B) added one more new product in their production line. But the *value* of plant A's new product is negligible compared to plant A's total value of production while that of plant B is significant. In

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[15] Just like w_{mvt}, w_{mt} can be calculated as follows. $w_{mt} = \dfrac{(s_{mt} - s_{mt-1})/(\ln s_{mt} - \ln s_{mt-1})}{\sum_{m \in M} \left[(s_{mt} - s_{mt-1})/(\ln s_{mt} - \ln s_{mt-1})\right]}$ where $s_{mt} = \dfrac{p_{mt} M_{mt}}{\sum_{m \in M} p_{mt} M_{mt}}$.

this case, the economic importance of adding the new product is much higher for plant B. Therefore, in calculating the product switching rate, we need to take into account the value of production of each product.[16]

First, we use the following formula to measure product adding and product dropping rates for plant i:

$$PA_{it} = \frac{\sum_{d \in J_{it}} p_{idt} Q_{idt} - \sum_{d \in J_i} p_{idt} Q_{idt}}{\sum_{d \in J_{it}} p_{idt} Q_{idt}} = 1 - \frac{\sum_{d \in J_i} p_{idt} Q_{idt}}{\sum_{d \in J_{it}} p_{idt} Q_{idt}} \tag{5}$$

$$PD_{it} = \frac{\sum_{d \in J_{it-1}} p_{idt-1} Q_{idt-1} - \sum_{d \in J_i} p_{idt-1} Q_{idt-1}}{\sum_{d \in J_{it-1}} p_{idt-1} Q_{idt-1}} = 1 - \frac{\sum_{d \in J_i} p_{idt-1} Q_{idt-1}}{\sum_{d \in J_{it-1}} p_{idt-1} Q_{idt-1}} \tag{6}$$

where J_{it} or J_{it-1} denotes the set of products produced by plant i, either in year t or in year t-1. $J_i = J_{it-1} \cap J_{it}$ is the set of common products that are produced by plant i in both periods. And d, p and Q represent domestic product, its price and quantity, respectively. The numerator of the product adding rate in equation (5) measures the value of added product between year t-1 and t and the denominator is the value of production at time t. Suppose that a plant does nothing between two periods (no adding and no dropping). Then since $J_i = J_{it-1} = J_{it}$, both PA_{it} and PD_{it} will be zero.

Then we define the product switching rate as follows:

[16] In fact, this is why the value of new (or extinct) varieties is taken into account in equation (3) in measuring the variety change in imported goods.

$$PS_{it} = \frac{\left(\sum_{d\in J_{it}} p_{idt}Q_{idt} - \sum_{d\in J_i} p_{idt}Q_{idt}\right) + \left(\sum_{d\in J_{it-1}} p_{idt-1}Q_{idt-1} - \sum_{d\in J_i} p_{idt-1}Q_{idt-1}\right)}{0.5\left(\sum_{d\in J_{it}} p_{idt}Q_{idt} + \sum_{d\in J_{it-1}} p_{idt-1}Q_{idt-1}\right)}$$

$$= 2 - \frac{\left(\sum_{d\in J_i} p_{idt-1}Q_{idt-1} + \sum_{d\in J_i} p_{idt}Q_{idt}\right)}{0.5\left(\sum_{d\in J_{it}} p_{idt}Q_{idt} + \sum_{d\in J_{it-1}} p_{idt-1}Q_{idt-1}\right)} \tag{7}$$

The numerator reflects the value of added product (the first bracket) plus the value of dropped product (the second bracket) and the denominator the average production in period t-1 and t.

2.3. Empirical Specification

Having established the methodologies for measuring import varieties and domestic varieties, we now turn to our empirical specification to test our main hypotheses: whether imported intermediate variety has an impact (i) on a plant's total factor productivity and (ii) on a plant's product switching behavior.

In Section IV, we will run the following regressions.

$$\Delta \ln tfp_{it}^{k} = \alpha + \beta_1 P_{t-1}^{C,INT_k} + \beta_2 \Lambda_{t-1}^{INT_k} + \Gamma' X_{it-1}^{k} + \varepsilon_{it} \tag{8}$$

$$PS_{it}^{k} = \alpha + \beta_1 P_{t-1}^{C,INT_k} + \beta_2 \Lambda_{t-1}^{INT_k} + \beta_3 tfp_{it-1}^{k} + \Gamma' X_{it-1}^{k} + \varepsilon_{it} \tag{9}$$

$\Delta \ln tfp_{it}^{k}$ is the growth rate of total factor productivity of plant i in industry k at time t and PS_{it}^{k} the product switching rate of plant i in industry k at time t measured in the previous subsection. X_{it}^{k} is a vector of plant characteristics including size, age, capital intensity, skill intensity and R&D intensity. Because we do not have the data on the usage of imported intermediate goods at plant level, the conventional price index and variety index of imported intermediate goods has to be calculated at industry level, by utilizing the information from an input-output table following GKPT (2010). For example, in equation (8) $\Lambda_t^{INT_k}$ is the imported intermediate input variety index in industry k, measured by

$$\Lambda_t^{INT_k} = \sum_{l \in K} \theta_{lk} \Lambda_t^{INT_l} \tag{10}$$

where θ_{lk} is the input-output coefficient (the share of input l out of the value of industry k's total input) and $\Lambda_t^{INT_l}$ is the aggregated variety change index of industry l's imported intermediate input. The P_t^{C,INT_k} can be measured by the similar way.

In the regression equation (9), we added the level of total factor productivity tfp_{it}^k as an additional regressor. This was motivated by BRS (2006) where they showed that product switching behavior (especially product adding) is related to the firm's productivity. That is, they argue that the ability to enter and exit product markets flexibly may be due to the capability of the firms concerned. Thus, a more capable firm (with higher productivity) is more likely to be involved in more active product switching behavior due to the self-selection effect. Although in our study we are not directly assessing this self-selection effect, adding the level of total factor productivity seems to be a more appropriate empirical specification.

3. Data Description

3.1. Price and Variety Indices of Imported Intermediate Goods

The yearly data on Korean imports are taken from KCS (Korea Customs Service) at the10-digit level, but with a different HS code system for three periods: the import data during 1991~1995, during 1996~2001 and during 2002~2005 are categorized according to HS-1988, HS-1996 and HS-2002 code systems, respectively.[17] By using these data, we first constructed conventional price indices and lambda ratios following equations (2) and (3).

Since we are interested in the price and variety change of intermediate goods, we need to identify which HS codes are intermediate goods. By using the UN's BEC (Broad Economic Categories) code and the classification by Hummels *et al.* (1999), we divided each HS code into three types of imports: intermediate goods, consumption goods and capital goods. Once we identify which HS codes corresponds to the intermediate goods category of the BEC codes, we constructed industry-level price indices and lambda ratios by using equations (4) and (10).[18] That is, we aggregated each intermediate HS code's price indices and lambda ratios at industry level following equation (4) (as in Broda and Weinstein (2006a)) and then we applied an input-output coefficient from Korea's input-output table in order to calculate equation (10).

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[17] Since the concordance matrix between different HS code system does not exist (between HS-1988 and HS-1996) or is incomplete (between HS-1996 and HS-2002), we calculated price and variety indices for each period given existing HS coding system. Therefore, we did not calculated these indices between 1995~1996 and 2001~2002.

[18] We have concordance matrices from each HS code to SITC 3 (provided by UN), from SITC3 to KSIC (Korea Standard Industrial Classification) (calculated by the authors) and from KSIC to IO table classification (provided by the Bank of Korea). By using these matrices we assigned one of the IO table industry classifications to each HS code.

3.2. Product Switching and Other Variables

All other variables are constructed by using the "Survey of Mining and Manufacturing" conducted by the KNSO (Korea National Statistical Office). This Survey covers all establishments with five or more employees in the mining and manufacturing sectors and contains necessary information to construct the variables used in this paper at plant level. Using this data, we calculated plant level total factor productivity and other control variables in equation (8) and (9).[19] Plant size is the natural logarithm of plant employment and plant age is the natural logarithm of a plant's operating years since establishment. Capital intensity is measured as the natural logarithm of per worker tangible fixed assets, while skill intensity is the ratio of non-production worker to production workers. R&D intensity is the ratio of R&D expenditure to total shipment value.

One of the variables that were not explored in the previous studies is the plant level product data: it contains the information about the value of shipments for each product category (based on KSIC classification) at plant level. By using this data, the product switching (adding and dropping) rate for each plant were calculated following equation (5) ~ (6). While we can calculate price indices and lambda ratios during the period between 1991~2005, we have plant product data only between 1990~1998. Thus, our regression analyses will use the panel data between 1991~1998.

[19] Plant total factor productivity is estimated using the chained-multilateral index number approach as developed in Good (1985) and Good *et al.* (1999). See Appendix 1 for more detail.

4. Results

4.1. Preliminary Analyses: Variety Changes in Korean Imports

Before we proceed to the main regression analyses, let us briefly describe the overall picture of the variety changes in Korean imports. Table 3-A provides a preliminary overview on the variety changes in all imported goods and Table 3-B in imported intermediate goods.

Table 3-A. Number of Goods and Varieties in Korean Imports: All Imported Goods

	Year	Number of HS categories	Median number of exporting countries	Average number of exporting countries	Total number of varieties
(a) 1991~1995 (in 10-digit HS-1988 code)					
Goods	1991	7,429	11	11.8	52,861
	1995	7,686 (3.5%)	13	14.5	65,423 (23.8%)
Common Goods 1991~1995	1991	7,035	11	11.8	51,244
	1995	7,035	13	14.6	62,374
1991 not in 1995	1991	394	10	10.9	1,617
1995 not in 1991	1995	651	10	12.4	3,049
(b) 1996~2001 (in 10-digit HS-1996 code)					
Goods	1996	7,786	13	14.6	66,786
	2001	8,035 (3.2%)	15	17.1	78,798 (18.0%)
Common Goods 1996~2001	1996	7,326	13	14.4	64,027
	2001	7,326	15	16.9	73,676
1996 not in 2001	1996	460	18	17.6	2,759
2001 not in 1996	2001	709	19	20.0	5,122
(c) 2002~2005 (in 10-digit HS-2002 code)					
Goods	2002	7,888	15	18.0	80,238
	2005	8,469 (7.4%)	16	19.3	88,899 (10.8%)
Common Goods 2002~2005	2002	7,597	16	18.0	79,244
	2005	7,597	16	19.4	81,768
2002 not in 2005	2002	291	12	14.9	994
2005 not in 2002	2005	872	16	18.6	7,131

Source: Korea Customs Service.
Note: The rates of increase of HS categories and varieties compared to each base year are in parentheses.

Table 3-B. Number of Goods and Varieties in Korean Imports: Imported Intermediate Goods

	Year	Number of HS categories	Median number of exporting countries	Average number of exporting countries	Total number of varieties
(a) 1991~1995 (in 10-digit HS-1988 code)					
Goods	1991	4,372	10	11.9	30,214
	1995	4,526 (3.5%)	12	14.1	36,116 (19.5%)
Common Goods 1991~1995	1991	4,166	10	11.8	29,444
	1995	4,166	12	14.2	34,590
1991 not in 1995	1991	206	11	12.7	770
1995 not in 1991	1995	360	10	12.6	1,526
(b) 1996~2001 (in 10-digit HS-1996 code)					
Goods	1996	4,579	13	14.3	37,512
	2001	4,722 (3.1%)	14	16.7	44,372 (18.3%)
Common Goods 1996~2001	1996	4,319	12	14.1	35,910
	2001	4,319	14	16.4	41,452
1996 not in 2001	1996	260	20	19.1	1,602
2001 not in 1996	2001	403	20	21.4	2,920
(c) 2002~2005 (in 10-digit HS-2002 code)					
Goods	2002	4,564	15	17.2	44,037
	2005	4,918 (7.8%)	16	18.2	48,104 (9.2%)
Common Goods 2002~2005	2002	4,404	15	17.2	43,458
	2005	4,404	16	18.2	44,261
2002 not in 2005	2002	160	16	18.3	579
2005 not in 2002	2005	514	15	17.9	3,843

Source: Korea Customs Service.

Note: The rates of increase of HS categories and varieties compared to each base year are in parentheses.

If we look at panel (a) of Table 3-A, we can see that during 1991~1995, the number of imported goods (i.e. 10-digit HS categories) increased from 7,429 to 7,686. That is, the number of *imported goods* has increased merely by 3.5%. However, the median number of exporting countries has increased from 11 to 13, which resulted in a substantial increase in the number of *imported varieties* (goods x country pair): from 52,861 to 65,423 (around 23.8%-increase). The same pattern can be found when we look at figures in the subsequent periods (panels (b) and (c)) and in the case of imported intermediate goods (Table 3-B).

In order to see how substantial the variety changes are in Korean imports, we do a similar exercise only for the number of varieties in Table 4. In panel (a), we can see that in 1991, the number of all imported varieties was 52,861, among which 17,406 varieties (32.9%) disappeared in 1995. On the other hand, out of 65,423 imported varieties in 1995, 45.8% did not exist in 1991. That is, a large portion of varieties was both disappearing and newly imported, while the share of disappearing varieties was consistently lower than that of newly imported varieties. And again, the same pattern emerges in the case of the varieties of intermediate imports and in other periods.

Table 4. Number of Varieties in Korean Imports: All and Intermediate Varieties

	Year	Number of varieties (goods-country pair)	
		All Imports	Intermediate Imports
(a) 1991~1995 (in 10-digit HS-1988 code)			
Varieties	1991	52,861 (100.0)	30,214 (100.0)
	1995	65,423 (100.0)	36,116 (100.0)
Common Varieties 1991~1995	1991	35,455 (67.1)	20,422 (67.6)
	1995	35,455 (54.2)	20,422 (56.5)
1991 not in 1995	1991	17,406 (32.9)	9,792 (32.4)
1995 not in 1991	1995	29,968 (45.8)	15,694 (43.5)
(b) 1996~2001 (in 10-digit HS-1996 code)			
Varieties	1996	66,786 (100.0)	37,512 (100.0)
	2001	78,798 (100.0)	44,372 (100.0)
Common Varieties 1996~2001	1996	44394 (66.5)	25352 (67.6)
	2001	44394 (56.3)	25352 (57.1)
1996 not in 2001	1996	22,392 (33.5)	12,160 (32.4)
2001 not in 1996	2001	34,404 (43.7)	19,020 (42.9)

(Table 4. *Continued*)

(c) 2002~2005 (in 10-digit HS-2002 code)			
Varieties	2002	80,238 (100.0)	44,037 (100.0)
	2005	88,899 (100.0)	48,104 (100.0)
Common Varieties 2002~2005	2002	55130 (68.7)	30699 (69.7)
	2005	55130 (62.0)	30699 (63.8)
2002 not in 2005	2002	25,108 (31.3)	13,338 (30.3)
2005 not in 2002	2005	33,769 (38.0)	17,405 (36.2)

Source: Korea Customs Service.
Note: The values in parentheses are the share out of all varieties in the corresponding years.

However, all these figures in all these tables used only count data in calculating imported varieties. As pointed out in Section II and in Broda and Weinstein (2006a), if a large number of new varieties takes a small market share, the changes in imported varieties described above may overestimate the importance of new varieties.

In order to appropriately take this issue into account, we need to rely on Feenstra's methodology. Figure 2 shows the distribution of the conventional price index and the exact price index for all imported goods and imported intermediate goods (calculated by using equations (2) and (3)). If the distribution of exact price is positioned to the left of the conventional price index, it means that the variety-adjusted prices for imports fell due to the variety growth (that is, due to lower lambda ratios). In both cases, the contribution of imported variety growth seems to be most substantial during the period of 1991~1995 and it was reduced as we move into later periods.[20]

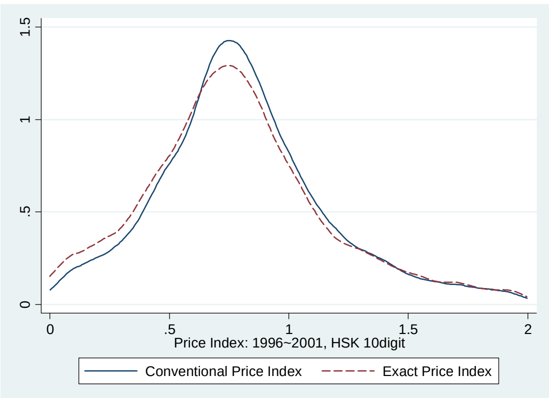
[20] The reason why this variety effect is most significant in the early 1990s seems to be clear from Table 1 and Figure 1 as discussed in Section I. The import tariff reduced rapidly during the early 1990s after which the tariff rate was fairly stable.

Figure 2. Distribution of Conventional and Exact Price Indices

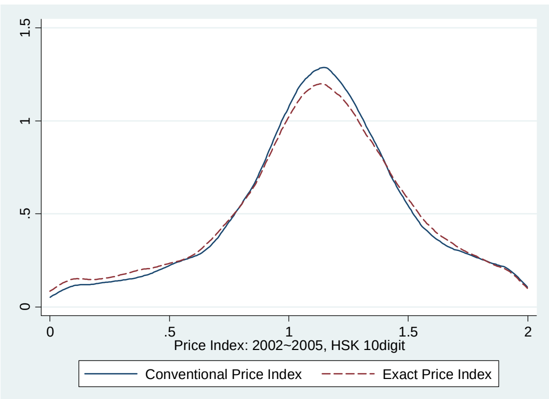
(a) All Imported Goods

< 1991~1995 >

< 1996~2001 >



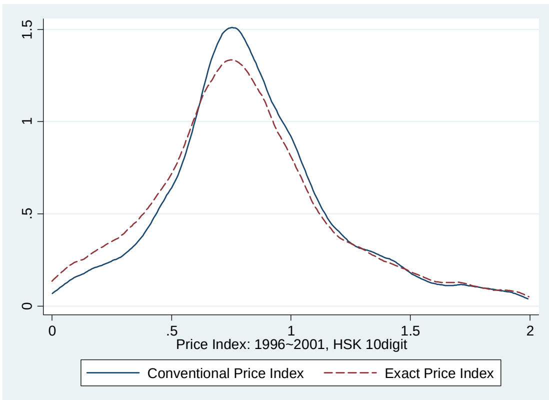
< 2002~2005 >



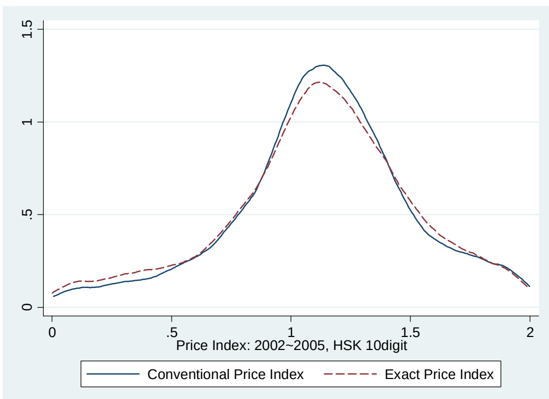
(b) Imported Intermediate Goods

< 1991~1995>

< 1996~2001 >



< 2002~2005 >



This distribution was drawn from the calculated conventional and exact price for each good (that is, for each 10-digit HS code). Now, by using equation (4) as in Broda and Weinstein (2006a), we can also calculate the aggregated exact price index and its two components (conventional price index and lambda ratio), which are shown in Table 5. During 1991~1995 and 1996~2001, the variety growth of all imported goods had the impact of lowering the conventional import price index by 3% (lambda ratio = 0.97). This implies that the variety growth effect has reduced the import price by 0.8%-points per annum. It is worthwhile to note two things about this figure. First, as mentioned before, this lambda ratio of 0.97 is an aggregated measure for all goods. Thus it may be useful to know how these lambda ratios vary across industries. We recalculated them for each industry following Korea's IO table classification and its descriptive statistics are in Table 6.[21] We can see that the cross-industry variation of the lambda ratios is not small, for example, with standard deviation of 0.292 for all imported goods and 0.664 for imported intermediate goods during the period of 1991~1995.

Second, comparing these results with other studies may be useful as well, in order to understand the relative magnitude of the variety growth effect in Korea. Other country studies that used a similar methodology include Broda and Weinstein (2006a) for US during 1972~2001 and GKPT (2010) for India during 1989~1997. As expected, the imported variety growth effect in India was most substantial because they experienced substantial trade reform during the sample period. The lambda ratio for all goods was 0.688 during the sample period (3.2%-points decrease of import price per annum) and that for intermediate goods were 0.624 (4.7%-points decrease of import

[21] Using equation (4), we can calculate the aggregated lambda ratios for any industrial or commodity classification. We used Korea's IO table classification here because this numbers will be used for our regression analyses in the next subsection.

price per annum). In the case of US (Broda and Weinstein (2006a)), the variety adjusted price for imports fell around 1.4% points per annum during 1972~1988 and 0.8% points per annum during 1990~2001. Thus the magnitude of the impact of imported variety in Korea during 1990s is very similar to the case of the US.[22]

In sum, although the imported variety growth effect at aggregate level in Korea during our sample period was not as great as in countries like India, the magnitude was similar to other industrial countries and its cross-industry variation was not small.

Table 5. Exact Price Indices and its Components

Periods	Commodity	Conventional Price Index (1)	Lambda Ratio (2)	Exact Price Index (1) x (2)
(a) 1991~1995 (in 10-digit HS-1988 code)	All Imported Goods	1.20	0.97	1.16
	Imported Intermediate Goods	1.25	0.96	1.21
(b) 1996~2001 (in 10-digit HS-1996 code)	All Imported Goods	0.91	0.97	0.89
	Imported Intermediate Goods	0.85	0.99	0.85
(c) 2002~2005 (in 10-digit HS-2002 code)	All Imported Goods	1.38	1.01	1.40
	Imported Intermediate Goods	1.26	1.00	1.26

22 In addition, Mohler and Seitz (2009) calculated the lambda ratios for 27 EU countries during 1999~2008. They showed that "newer" and smaller member states exhibit lower lambda ratio. The estimated median lambda ratio was 0.99 for France, Germany, Austria and Portugal and 0.98 for UK, Italy, Belgium and Netherlands and 0.97 for Denmark, Finland and Sweden. The country that gained most from imported variety was Latvia (0.79).

Table 6. Descriptive Statistics of Lambda Ratios

Periods	Statistics	Lambda Ratios with IO Table Industry Classification	
		All Goods	Intermediate Goods
(a) 1991~1995	Percentiles 5	0.681	0.554
	Median	0.975	0.983
	Mean	0.956	1.019
	Percentiles 95	1.148	1.343
	Std. Dev.	0.292	0.663
	N. observations	141	115
(b) 1996~2001	Percentiles 5	0.869	0.758
	Median	0.992	0.991
	Mean	0.995	1.012
	Percentiles 95	1.098	1.204
	Std. Dev.	0.177	0.335
	N. observations	141	115
(c) 2002~2005	Percentiles 5	0.924	0.881
	Median	1.002	1.000
	Mean	0.999	0.993
	Percentiles 95	1.051	1.054
	Std. Dev.	0.051	0.094
	N. observations	141	115

4.2. Regression Results

4.2.1. Regression of TFP Growth

In this subsection, we first report the regression results of equation (8) with panel data.[23] One problem that might arise in estimating equation (8) is the potential reverse causality problem: that is, plants with higher total factor productivity may have higher demand for imported intermediate varieties rather than the other way around. In order to reduce this reverse causality problem, we regress the plants' TFP growth rate on lagged independent variables with one-year lag. The first two columns in Table 7 show the results of this regression. In both cases (with and without other control variables) the coefficients on the lambda ratio have negative sign, and are significant. Note that the lower the lambda ratio the higher the imported variety growth effect.

[23] All the results are panel data regression with plant-specific fixed-effect and year dummies are included as well to observe year-specific shocks. As mentioned earlier, in our regression analyses, we used only the data from 1991~1998 due to data limitation.

Thus, this implies that plants with higher variety growth in imported intermediates experienced higher TFP growth.

Table 7. Regression of TFP Growth

Variables	Fixed Effect Estimation		2-Step GMM Estimation	
	(1)	(2)	(3)	(4)
Lambda Ratio	-0.020**	-0.021**	-0.103***	-0.091***
	(0.009)	(0.009)	(0.036)	(0.034)
Conventional Price Index	0.025***	0.025***	0.036*	0.028
	(0.009)	(0.009)	(0.019)	(0.018)
Size		0.068***		0.096***
		(0.005)		(0.007)
Age		-0.001		-0.001*
		(0.001)		(0.000)
Capital Intensity		0.060***		0.072***
		(0.002)		(0.003)
Skill Intensity		0.001**		0.001
		(0.000)		(0.000)
R&D Intensity		0.001**		0.001
		(0.000)		(0.000)
Plant fixed effects	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes
Weak Instruments			255.7	256.2
Hansen J-statistic			3.405	3.524
[p-value]			0.182	0.172
Observation	80,327	80,319	33,648	33,646
R-Squared	0.017	0.054	0.017	0.066

Note: Heteroskedasticity-consistent robust standard errors are in parentheses. *, **, and *** denote that the estimated coefficients are significant at 10%, 5% and 1% level, respectively. Instruments in GMM estimation are initial number of input varieties in 1991, initial input tariff rate and a lagged lambda ratio at each industry level.

However the estimated coefficient on the conventional price index is significantly positive, which is somewhat puzzling. Note that the conventional price index is a measure of price change of continuously imported intermediate varieties. If this continuously imported variety is of the same quality between two periods, a price reduction in this continuous variety will reduce the unit cost of production and thus improve productivity. In this situation, we expect the coefficient on the conventional price index to be negative. On the other hand, if the quality of this continuously imported variety is upgraded so that a higher price is charged, it is also possible to expect a positive sign for the coefficient on the conventional price index. A recent study by Fukao and Ito (2009) provided empirical evidence on this interpretation. By using Japan's micro-level data (Census of Manufactures) and trade statistics, they found that commodities with higher prices are of higher quality and more human capital-intensive. Given this interpretation, higher priced intermediate input with higher quality can improve a plant's productivity. However, since we do not have precise information about how the quality of the continuously imported intermediate goods has evolved, we need to be careful in interpreting this result.

Taking lags on independent variables may not be enough to control for the endogeneity problem of imported intermediate variety.[24] In order to treat this problem more seriously, we estimated equation (8) using a 2-step GMM technique by using various instruments. The set of instruments for the lambda ratio was the 1991 levels of number of intermediate input varieties, the 1991 level of input tariff and a lagged value of the lambda ratio in each industry.[25] These results are shown in column (3) and (4) in Table 7. In these two specifications, the instruments provide a good fit in the first stage with F-statistics (the Kleibergen-Paap statistic) being well above the critical values listed in Stock and Yogo (2005), which means that tests for weak instruments were passed. And over-identification tests were passed as well with p-values of Hansen's J-statistic of 0.182 and 0.172, respectively.

The estimated coefficients on the lambda ratio remain negative but with higher

[24] The conventional price index is unlikely to be subject to the endogeneity problem because our import data contains tariff-exclusive prices.
[25] The input tariff for each industry was calculated as a weighted average of the output tariff. Here, the weights are once again based on the input-output coefficient. The output tariff for each industry, in turn, is a weighted average of actual tariff of each HS-code that belongs to intermediate goods category.

significance level and larger magnitude after the GMM technique was adopted. Thus, even after treating the potential endogeneity problem of the lambda ratio, the impact of imported intermediate variety growth on productivity survives. Note that the coefficient on the conventional price index becomes insignificant with full specification (column (4)). Thus our estimation results confirm that plants that belongs to industries with higher imported intermediate variety growth experienced higher TFP growth.

The estimated coefficients on other control variables could be interpreted in an economically sensible way as well. Other things being equal, the TFP growth rate is higher if plants are larger in size, younger and with higher capital and R&D intensity (although the coefficients on the last two variables are not significantly different from zero in column (4)). Now we turn to the regression results of product switching behavior.

4.2.2. Regression of Product Switching Rate

In estimating (9), we face the same endogeneity problem as before: plants may decide to introduce new products for any reasons unrelated to trade, which can result in the increase of demand for imported intermediates. Since the first stage regression of TFP growth with 2-step GMM specification fits well, we continue to use the same set of instrumental variables to reduce the endogeneity problem in these regressions as well.[26] The results are shown in columns (1) ~ (3) of Table 7.[27] As discussed earlier in Section II, in order to capture the selection-effect as in BRS (2006), we added TFP level

[26] Just like TFP growth regressions, all tests for weak instrument and over-identification tests were passed in all our regressions.

[27] In this table, all of the regressions are estimated using a 2-step GMM with instrumental variables. If we run the regression without taking into account the endogeneity problem, all the coefficients on lambda ratios, conventional price indices and the TFP level are significantly estimated as well as reported in Appendix 2.

as a regressor. This will capture the plants' ability to enter and exit product markets flexibly. As we can see in columns (2) and (3), this selection-effect exists in our data (significantly positive coefficient on TFP level).

Table 8. 2-Step GMM Regression of Product Switching Rate

Variables	All Plants			Multi-Product Plants		
	(1)	(2)	(3)	(4)	(5)	(6)
Lambda Ratio	-0.533***	-0.513***	-0.510***	-0.591***	-0.582***	-0.584***
	(0.174)	(0.176)	(0.178)	(0.187)	(0.188)	(0.190)
Conventional Price Index	0.405***	0.408***	0.407***	0.429***	0.434***	0.436***
	(0.103)	(0.103)	(0.104)	(0.125)	(0.126)	(0.127)
TFP level		0.054**	0.053*		0.074**	0.073**
		(0.027)	(0.027)		(0.037)	(0.037)
Size			0.026			0.027
			(0.026)			(0.036)
Age			-0.001			-0.001
			(0.002)			(0.002)
Capital Intensity			-0.017			-0.004
			(0.012)			(0.016)
Skill Intensity			-0.000			-0.000
			(0.001)			(0.001)
R&D Intensity			-0.001			-0.001
			(0.001)			(0.001)
Plant fixed effects	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes
Weak Instruments	289.4	277.8	274.8	248.6	242.9	244.0
Hansen J-statistic	1.781	1.065	1.048	1.936	1.228	1.111
[p-value]	0.410	0.587	0.592	0.380	0.541	0.574
Observation	31,528	30,867	30,792	16,121	15,796	15,747
R-Squared	0.003	0.003	0.003	0.005	0.006	0.006

Note: Heteroskedasticity-consistent robust standard errors are in parentheses. *, **, and *** denote that the estimated coefficients are significant at 10%, 5% and 1% level, respectively. Instruments in GMM estimation are initial number of input varieties, initial input tariff rate and a lagged lambda ratio at each industry level.

In the case of the imported variety growth effect, we have similar results to those of the previous TFP growth regression. Other things being equal, the lower the lambda ratios (i.e., the greater the imported intermediate variety growth effects) the higher the product switching rates. This means that when a plant is exposed to higher imported intermediate variety growth, it is more likely to be involved in a simultaneous process of product adding and dropping. If we understand this product switching behavior as being part of the resource reallocation process within a plant, our results suggest that higher imported intermediate variety growth is one of the channels through which this resource reallocation process can be enhanced.

Next, we divide our sample into two subgroups (single-product plants and multi-product plants) and then run the same regression for multi-product plants only (columns (4) ~ (6)). A single-product plant is defined as a plant which produces only one product during the sample period. Thus, by definition, their switching rates can take only zero or two. On the other hand, in the case of multi-product plants, their adding and dropping rates take continuous values between zero and two. Thus, the product switching behavior of these single-product plants should be estimated with different specifications (such as logit or probit models). Thus we excluded these single-product plants from the sample in columns (4) ~ (6). In addition to this econometric issue, there exist other economic reasons why we estimated only for multi-product plants. First, around 80% of total shipments can be explained by multi-product plants during 1990~1998 in our sample and thus these plants' switching behaviors are of greater importance than those of single-product plants.[28] Second, since the focus of the recent theoretical and empirical research lies on the behavior of multi-product firms (such as BRS (2006, 2009)), analyzing this sub-group separately may be helpful in understanding this issue.

Nevertheless, the regression results for multi-product plants do not change very much compared with those for all plants. Plants' product switching behavior is more active if they experience greater access to imported intermediate varieties and

[28] In the case of the US, multi-product firms' share of total output is 91%. See BRS (2006).

(potentially) a higher quality of existing intermediate goods. In this case as well, the selection-effect does exist (a significantly positive coefficient on TFP level). Overall then, our regression results imply that imported intermediate variety has an impact on product switching behavior of the Korean plants through a resource reallocation process.

4.3. Additional Results

4.3.1. Regression of Product Adding and Dropping Rates

Since the product switching rate contains collected information on both product adding and product dropping rates, we can run separate regressions for these variables which are shown in Table 9. As noted earlier and analyzed in Hahn (2010), our plant-product data shows that 68.0% of plants (accounting for 76.9% of shipments) are both adding and dropping products simultaneously during 1990~1998. In fact, the correlation between the product adding and product dropping rate is around 0.85 in our sample. In addition, the correlation between the product switching rate and the product adding rate is 0.96 and that between the product switching rate and product dropping rate 0.95.

Given that a large proportion of plants are both adding and dropping products simultaneously and that the correlations among switching, adding and dropping rates are high, it is no surprise to find that the regression results in Table 9 are very similar to those in Table 8. In Korea, greater access to imported variety boosts both product adding and product dropping simultaneously.

Table 9. 2-Step GMM Regression of Product Adding and Dropping Rates: Multi-Product Plants

Variables	Dependent: Product Adding Rate			Dependent: Product Dropping Rate		
	(1)	(2)	(3)	(4)	(5)	(6)
Lambda Ratio	-0.245**	-0.215**	-0.216**	-0.349***	-0.366***	-0.365***
	(0.099)	(0.099)	(0.101)	(0.100)	(0.100)	(0.102)
Conventional Price Index	0.175***	0.166**	0.167**	0.266***	0.276***	0.275***
	(0.066)	(0.066)	(0.066)	(0.067)	(0.068)	(0.068)
TFP level		0.041**	0.041**		0.037*	0.037*
		(0.019)	(0.019)		(0.019)	(0.019)
Size			-0.003			0.027
			(0.019)			(0.019)
Age			-0.000			0.000
			(0.001)			(0.001)
Capital Intensity			-0.006			0.000
			(0.009)			(0.009)
Skill Intensity			-0.000			0.000
			(0.000)			(0.000)
R&D Intensity			-0.001			-0.000
			(0.001)			(0.001)
Plant fixed effects	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes
Weak Instruments	254.5	248.3	249.1	249.9	243.8	244.7
Hansen J-statistic	1.421	0.692	0.579	2.191	1.627	1.601
[p-value]	0.491	0.707	0.749	0.334	0.443	0.449
Observation	16,327	15,996	15,947	16,335	16,012	15,961
R-Squared	0.005	0.005	0.006	0.005	0.005	0.006

Note: Heteroskedasticity-consistent robust standard errors are in parentheses. *, **, and *** denote that the estimated coefficients are significant at 10%, 5% and 1% level, respectively. Instruments in GMM estimation are initial number of input varieties, initial input tariff rate and a lagged lambda ratio at each industry level.

4.3.2. Regression of Product Scope

Our final regression is to investigate the relation between product scope change (as measured by the growth rate of number of products) and imported intermediate variety growth as in GKPT (2010). Table 10 shows the results. Whether or not single-product plants are excluded from the regression does not affect the regression results. However, our results are in sharp contrast to those in GKPT (2010), which analyzed the case of India. In GKPT (2010), the coefficient on the lambda ratio was estimated to be negative. Thus their interpretation was that greater access to new imported intermediate varieties resulted in an increase in the number of products (i.e., the product scope) of plants.

Table 10. 2-Step GMM Regression of Product Scope Change

Variables	All Plants			Multi-Product Plants		
	(1)	(2)	(3)	(4)	(5)	(6)
Lambda Ratio	0.178*	0.233**	0.238**	0.250*	0.325**	0.330**
	(0.104)	(0.101)	(0.101)	(0.144)	(0.139)	(0.140)
Conventional Price Index	-0.106*	-0.123**	-0.125**	-0.166*	-0.196**	-0.196**
	(0.056)	(0.055)	(0.055)	(0.092)	(0.092)	(0.092)
TFP level		0.031**	0.033**		0.060**	0.064**
		(0.014)	(0.014)		(0.026)	(0.026)
Size			-0.040***			-0.077***
			(0.014)			(0.027)
Age			0.000			0.000
			(0.001)			(0.001)
Capital Intensity			-0.007			-0.014
			(0.006)			(0.012)
Skill Intensity			-0.000			-0.000
			(0.000)			(0.001)
R&D Intensity			0.000			0.000
			(0.000)			(0.001)
Plant fixed effects	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes
Weak Instruments	289.4	277.8	274.8	248.6	242.9	244.0
Hansen J-statistic	2.919	1.901	2.069	2.873	1.695	1.854
[p-value]	0.232	0.387	0.355	0.238	0.429	0.396
Observation	31,528	30,867	30,792	16,121	15,796	15,747
R-Squared	0.001	0.001	0.001	0.001	0.001	0.003

Note: Heteroskedasticity-consistent robust standard errors are in parentheses. *, **, and *** denote that the estimated coefficients are significant at 10%, 5% and 1% level, respectively. Instruments in GMM estimation are initial number of input varieties, initial input tariff rate and a lagged lambda ratio at each industry level.

But in the case of Korea, the coefficient on the lambda ratio was positively estimated in Table 10, which means that greater access to new imported intermediate varieties induced a reduction of product scope. What brings about this difference between India and Korea? One plausible explanation might be that these two countries are at different stages of economic development. In an early stage of economic reform accompanied by trade liberalization (the sample period of India in GKPT (2010)), greater access to imported intermediate variety is more likely to expand the number of products of domestic producers. But as the economy is maturing in its economic development (the sample period of Korea in this paper), it is also possible for domestic producers to reallocate their resources into more profitable products rather than just to expand the number of products. Although we do not have direct evidence to support this explanation, we think that it is consistent with our findings in the previous regressions.

5. Summary and Concluding Remarks

By utilizing previously unexplored plant-product data on Korean manufacturing and detailed import data during 1991~1998, this paper empirically investigates the role of imported intermediate varieties. Specifically, we examined whether greater access to imported intermediate varieties enhanced plants' total factor productivity and product switching behavior. First, as consistent with previous empirical studies using macro- and micro-data, we find that plants that belong to industries with higher imported intermediate variety growth experienced higher productivity growth.

Secondly and perhaps more importantly, our empirical results suggest that increased imported intermediate varieties had a positive impact on stimulating the product switching behavior of domestic plants. Since product switching behavior (that is, simultaneously adding and dropping products) could be understood as a part of the continual process of "creative destruction" within plants, this result suggest that imported intermediate variety growth may be one of the channels through which resource reallocation within firms can be enhanced. Taking into account the fact that 68% of Korean plants (77% when weighted by shipments) are both adding and dropping products during our sample period, this finding is of greater empirical importance.

Additionally, unlike the previous study for India, we found that imported intermediate variety growth has reduced the product scope (that is, the number of products) of domestic plants. Although this finding is not inconsistent with our finding related to product switching behavior, it suggests that imported intermediate variety growth may have different implications for industrial countries and developing countries.

However, there are many other important issues that were not included in this paper but are necessary to consider in order to better understanding the precise mechanisms of these channels. For example, whether intermediate imports from advanced countries had different impacts from those from developing countries? What are the characteristics of the added product and the dropped product in this process? Do they really represent a creative destruction process? These are the areas for future research.

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Appendix 1. Measurement of Plant Total Factor Productivity

Plant total factor productivity is estimated using the chained-multilateral index number approach as developed in Good (1985) and Good *et al.* (1999). It uses a separate reference point for each cross-section of observations and then chain-links the reference points together over time. The reference point for a given time period is constructed as a hypothetical firm with input shares that equal the arithmetic mean input shares and input levels that equal the geometric mean of the inputs over all cross-section observations. Thus, the output, inputs, and productivity level of each firm in each year are measured relative to the hypothetical firm at the base time period. This approach allows us to make transitive comparisons of productivity levels among observations in a panel data set.[1]

Specifically, the productivity index for firm i at time t in our study is measured in the following way:

$$\ln TFP_{it} = \left(\ln Y_{it} - \overline{\ln Y_{it}}\right) + \sum_{\tau=2}^{t}\left(\overline{\ln Y_{\tau}} - \overline{\ln Y_{\tau-1}}\right)$$
$$-\left\{\sum_{n=1}^{N}\frac{1}{2}\left(S_{nit} + \overline{S_{nt}}\right)\left(\ln X_{nit} - \overline{\ln X_{nt}}\right) + \sum_{\tau=2}^{t}\sum_{n=1}^{N}\frac{1}{2}\left(\overline{S_{n\tau}} + \overline{S_{n\tau-1}}\right)\left(\overline{\ln X_{nt}} - \overline{\ln X_{nt-1}}\right)\right\}$$

where Y, X, S, and TFP denote output, input, input share, TFP level, respectively, and symbols with upper bar are corresponding measures for hypothetical firms. The subscripts τ and n are indices for time and inputs, respectively. In our study, the year 1990 is the base time period.

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[1] Good *et al.* (1999) summarize the usefulness of chaining multilateral productivity indices succinctly. While the chaining approach of Tornqvist-Theil index, the discrete Divisia, is useful in time series applications, where input shares might change over time, it has severe limitations in cross-section or panel data where there is no obvious way of sequencing the observations. To the contrary, the hypothetical firm approach allows us to make transitive comparisons among cross-section data, while it has an undesirable property of sample dependency. The desirable properties of both chaining approach and the hypothetical firm approach can be incorporated into a single index by chained-multilateral index number approach.

As a measure of output, we used the gross output (production) of each plant in the Survey deflated by the producer price index at disaggregated level. As a measure of capital stock, we used the average of the beginning and end of the year book value capital stock in the Survey deflated by the capital goods deflator. As a measure of labor input, we used the number of workers, which includes paid employees (production and non-production workers), working proprietors and unpaid family workers. Here, we allowed for the quality differential between production workers and all the other types of workers. The labor quality index of the latter was calculated as the ratio of non-production workers' and production workers' average wage of each plant, averaged again over the entire plants in a year. As a measure of intermediate input, we used the "major production cost" plus "other production cost" in the Survey. Major production cost covers costs arising from materials and parts, fuel, electricity, water, manufactured goods outsourced and maintenance. Other production cost covers outsourced services, such as advertising, transportation, communication and insurance. The estimated intermediate input was deflated by the intermediate input price index.

We assumed constant returns to scale so that the sum of factor elasticity equals to one. Labor and intermediate input elasticity for each plant are measured as average cost shares within the same plant-size class in the five-digit industry in a given year. Thus, factor elasticity of plants is allowed to vary across industries and size classes and over time. Here, plants are grouped into three size classes according to the number of employees: 5-50, 51-300, and over 300.

Appendix 2. Fixed Effect Estimation Results

Table A-1. Fixed Effect Estimation of Switching and Adding Rates

Variables	Dependent Variable: Switching Rate			Dependent Variable: Adding Rate		
	(1)	(2)	(3)	(4)	(5)	(6)
Lambda Ratio	-0.107***	-0.117***	-0.117***	-0.043***	-0.047***	-0.047***
	(0.018)	(0.018)	(0.018)	(0.009)	(0.009)	(0.009)
Conventional Price Index	0.189***	0.200***	0.201***	0.090***	0.095***	0.095***
	(0.027)	(0.027)	(0.027)	(0.014)	(0.014)	(0.014)
TFP level		0.026*	0.025*		0.015**	0.015**
		(0.014)	(0.014)		(0.007)	(0.007)
Size			-0.014			-0.019***
			(0.013)			(0.006)
Age			0.001			0.000
			(0.001)			(0.000)
Capital Intensity			-0.010*			-0.009***
			(0.006)			(0.003)
Skill Intensity			0.000			-0.000
			(0.000)			(0.000)
R&D Intensity			-0.000			-0.000
			(0.001)			(0.000)
Plant fixed effects	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes
Observation	96,881	95,098	94,798	100,410	98,596	98,182
R-Squared	0.004	0.004	0.004	0.006	0.006	0.006

Note: Heteroskedasticity-consistent robust standard errors are in parentheses. *, **, and *** denote that the estimated coefficients are significant at 10%, 5% and 1% level, respectively.

Table A-2. Fixed Effect Estimation of Dropping Rate and Product Scope

Variables	Dependent Variable: Dropping Rate			Dependent Variable: Product Scope		
	(1)	(2)	(3)	(4)	(5)	(6)
Lambda Ratio	-0.056***	-0.061***	-0.061***	0.024***	0.024***	0.025***
	(0.009)	(0.009)	(0.009)	(0.008)	(0.008)	(0.008)
Conventional Price Index	0.090***	0.095***	0.096***	-0.010	-0.013	-0.012
	(0.014)	(0.014)	(0.014)	(0.013)	(0.013)	(0.013)
TFP level		0.031***	0.031***		0.026***	0.026***
		(0.007)	(0.007)		(0.007)	(0.007)
Size			-0.003			-0.028***
			(0.007)			(0.007)
Age			0.000			-0.000
			(0.000)			(0.001)
Capital Intensity			-0.004			-0.005*
			(0.003)			(0.003)
Skill Intensity			0.000			-0.000
			(0.000)			(0.000)
R&D Intensity			0.000			0.000
			(0.000)			(0.000)
Plant fixed effects	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes
Observation	99,753	97,940	97,630	96,881	95,098	94,798
R-Squared	0.002	0.002	0.003	0.002	0.002	0.002

Note: Heteroskedasticity-consistent robust standard errors are in parentheses. *, **, and *** denote that the estimated coefficients are significant at 10%, 5% and 1% level, respectively.

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CHAPTER 4

Policy Reforms, Firm Entry, and Labor Productivity Change: Learning from the Example of Vietnamese Manufacturing

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This study examines the impact on productivity growth of the high entry rate occurring in Vietnamese manufacturing. The high rate of entry is considered to be a result of the rapid and substantial policy reform in the areas of trade and investment, and hence it acts as a proxy for the policy reforms. The study utilizes firm-level data of the Vietnamese manufacturing sector for the period 2000-07. The final prediction for the impact of trade policy liberalization, from models with firm heterogeneity, is adopted as the basis for the study's analytical framework. Empirical analysis examines the impact of firm entry at both industry and firm level. The former establishes a positive relationship between firm entry and productivity growth. In particular, the econometric analysis finds that firm entry over the period 2000-03 increased the productivity growth of industry in the subsequent period of 2004-07. The findings indicate a reallocation of resource and market share. Examination of the firm level distribution of productivity growth during the period 2004-07 shows that firms had become more productive over this period. The number of firms located at the bottom and near the median of the distribution becomes smaller over the period. The econometric results confirm the descriptive observation and statistically demonstrate the contribution of firm entry to changes in the distribution.

1. Introduction

Liberalizing their trade and investment regime has been a key policy priority for many developing countries, particularly during the 1980s and 1990s. While benefit in terms of productivity gains across sectors is well documented, there is still little known about the impact of the liberalizations on productivity at plant or firm level. The evidence so far tends to be inconclusive and sometimes even conflicts with the predicted positive impact of the liberalization. Aitken and Harrison (1999), for example, did not find productivity improvement among domestic plants as an impact of an increased foreign presence in the Chilean manufacturing. More recently, Trefler (2004) gives rather puzzling results, which reveal that, among other things, the tariff cut between US and Canada over the period 1989-99 only brought about an increase in productivity at industry level, not at plant level.

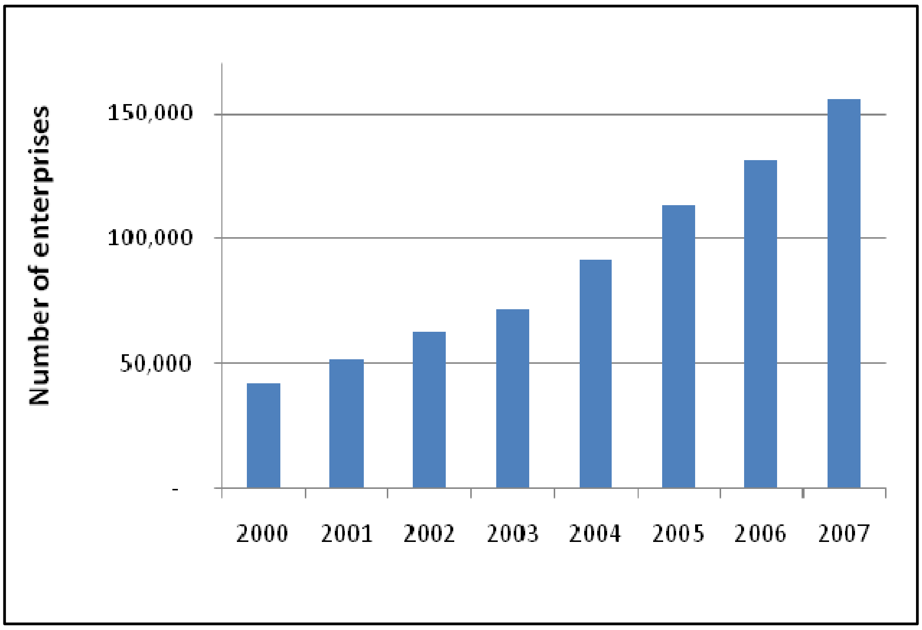
Recent theoretical development in the field of international trade allows us to understand more about what happens in respect of productivity change within an industry when trade and investment liberalization occurs. Departing from the standard trade models, the new wave of trade models recognizes the impact of firm heterogeneity, particularly in terms of productivity, within an industry (Pavcnik 2002). These models points to the importance of firm dynamics (i.e., entry, exit, and growth of the survivors) in shaping both aggregate- and plant-level productivity change. In an environment with heterogeneous firms, trade and investment liberalization induce the entry of more capable firms, force the less productive plants to exit, and hence trigger a reallocation of market share towards the more productive plants. The disappearance of the less productive firms is reflected by a positive change in the level of industry productivity (or 'between' firms productivity growth).

Trade and investment liberalization encourages firms to adopt new technology to ensure their survival, either in domestic foreign markets. Firms, however, perceive such encouragement differently; some firms choose to adopt the technology but the others do not. Thus, there is an impact at the firm level commonly termed 'within' firm/plant productivity growth.

This study attempts to examine the impact of a high incidence of firm entry into Vietnamese manufacturing over the period 2000-07. The period under examination follows a period of rapid investment and trade policy reform during the 1990s.

This study is motivated by what has happened to the Vietnamese economy since the beginning of economic reform. Rapid trade and investment liberalization since the early 1990s, which substantially reduces the cost of establishing a private enterprise, and the cost of exporting, seems to have triggered a rapid growth in the number of firms entering the country's manufacturing and services sectors.[1] Figure 1.1 demonstrates this, where the number of firms in the sectors grew almost four times over the period 2000-07. The rapid growth goes along with the other favorable performance, such as the jump in the inflow of foreign direct investment (FDI), employment, and output. Consistently, exported output of firms in the manufacturing sector had also grown rapidly over this period. Moreover, as suggested by Figure 1.2, much of this improvement seems to have been a result of the establishment of foreign firms, both purely foreign-owned and joint-venture firms.

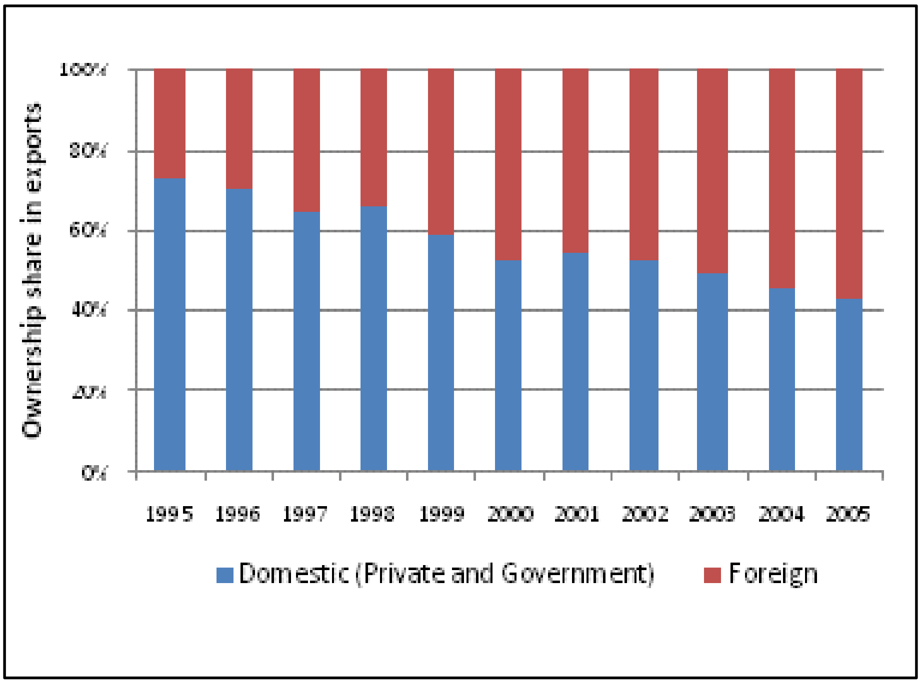
Figure 1.1. Number of Enterprises in the Vietnamese Manufacturing and Services Sectors, 2000-2007



Source: General Statistic Office.

[1] See, for example, Quang Tran (2008) for an elaborated review of investment and trade policy reform in Vietnam.

Figure 1.2. Foreign and Domestic Ownership Share in the Vietnamese Exports of Goods, 1995-2005



Source: General Statistic Office.

The issues concerning firm dynamics and productivity growth, on the one hand, and the extraordinary firm entry performance in the Vietnamese manufacturing sector, on the other, leads this study to ask the following questions:

1. How did firm entry into Vietnamese manufacturing, which is most likely related to the rapid trade and investment policy reform, affect the growth in productivity of the sector? Did the entry increase the productivity of the industry?
2. How did firm entry affect productivity change at firm level, that is to say the 'within' firms productivity growth?

The rest of this paper is organized as follows. Section 1 provides a brief overview of policy reform in Vietnam in the past two decades. Section 2 explains the analytical framework adopted by the study. Section 3 describes the data used in the study, in terms of definition as well as measurement of the key variables for the empirical analysis. Section 4 details the empirical strategy and results, and Section 5 summarizes and concludes the study.

2. Brief Overview of Investment and Trade Policy Reform In Vietnam

The reform (*Doi Moi*) initiated in 1986 has rapidly changed the structure and orientation of industrialization in Vietnam. Policy changes to increase private direct investment, particularly foreign direct investment (FDI), and opening up the trade regime have been the key features of the reform.

Essentially, this follows the strategy commonly adopted by the other developing countries in the Southeast Asian region. There is, however, a notable difference, and that is, that from the very beginning of the reform the government seems to have had a deep understanding of the importance of hosting FDI in the process of transition (Quang Tran 2008). Moreover, the policy of inviting FDI was complemented by relevant policies that encourage exports, reflecting a clear framework in the policy. The serious consideration of hosting FDI is clearly reflected by a rapid change in the policy over time. The law on foreign investment was amended five times in an only very short period of time, that is, in 1990, 1992, 1996, 2000, and 2003.

The amendments of laws governing FDI in 1990 and 1992 facilitated the operation of foreign firms (Quang Tran 2008; CIEM 2006). The law of 1990 and 1992 permits the formation of private-foreign joint venture firms and lowers the extent of discrimination against foreign firms. Facilitation of their operations is also reflected in the creation of an export economic zone, and in encouragement for foreign firms to establish their presence in the zone. The law of 1990 also stipulates another incentive system in the form of a tax exemption or tax reduction on profits. Notwithstanding these progressive and liberal policy actions, and excepting also the policy of directing FDI towards location in the EPZ, much FDI policy prior the law of 1992 was still within the framework of an import substitution policy for industrialization (Quang Tran 2008).

The change in direction towards a more export-oriented strategy was only clear with the law amendments of 1996 and 2000. To illustrate, the 1996 FDI law specifically prioritizes FDI to be allocated in export oriented, as well as technology- and labor-intensive sectors. In addition, and perhaps more importantly, the 1996 and 2000 law changes really aim at cutting the transaction cost of establishing foreign investment.

The law made substantial changes aiming at easing the process of producing an investment license and gaining registration. The 90 days waiting time for foreign investors to acquire a license, for example, was reduced by two thirds by the 2000 law change. Procedures for registration and for acquiring investment licenses were made much simpler, and approval for investment at regional level was permitted.

As for trade policy, gradual reform can also be observed, although it happened at a rather slower pace than FDI policy reform. The early trade policy reform aimed at reducing export bias, including partly removing restriction on a number of trade entities, reducing export duty, relaxing export shipment licensing, and replacing import quotas with import duties (Quang Tran, 2008; Riedel and Comer, 1998).

Trade reform has intensified in the past ten years due to the commitments made by Vietnam in various global and regional trade agreements, in particular the World trade organization (WTO), the ASEAN free trade area (AFTA), and the US-Vietnam bilateral trade agreement (BTA). These commitments caused the country to reschedule its tariff rate twice, in 1992 and 1999. Under AFTA, for example, the country has reduced its average common effective preferential tariff rates (CEPT) from 12.7 to 10.7 over the period 1996-2002. The CEPT rate will be further reduced as a result of Vietnam's commitment with ASEAN. Meanwhile, because of requirements for accession to the WTO and its commitment under AFTA, Vietnam has removed almost all quantitative restrictions on imported goods. In addition to the areas of tariff and quantitative restrictions, reform also took place in the area of trade facilitation, such as customs. This was particularly motivated by the BTA between Vietnam and US.

3. Analytical Framework

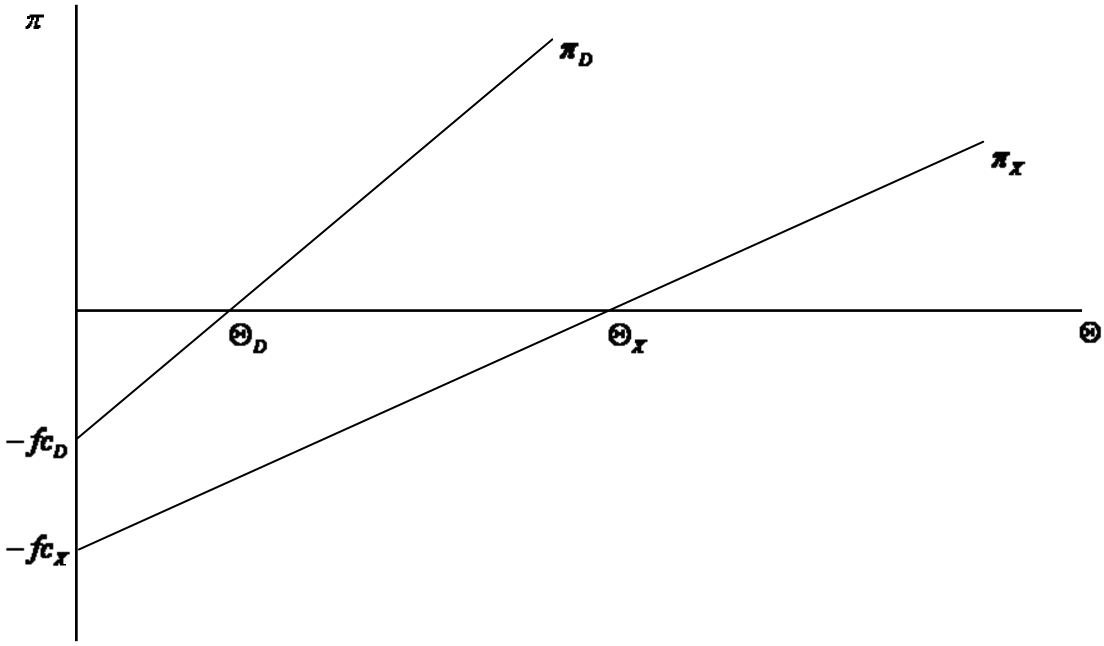
There is now a new wave of theoretical development that underlines the importance of plant heterogeneity in shaping firms' productivity within an industry. This was born from growing evidence that the variation of exporting firms cannot be derived from a random sample, since not all firms within an industry export. Eaton *et al.* (2004), for example, highlights this for French manufacturing, and Helpman *et al.* (2004) did so for the data of US manufacturing.

This study relies on the prediction of models containing plant heterogeneity in its empirical analysis, in particular Melitz (2003) and Bustos (2005). Melitz built a theoretical model that takes into account the importance of the heterogeneity in an imperfect competition setting. Figure 2.1 illustrates this.[2] Consider, first, Figure 2.1a which draws operating profit schedules for firm i as a function of productivity. π_D draws the profit function for a firm that serves the domestic market while π_X draws the profit function for firms that export. fc_D and fc_X are the fixed costs for the firm's domestic and export operations, respectively. $fc_X > fc_D$ because exporting involves additional costs which typically are incurred to transport the goods from home/domestic to the export market (e.g. transport costs, insurances, fees, duties, etc.). The key point from Figure 2.1a is that, there exist productivity thresholds, namely Θ_D and Θ_X, which determine firm survival in markets. Thus, firms with productivity levels below Θ_D choose not to operate, because for these firms operating profits do not cover fixed cost. Only firms with a productivity level above Θ_D choose to produce. Similarly, firms with productivity levels below Θ_X – but above Θ_D – choose to only supply the domestic market, because the operating profits of these firms do not cover the fixed costs for exporting. Firms with productivity levels above Θ_X are the only firms that can serve the export market. Figure 2.1a underlines the existence of firm heterogeneity creating different outcomes in terms of firm survival in both domestic and export markets. It explains the static version of the Melitz's model.

[2] The exposition of Melitz's (2003) and Bustos' (2005) model borrows that written in Helpman (2006).

Figure 2.1. Illustration of Melitz's (2003) Model

a. The Basic



b. Introducing Trade Liberalisation

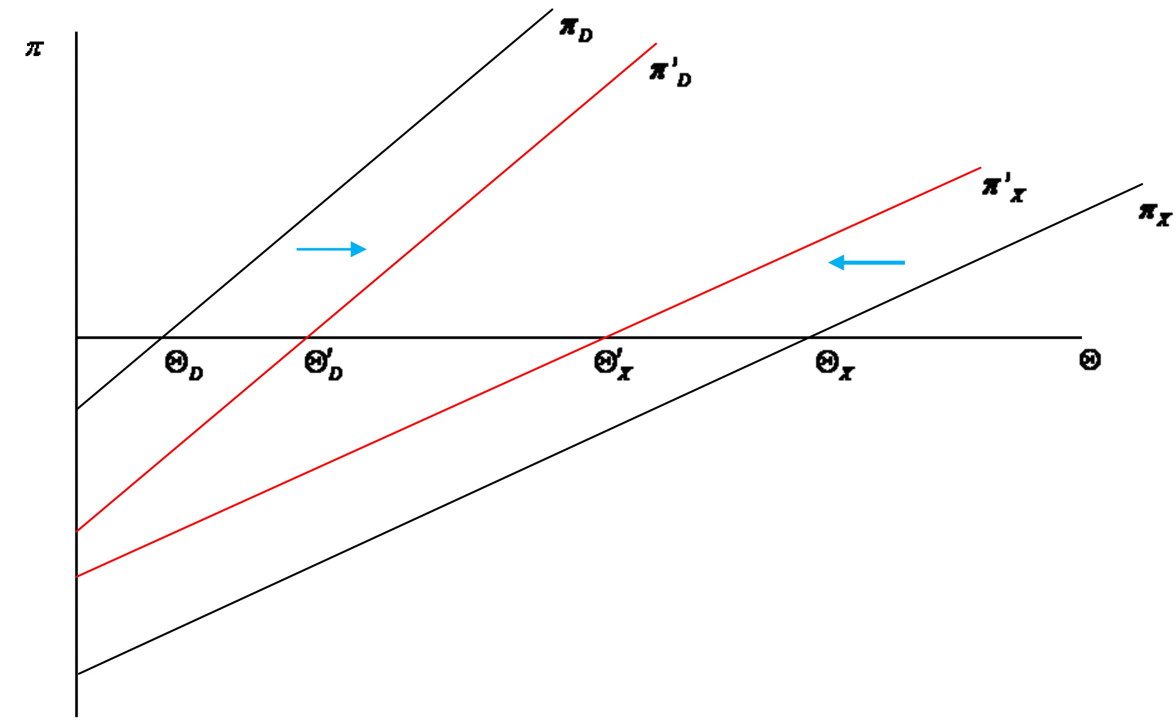


Figure 2.1b introduces the dynamic version of the model in the context of trade liberalization. The dynamic model now requires fc_D and fc_X to be borne during every period of time. In addition, there is now an additional fixed entry cost, which is borne only once when a firm enters the market. The model assumes a constant rate of firm death and birth over time and the extent of these are equal in the steady state equilibrium. This creates a constant total number of firms over the time, given that a fraction of firms with a productivity level above the threshold Θ_D stay in the market.

Consider now a multilateral trade liberalization that reduces the costs of exporting. A larger proportion of firms choose to export, because the lower exporting costs increase the profits for exporters. This, however, reduces the demand facing every supplier and reduces the profits for all firms, both the exporters and non-exporters. Allowing for the general equilibrium effect to work out gives a final outcome of a lower productivity threshold for exporting (i.e. Θ'_X) but with a higher productivity threshold for firm survival in the market (i.e. Θ'_D).[3] Non-survival threat is thus higher after trade liberalization, but there are more firms encouraged to export.

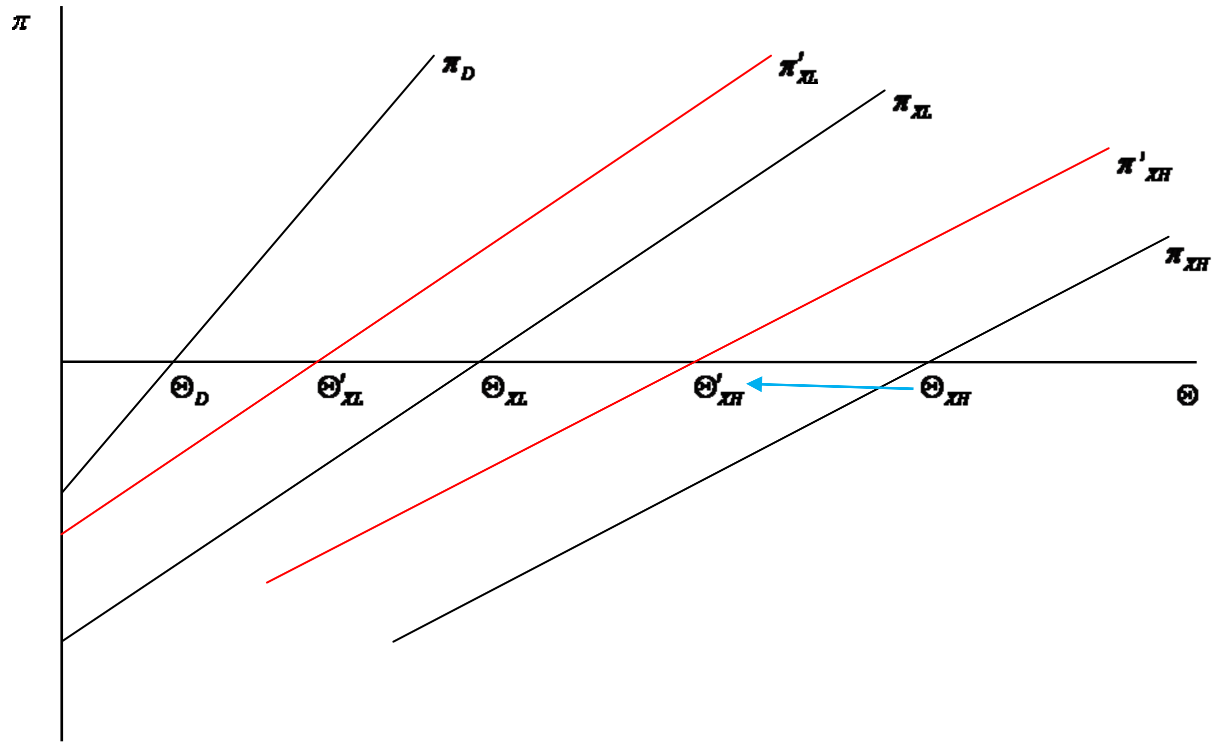
All in all, Melitz's model predicts that firm dynamics created by trade liberalization reduce productivity threshold for any firm to export, implying that any firm now has higher probability of exporting compared to the situation before the liberalization. At the same time, however, trade liberalization increases the productivity threshold for survival selection of any operating firm. This means that only the more productive firms survive after the trade or investment liberalization. Industry output hence is reallocated to these survivor firms. What we should ideally observe then is a situation where the overall industry productivity improves.

Other models adapt Melitz's model to include technology adoption and innovation to reflect technology upgrading by firms. Some of these models are Bustos (2005), Yeaple (2005), and Ekholm and Midelfart (2005). Figure 2.2 illustrates Bustos' model. First, upon entry and after learning of its productivity level, a firm may choose to adopt two types of technology- traditional (*L*) or advanced (*H*) technology. Acquiring advanced technology requires higher fixed cost, and hence $fc_{DH} > fc_{DL}$ as well as

3 Other models that underline firm level heterogeneity, such as those of Bernard *et al.* (2004) and Melitz and Ottaviano (2005) yield a similar prediction outcome.

$fc_{XH} > fc_{XL}$, but at the same time reduces the variable cost component. This setting defines the productivity threshold as $\Theta_{XH} > \Theta_{XL} > \Theta_D$. A firm with a productivity level between Θ_D and Θ_{XL} uses traditional technology to serve only the domestic market, and a firm with a productivity level between Θ_{XD} and Θ_{XH} serves both domestic and export markets with traditional technology. Meanwhile, a firm with productivity level above Θ_{XH} uses advanced technology to serve both export and domestic market.

Figure 2.2 Introducing Technology and Trade Liberalisation



A multilateral trade liberalization in this setting raises the profit of all exporters. The increase however is proportionately much larger for firms that adopt advanced technology, for the reason of lower average costs. As a result, the productivity threshold for exporting is lowered and now becomes Θ'_{XH}. It hence gives an incentive for exporters using traditional technology to upgrade by acquiring advanced technology.

Bustos' model overall predicts that only a fraction of firms, that is firms with an intermediate level of productivity, respond to the trade liberalization by upgrading their technology. This comes as a result of both the coexistence of firms within the industry with different level of productivity, and the existence of different type of technology adopted by firms in the industry. The less productive firms, meanwhile, continue using traditional technology.

As noted, this study relies on the prediction of Melitz's (2003) and Bustos' (2005) models in assessing whether the impact of trade and investment liberalization in Vietnam during the 1990s changed the productivity of industries and firms in Vietnamese manufacturing. It presumes that the significant increase in the extent of firm entry during the early 2000s was a result of the trade and investment liberalization. In other words, it assumes that the significant growth in entry proxies the trade and investment liberalization.

Given this presumption and the prediction of Melitz's model, the quantitative analysis predicts a positive relationship between firm entry and productivity growth, reflecting a reallocation of resource towards more productive firms. This is the first hypothesis this study intends to explore. The other hypothesis relies on Bustos' model. Again, given the presumption stated in the previous paragraph, this study predicts that the significantly higher firm entry rate during the early 2000s only increased the productivity of firms that had already acquired an intermediate productivity level.

Having put forward the testable hypotheses, it is important to mention the existence of a closely related strand of literature that examines the relationship between firm dynamics and economic performance. There are theoretical works, in particular Jovanovic (1982) and Hopenhayn (1992) that model the interrelationship between entry/exit, and firm heterogeneity in terms of productivity. These models detail how competitive struggle, reflected by firm dynamics (i.e., entry, exit and growth), affect productivity growth. Empirical studies on this include, among others, Olley and Pakes (1996), Liu (1993), Liu and Tybout (1996), and Aw *et al.* (2001). Aw *et al.* for example, found that new firms in Taiwanese manufacturing have lower average productivity than incumbents, albeit there is a large variation in the productivity level across the firms. They moreover found that the more productive entrants survive and their productivity converges to the level of incumbents (Aw *et al.,* 2001, p.53).

While important, this study does not specifically elaborate the aspect of competitive struggle, stemming from firm entry, in affecting productivity growth. Instead, it addresses more the outcome of this competitive struggle process. Obviously it is a useful exercise to understand this process; however, given the rapid development of the Vietnamese economy in the past two decades, and the fact that much is yet to be learned about it, this study serves only as an early step in gaining further understanding of how firm dynamics affect productivity growth. Further studies that elaborate this are clearly necessary.

4. Data

The data for the empirical analysis is constructed from the following sources:

- The Surveys of Vietnamese Enterprises (the Survey) for the period 2000-07, which are published by the General Statistical Office (GSO). An enterprise is defined as an economic business unit that has its own business accounts and its own legal status (GSO 2009). The Survey covers enterprises operating in all sectors, including services, agriculture, mining and oil-and-gas. This study, however, focuses on and takes only the subset of the enterprises that operate in, the manufacturing sector.
- A separate dataset that includes only key information of, and is related to, gross output, intermediate costs, and value added. This dataset is derived from, or constructed based on, the Survey of Vietnamese Enterprises and can be 'matched' with the original raw dataset of the Survey.
- The data on average tariff rates across the industry, at four-digit ISIC for the period of 2000-07, are drawn from the UN TRAIN database.
- The data on exports and imports are derived from the UN COMTRADE database. They are defined at four-digit ISIC and derived for the period 2000-07.
- Wholesale Price Index (WPI) data at two-digit industry level, published by the GSO and accessed from CEIC database.

The data from the Survey are very rich in firm- and industry-level information. This is because the Survey covers a wide range of information on firms, including basic information (e.g. year of establishment, industry classification, and location), firm characteristics (e.g. ownership, source of capital, and characteristics of technology used), production (e.g. sales/gross output, costs, and employment), etc.

However, the data do have limitations. First, while very useful, the code that identifies firms over the years does not seem to be consistent in some years, at least within the period covered by this study. A careful examination of the code indicates that the code is consistent for the data period of 2000-04 but it might not be for the period 2005-07. The code for the latter period, however, is internally consistent, although it is unlikely to match the code for the former period. Second, there is a large extent of consistency in the variable enumeration across the years. Therefore, the utilization of the data requires a careful and thorough examination of the variable definitions. Third, some relevant or important variables are either not included or not readily available. To illustrate, while there is a detailed classification of firms by type of ownership (i.e., state owned, private, or joint venture), there is no information of the share of each type of ownership. Another example is that the extent of value added, and inputs, are not readily available. Unlike similar datasets in other countries, where these data are readily available, researchers using the Survey's data are required to manually compute this information.

Some adjustments have been made to prepare the data for this study. First, given concern over the reliability of the firm codes, a pooled cross-section of firm-level data was constructed from 2000 to 2007 – this was instead of creating panel data for the period. Second, some observations were dropped. In most cases, this adjustment was made because there were one or two pieces of crucial variable/information that were either missing, or were possibly in error from the data entry stage, or from the implementation of the Survey. The post-adjustment pooled data contains about 7,000 to 10,000 firms/observations over the period 2000-07.

4.1. Labor Productivity

This study employs real value added per unit of labor (*RVL*) as a proxy for labor productivity. It is defined as the nominal value added deflated by the wholesale price index (WPI). Value added is chosen to proxy output, instead of gross output, because it avoids the double-counting problem and is less sensitive to substitution between intermediate and labor inputs. Value added subtracts the value of intermediate goods from gross output. Employment, meanwhile, is measured by the total number of paid employees, which consists of production and non-production workers. The head-count measure is chosen because the number of hours worked, which is the ideal measure of employment, is not available.

4.2. Firm Entry

As is common practice, the extent of firm entry is measured in terms of number of firms, labeled as EN. It is consistent with the importance of the number of firms in shaping market structure.

Entry of firms is ideally defined as the gross value of exits. It is defined in terms of number of firms between two time period, t and $t-1$. Thus,

$$EN_{j,t} = \frac{NEP_{j,t}}{NTP_{j,t-1}},$$

where: $NEP_{j,t}$ = total number of plants that enter industry j between t and $t-1$

$NTP_{j,t-1}$ = total number of plants in industry j in year $t-1$

However, there is a possibility of inconsistency in the firm code in the data over the years, and hence the construction of entry based on its gross value is likely to produce a misleading entry rate. This study takes an alternative approach to overcome this issue, which is defining the entry as its net value of exits. Measuring entry in this way understates the extent of real entry, but arguably it is the appropriate approach bearing in mind the unreliability of firm codes in the data. Instead of taking the short annual difference, this study takes a slightly longer time period in calculating the entry, which is between t and the year of 2000. In this study, t is defined as annual point of observation for the period 2004-07.

Thus, at the end, firm entry is defined as

$$EN_{j,t} = \frac{NEP_{j,2000-t} - NXP_{j,2000-t}}{NTP_{j,2000}}$$

$$= \frac{NTP_{j,t} - NTP_{j,2000}}{NTP_{j,2000}}$$

where: $NXP_{j,2000-t}$ = total number of plants that exit industry *j* over the period 2000 and $t-1$;

$NEP_{j,2000-t}$ = total number of plants that enter industry *j* over the period 2000 and $t-1$;

t = 2004, …, 2007.

5. Empirical Strategies and Empirical Strategies and Results

5.1. Firm Entry and 'between-firm' Productivity Growth

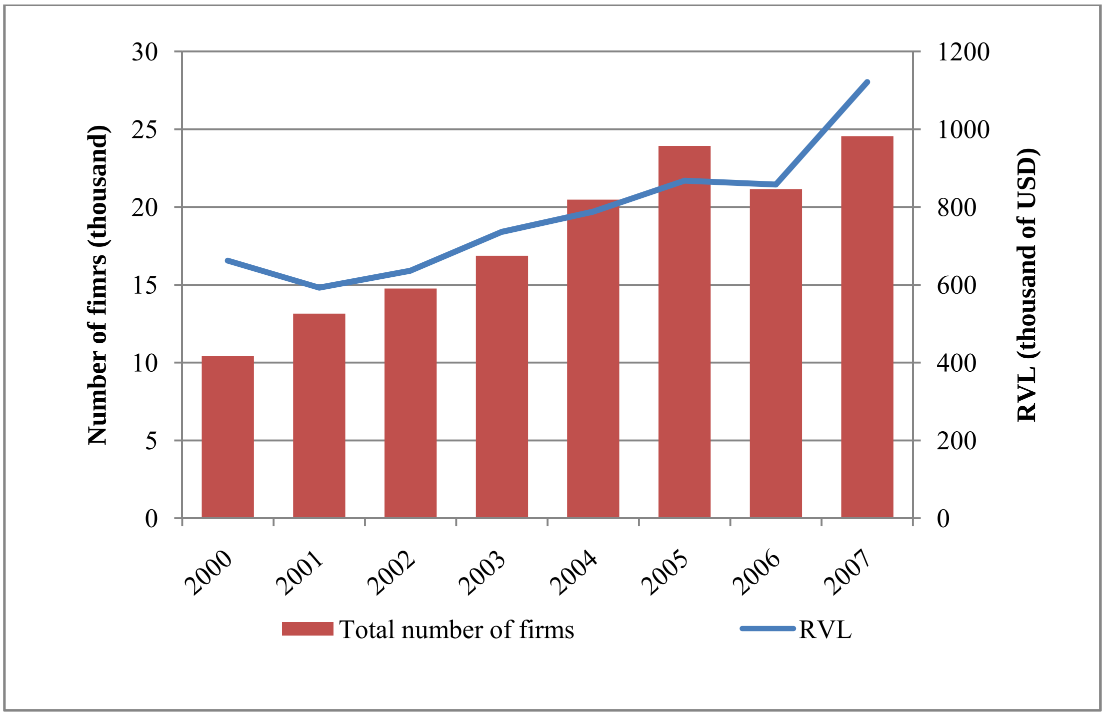
This section examines whether there is a relationship between firm entry and labor productivity growth at industry level, or the 'between firm' productivity growth. It is worth recalling that firm entry is assumed to reflect/proxy the rapid and successful investment and trade liberalization in Vietnam. Thus, the quantitative analysis aims at establishing a connection between the liberalization policy, both in trade and investment, and industry-level productivity growth.

Labor productivity growth is defined as the percentage change in the real labor productivity (LPG) between t and 2001. Thus, for industry j and year *t* over the period 2004-07,

$$LPG_{j,t} = \frac{RVL_{j,t} - RVL_{j,2000}}{RVL_{j,2000}} \quad (1)$$

Figure 5.1 gives the first glimpse of the potentially positive impact of firm entry on labor productivity growth. It plots the stock of firms and $LPG_{j,t}$ for every year over the period 2000-07, for the whole of Vietnamese manufacturing. The figure suggests a positive relationship between firm entry and industry productivity growth. As illustrated, both the number of firms and labor productivity exhibit an increasing trend over the period. It is worth mentioning that the rates of growth of these variables are about the same and are high, at about 30 percent per annum.

Figure 5.1. Number of Firms and Industry Productivity in the Vietnamese Manufacturing, 2000-2007



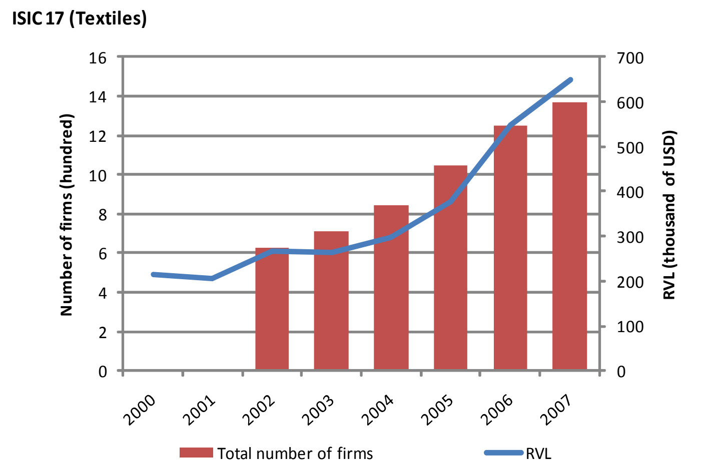
Source: Enterprise Survey (GSO).

Although the picture in Figure 5.1 is consistent with the theory reviewed earlier, it is rather surprising that the rapid growth in productivity seems to have happened without a lag, in respect to the increase in the number of firms. It seems reasonable to argue that the positive impact of the new entrants in pushing up industry-level productivity – if any – should take some time before it materializes. A possible explanation is a situation where there was a favorable business outlook in the economy due to the progressive transition process of the Vietnamese economy but, at the same time, there were not enough firms to satisfy the growing demand of the industry. The argument is associated, to some extent, with higher demand for exports and the policy reform to reduce export bias.

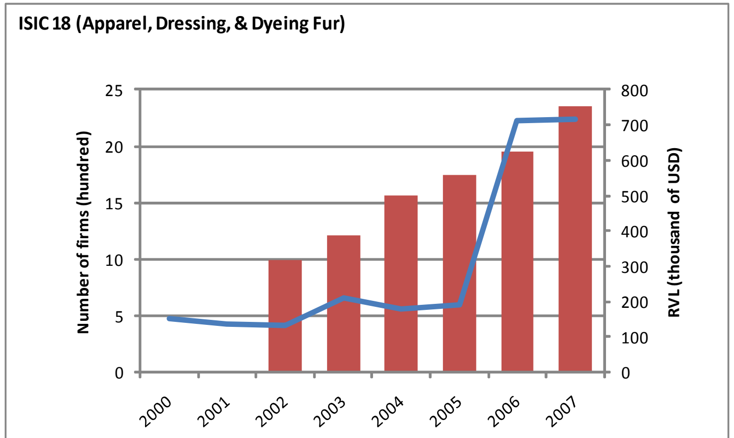
There does not seem to be much variation in the pattern observed across the more disaggregated sectors, defined at the two-digit ISIC level. Illustrated in Figure 5.2, almost all labor- and resource-intensive industries, including textiles and garments (i.e. ISIC 17 and 18, respectively), furniture (ISIC 36), paper and paper products (ISIC 21), and rubber and plastics (ISIC 25), exhibit the same observed pattern. The same pattern is also observed in the capital-intensive sector of fabricated metal products (ISIC 28) and machinery and equipment (ISIC 29). In contrast, a completely different pattern, which is an increasing number of firms but declining productivity, is observed in industries that can be classified as technology-intensive industries, namely electrical machinery and apparatus (ISIC 31) and other electrical equipment (i.e. radio, television, and communication equipment – ISIC 32).

The different pattern is particularly surprising owing to the strong effort from the government in inviting high technology FDI (i.e., sector priority for FDI, encouragement to invest in EPZ, etc. See the overview in Section 2). This pattern suggests a low value added for goods produced by these sectors. Nonetheless, it is consistent with what happened in some other developing Southeast Asian countries during the early stage of their industrialization. As observed by Ariff and Hill (1985), electronic industries in Indonesia and Malaysia were highly labor intensive at the early stage of the sector's growth. A labor-intensive electronic sector obviously gives a lower value added than a 'true' high-technology electronics sector.

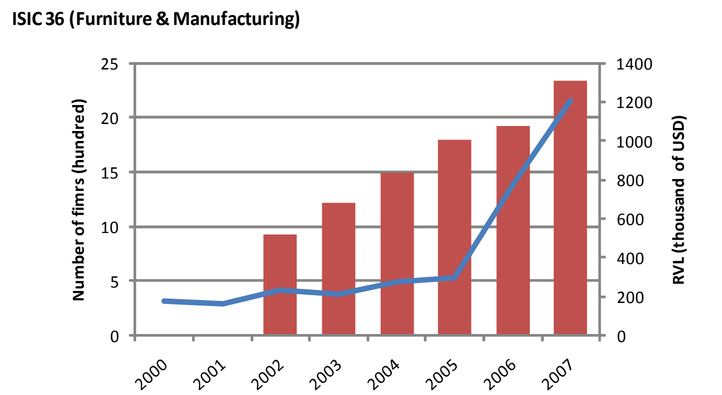
Figure 5.2. Number of Firms and Industry Productivity in the Vietnamese Manufacturing by Broad Industry Groups, 2000-2007



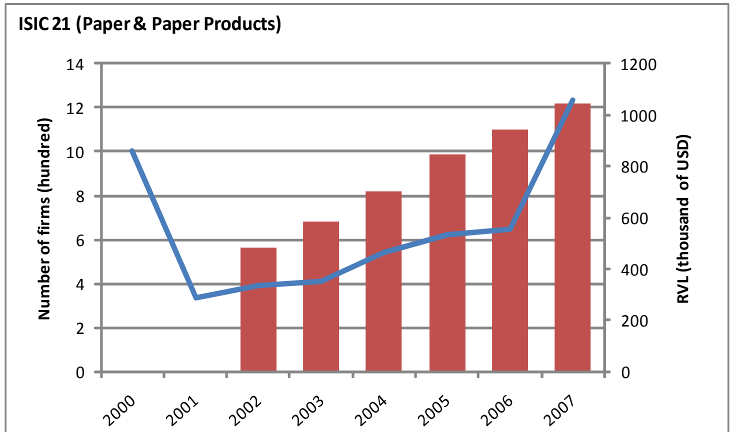
Source: Enterprise Survey (GSO).



Source: Enterprise Survey (GSO).



Source: Enterprise Survey (GSO).



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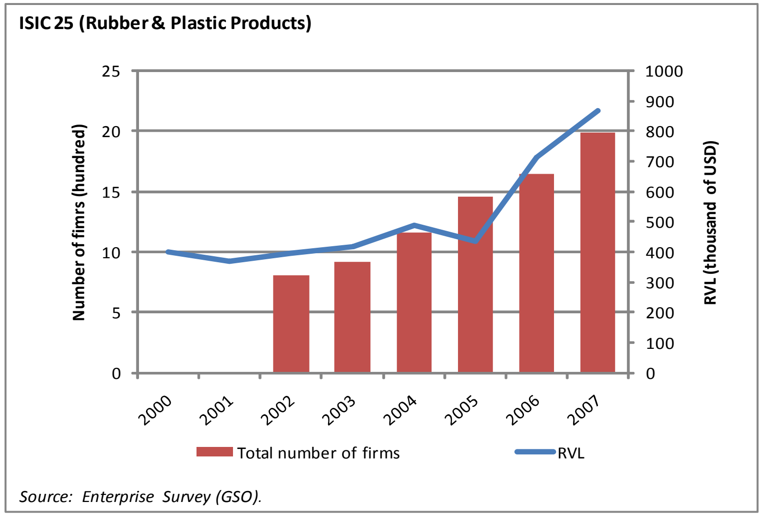
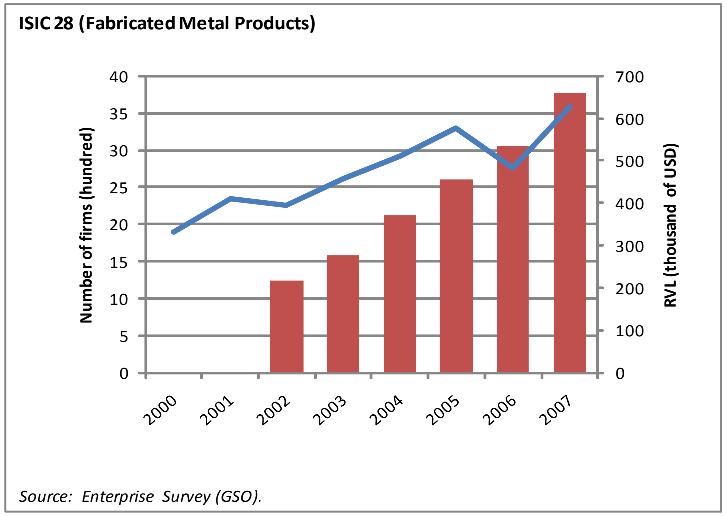
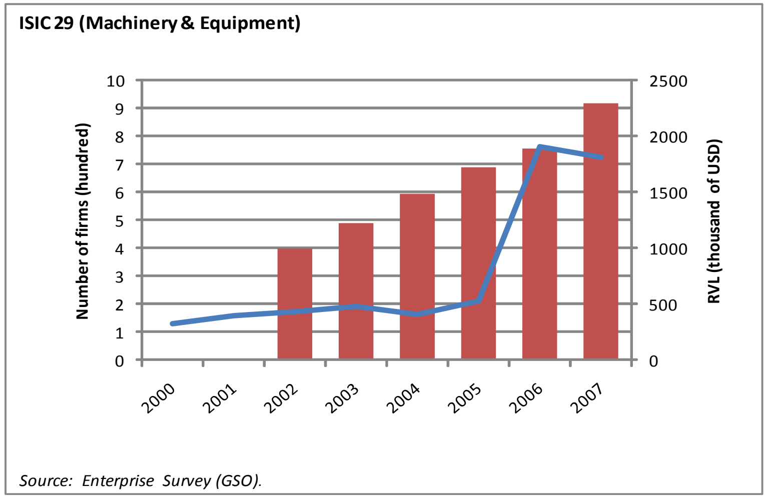
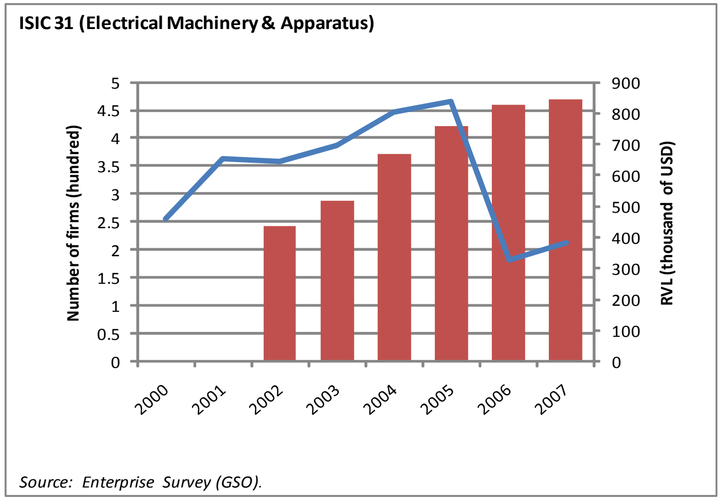








Source: Enterprise Survey (GSO).

Given the picture from the descriptive analysis, a formal test is necessary. This is done by testing the impact of firm entry on the industry labor productivity growth in a regression framework. In particular, we estimate the following equation,

$$LPG_{j,t} = \alpha_0 + \alpha_1 ' EN_{j,t-1} + \alpha_2 ' X_{j,\overline{2000-(t-1)}} + \upsilon_{j,t} \quad (1)$$

where: t = 2004, …, 2007;

j = industry j, defined at three-digit ISIC;

$LPG_{j,t}$ = labor productivity growth of industry j over the period $2000-t$;

$EN_{j,t-1}$ = entry rate in industry j over the period $2000-(t-1)$;

$X_{j,\overline{2000-(t-1)}}$ = matrix of control variables defined at their average value for the period $2000-t$;

The study applies OLS estimation to the pooled cross-section data assembled for this study (see the description in Section 4).

It is important to mention that the specification of time attached to *EN* and the other explanatory variables in *X*,, which is one-year, should be able to ensure exogeneity of these variables. However, $EN_{j,t-1}$ may still be endogenous. The reason should be obvious and is that, $EN_{j,t-1}$ over the period is unlikely to be drawn from a random process. This is because the rapid and bold trade and investment liberalization during the 1990s and early 2000s are likely to systematically affect the extent of firm entry over the covered period. Therefore, while the predetermined specification of *EN* statistically should wipe out any correlation of the variable with the error terms $\upsilon_{j,t}$ in (1), the non-random process from which distribution $EN_{j,t-1}$ is drawn arguably re-establishes this correlation. Hence, a failure to address this issue could lead to bias and inconsistent estimates.

The two-stage least squares approach (2SLS) is adopted to address the endogeneity of $EN_{j,t-1}$. In this approach, the fitted value of $EN_{j,t-1}$, labeled $\widehat{EN}_{j,t-1}$, is used as an instrumental variable (IV) which replaces $EN_{j,t-1}$ in the structural equation (1). Therefore, it is necessary now to define a statistical equation that determines $EN_{j,t-1}$. This is specified as the following,

$$EN_{j,t-1} = \beta_0 + \beta_1 ' Y_{j,t-2} + \beta_2 ' X_{j,\overline{2000-(t-1)}} + \varepsilon_{j,t} \quad (2)$$

where $Y_{j,t-2}$ is a matrix containing variables that measure the extent of trade and investment liberalization occurring over the period 2000-05. This study specifies the percentage change in import penetration ($\%\Delta IMP_{j,2000-(t-2)}$), tariff rate ($\%\Delta TARIFF_{j,2000-(t-2)}$), industry foreign ownership intensity ($\%\Delta FOR_{j,2000-(t-2)}$), and export intensity ($\%\Delta EXP_{j,2000-(t-2)}$), between *t-2* and the year 2000 as the measures of the trade and investment liberalization.[4] In other words, equation (2) also serves as a formal test for the impact of the liberalization on entry during the period.

The percentage change in import penetration (i.e., $\%\Delta IMP_{j,2000-(t-2)}$) provides an alternative proxy to measure of the extent of trade liberalization. It is expected to negatively related to firm entry ($EN_{j,t-1}$) because higher *IMP*, which reflects a more open international trade regime, also reflects higher potential competition from imports, which in turn lowers the expected profit and therefore discourages entry. The limit-price model (Orr 1974) postulates that entry occurs whenever the expected post-entry profit exceeds the level of profit in the long run.

The percentage change in tariff rate ($\%\Delta TARIFF_{j,2000-(t-2)}$) is another proxy for the extent of trade liberalization. Drawing from the Orr's model, it is expected to be positively related to firm entry. A higher extent of domestic market protection from a higher tariff rate should increase the expected profit for incumbents. This increases the expected operating profit, and hence it encourages entry.

Meanwhile, the percentage change in the foreign ownership intensity ($\%\Delta FOR_{j,2000-(t-2)}$) – or intensity of foreign-firm presence in an industry – attempts to measure the extent of liberalization in the direct investment regime. This is particularly true for the regime that governs FDI. It is expected to be positively related to firm entry. The so-called 'push' hypothesis of firm entry over the business cycle postulates that new businesses are formed when there is a vacuum in business activity.

[4] See Appendix for the definition and measurement of *IMP*, *TARIFF*, *FOR*, and *EXP*.

The percentage change in export intensity ($\%\Delta EXP_{j,2000-(t-2)}$) reflects both investment and trade liberalization. The former derives from the fact that reform of policy on direct investment has been largely geared towards facilitating and providing incentives for FDI, while the latter comes from the objective of reducing export bias from some elements of the trade liberalization. The impact of this variable is difficult to predict *a priori*. A more favorable investment climate, and higher expected profit from a higher export orientation of the industry, encourages firms to enter. However, the expected fiercer competition in the industry is likely to discourage entry plans, because of the expectation of a larger number of exporters and the consideration that exporters are generally more efficient than non-exporters.

This study follows the Orr model's limit-price model in defining the other explanatory variables in equation (2), as commonly adopted in firm entry literature. There are three groups of variables guided by the model, namely demand opportunity, risk, and entry barrier variables. This study includes price-cost margin (*PCM*) as a proxy for expected profitability and the standard deviation of PCM (*SDPCM*) as a variable to measure the risk associated with operating in the industry. As for the entry barriers, the study includes industry economies of scale (*ES*), capital required to establish a firm at the industry minimum efficiency scale, or capital requirement (*KR*), and Herfindahl Index (*HHI*) as measures of industry concentration.

Table 5.1 presents the 2SLS estimation result of the structural equation (1) (i.e., the *LPG* equation). Although this study is particularly interested on the estimate of $EN_{j,t-1}$, it is also worth reporting the results of the firm entry equation (i.e. equation (2)), which is the equation that produces the instrumental variable of the endogenous $EN_{j,t-1}$). The estimation result of the entry equation is presented in Table 5.1. The fitted values were used as the data for estimation of equation (1). The Hausman test of exogeneity was rejected at the 1 percent level, confirming the prediction that $EN_{j,t-1}$ is endogenous. All explanatory variables of the entry equation are instruments of $EN_{j,t-1}$. The estimation includes dummy variables for years and broad industry groups, to account for the differences across years and industries. Several specifications in estimating equation (2) were checked, each of which individually includes the investment and trade liberalization variables into the equation.

Consider, first, the results of the firm entry estimation (see specification (5.1) in Table 5.1). Out of all variables measuring the extent of the investment and trade liberalization, only the coefficient of ($\%\Delta FOR_{j,2000-(t-2)}$) and ($\%\Delta EXP_{j,2000-(t-2)}$) is statistically significant and shows the expected sign. This is however only significant at the 10 percent level for ($\%\Delta EXP_{j,2000-(t-2)}$). This confirms the observation that the progressive investment and trade liberalization in the country was responsible for the high firm entry level we observed earlier. Comparing the magnitude and statistical significance of these coefficients, however, it is suggested that investment liberalization has affected entry more than trade liberalization. The estimate of ($\%\Delta FOR_{j,2000-(t-2)}$), for instance, is statistically significant at the 1 percent level, while not so for the estimate of ($\%\Delta EXP_{j,2000-(t-2)}$), which is significant only at the 10 percent level.

The estimated coefficient of the variables on demand opportunities and risk suggests that much firm entry during the period was driven by a very favorable profit situation with low market risk. The coefficient of $PCM_{j,\overline{2000-(t-1)}}$ is substantially large, positive, and very statistically significant at the 1 percent level, while the coefficient of $SDPCM_{j,\overline{2000-(t-1)}}$ is very statistically insignificant. This inference lends support for the 'push' hypothesis of firm entry during a business cycle, where firms are encouraged to enter given a favorable business situation. As argued by Highfield and Smiley (1987), the situation under this hypothesis predicts that entry barriers are at their minimum level. Indeed, this is suggested by the results. None of the estimated coefficients of entry barrier variables (i.e., $ES_{j,\overline{2000-(t-1)}}$, $KR_{j,\overline{2000-(t-1)}}$, and $HHI_{j,\overline{2000-(t-1)}}$) is statistically significant, indicating that entry barriers did not create a binding constraint for the establishment of firms (or firm entry) during this period.

Turning now to the results of the estimation of the *LPG* equation (see specification (5.2) in Table 5.1). The coefficient of $EN_{j,t-1}$ is positive and very statistically significant at the 1 percent level. Thus, the extent of firm entry during the period 2000-03 did increase the aggregate industry productivity over the subsequent period (i.e., the period 2004-07). The magnitude of the increase, moreover, is quite large. The estimated coefficient of $EN_{j,t-1}$ suggests that a 10 percent increase in the rate of firm entry leads to an increase of 2.2 percent in labor productivity growth during the period.

This finding supports the prediction of Melitz's (2003) model for the impact of trade liberalization on the overall productivity growth of an industry. It suggests a reallocation of resources in the sectors within Vietnamese manufacturing towards the more efficient firms, as a result of the level of firm entry. This finding confirms the descriptive observation presented in Figure 5.1 and 5.2 for the parallel increasing trend in the number of firms and industry productivity over the period.

It is worth mentioning that a suggestion on resource reallocation was also found in Olley and Pakes (1996). They found that reallocation of capital drives productivity growth in the US telecommunication industry. What this study found, however, is in contrast to the finding of some other studies, which in fact suggest only weak resource reallocation among firms.[5] Given the reasoning put for forward by these studies, which is that there is a small productivity differential across entrants, the finding of this study hence indicates substantial differences in the productivity of the entrants. This is a sensible inference, owing to the much opened investment and trade regime in Vietnam.

[5] See, for example, Liu and Tybout (1996) and Aw *et al.* (2001) for the case of Colombia and Taiwan manufacturing sectors, respectively.

Table 5.1. Firm Entry and Industry Level Productivity Growth: Regression Results

Independent variable	Dependent variable	
	$EN1_{j,(t-1)}$	$LPG_{j,t}$
	(5.1)	**(5.2)**
$EN1_{j,t-1}$		0.225 (3.32)**
$\%\Delta IMP_{j,2000-(t-2)}$	-0.0105 (0.80)	
$\%\Delta TARIFF_{j,2000-(t-2)}$	0.0044 (0.25)	
$\%\Delta FOR_{j,2000-(t-2)}$	0.5528 (2.71)**	
$\%\Delta EXP_{j,2000-(t-2)}$	-0.0679 (1.90)+	
Avg. $ROOM_{j,2000-(t-1)}$	43.6361 (0.72)	
Avg. $PCM_{j,2000-(t-1)}$	87.002 (3.15)**	-23.055 (3.16)**
Avg. $SDPCM_{j,2000-(t-1)}$	-1.2899 (0.02)	
Avg. $ES_{j,2000-(t-1)}$	-0.0009 (0.32)	0.0002 -0.34
Avg. $KR_{j,2000-(t-1)}$	-0.00001 (0.99)	2.32[a] -0.97
Avg. $HHI_{j,2000-(t-1)}$	-12.848 (1.49)	0.333 -0.17
Year dummy 2005	-3.077 (0.82)	1.102 -1.32
Year dummy 2006	1.863 (0.51)	0.292 -0.37
Year dummy 2007	3.857 (0.93)	-1.112 -1.26
Industry dummy variables	Included	Included
Constant	-13.58 (1.48)	7.406 (3.59)**

Notes: 1) Robust Z statistics in parentheses.
2) Significance level: ** significant at 1%; * significant at 5%; + significant at 10%.
a) The coefficient was multiplied by 10-06 to improve presentation.

This section examines whether or not the reforms towards a more market-oriented economy – reflected by the significantly higher firm entry rate in the early 2000s –

results in productivity change within industries. As in one of the predictions of Bustos' (2005) model, trade and investment liberalization gives firms incentives to upgrade their technology. Given the distribution of the firms' productivity, the upgrading is predicted to only materialize at firms that have already achieved some intermediate level of productivity prior the liberalization.

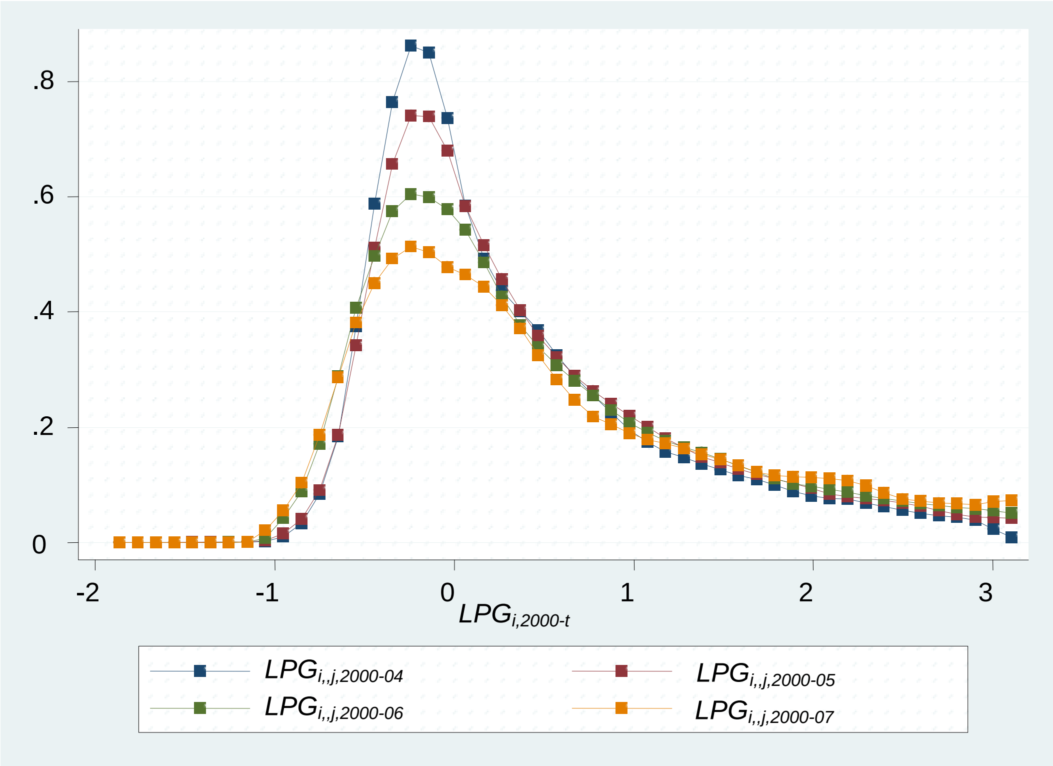
To proceed, we examine the distribution of firm-level labor productivity growth over the time. Adopting the approach used by Lileeva (2008), the following labor productivity growth at firm level is computed:

$$LPG_{i,j,t} = \frac{RVL_{i,j,t} - RVL_{50,j,2000}}{RVL_{50,j,2000}} \quad (1)$$

where $LPG_{i,j,t}$ is the labor productivity growth of firm *i*, in industry *j*, over the period $2000-t$, $RVL_{50,j,2000}$, and $RVL_{25,j,2000}$ are the 50th (median) and 25th percentiles of the distribution of firm-level labor productivity in 2000, respectively. The study experiments by plotting the distribution of $LPG_{i,j,t}$ for each year over the period 2004-07.

Figure 5.3 plots the kernel density of $LPG_{i,j,t}$ for the whole Vietnamese manufacturing sector for the whole period. There is a clear observation of a changing distribution over time. The density, or the share of firms operating near the centre of the distribution, or median, gets smaller over time. Consider, for example, the distribution of $LPG_{i,j,t}$ for $t = 2004$ and $t = 2007$. Here, the share of firms with $LPG_{i,j,t}$ near the median of the distribution is about 15 percent less in 2007 than that in 2004. Some of the firms that located near the median of the distribution in 2004 are 'redistributed' to the right-hand tail of the distribution, which is the area in the distribution for higher productivity growth. Therefore, there are more firms with higher labor productivity in 2007 rather than those in 2004.

Figure 5.3. Distribution of Firm Productivity Growth over the Period 2004-2007



The inference is clearer at the more disaggregated level. This is illustrated by Figures 5.4 to 5.7, which draw the distribution of productivity growth occurring in some broad industry groups defined at the two-digit ISIC. The figures show that many of the firms in these industries (i.e., in textiles, garments, machinery and equipment, and electrical machinery) have become substantially more productive in 2007 compared to their situation in 2004; the density at the right-hand tail of the distribution in 2007 is consistently higher for these industries. This pattern is also observed in many other industry groups that are not shown here.

The shape of the change in the distribution, however, varies quite substantially. There are changes in the distribution which are not as clear as those observed so far. Figure 5.8 an example of this, which occurs in the food and beverage products industry. Besides this, there are also a few industries that show an opposite pattern, where the right-hand tail of the distribution gets smaller over the years. A clear example perhaps is shown by the change in the distribution occurring in the tobacco products industry (see Figure 5.9).

Figure 5.4. Distribution of Firm Productivity Growth over the Period 2004-2007: Textiles

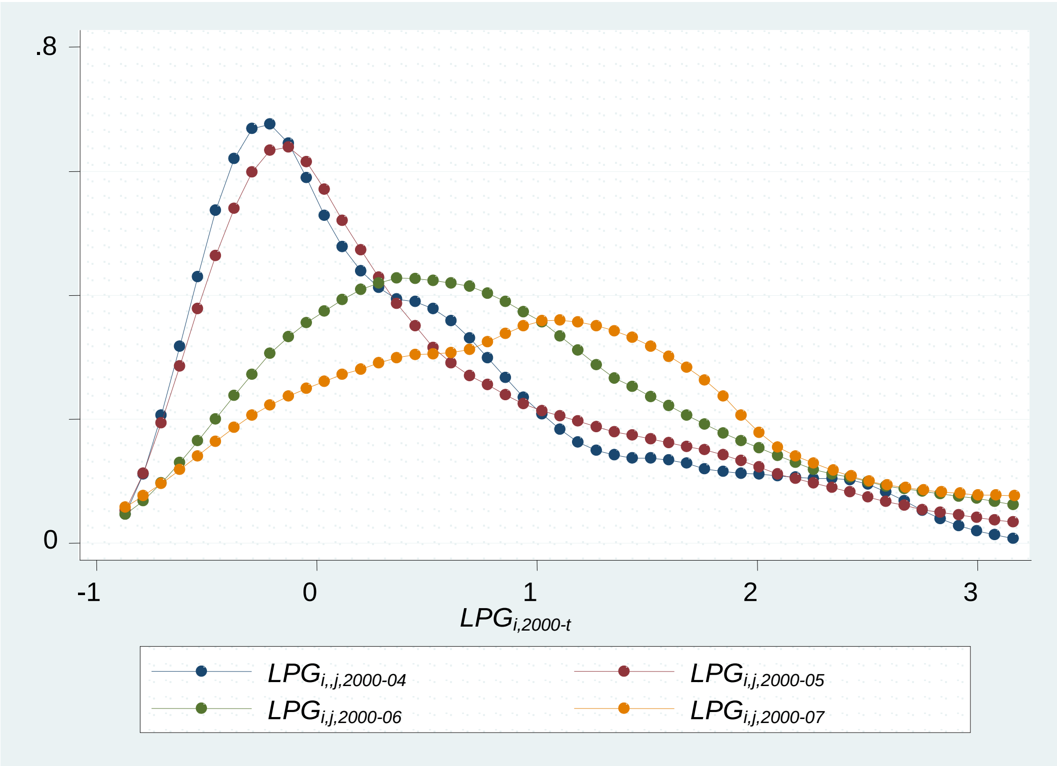


Figure 5.5. Distribution of Firm Productivity Growth over the Period 2004-2007: Garments

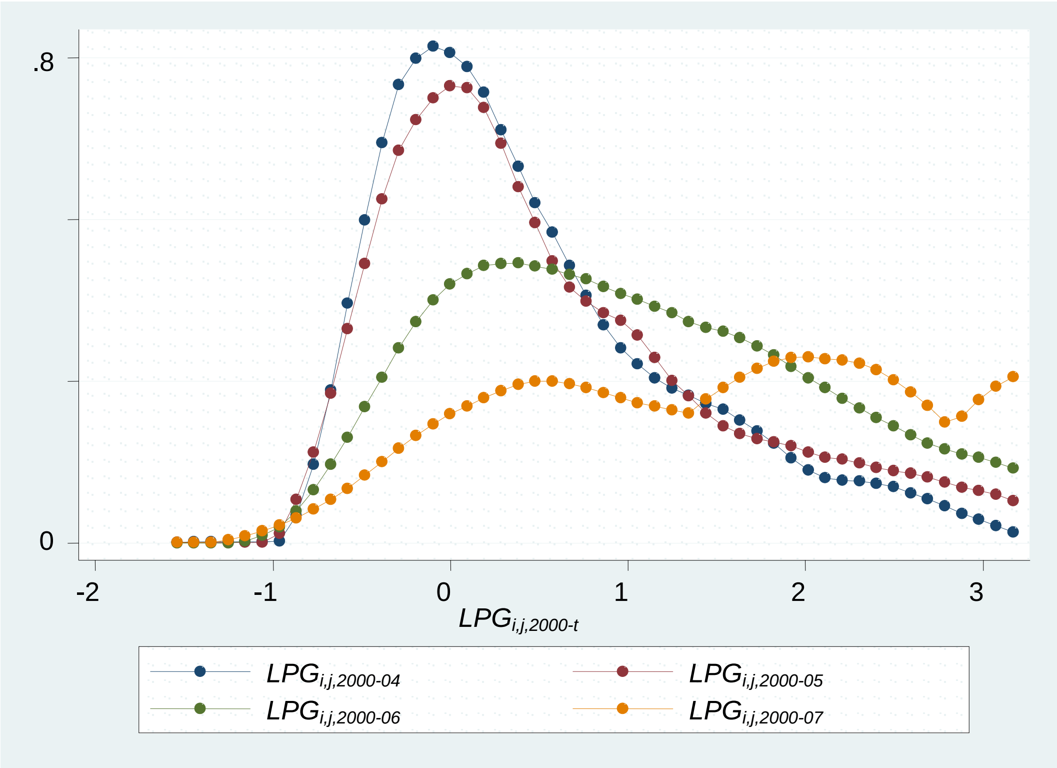


Figure 5.6. Distribution of Firm Productivity Growth over the Period 2004-2007: Machinery and Equipment

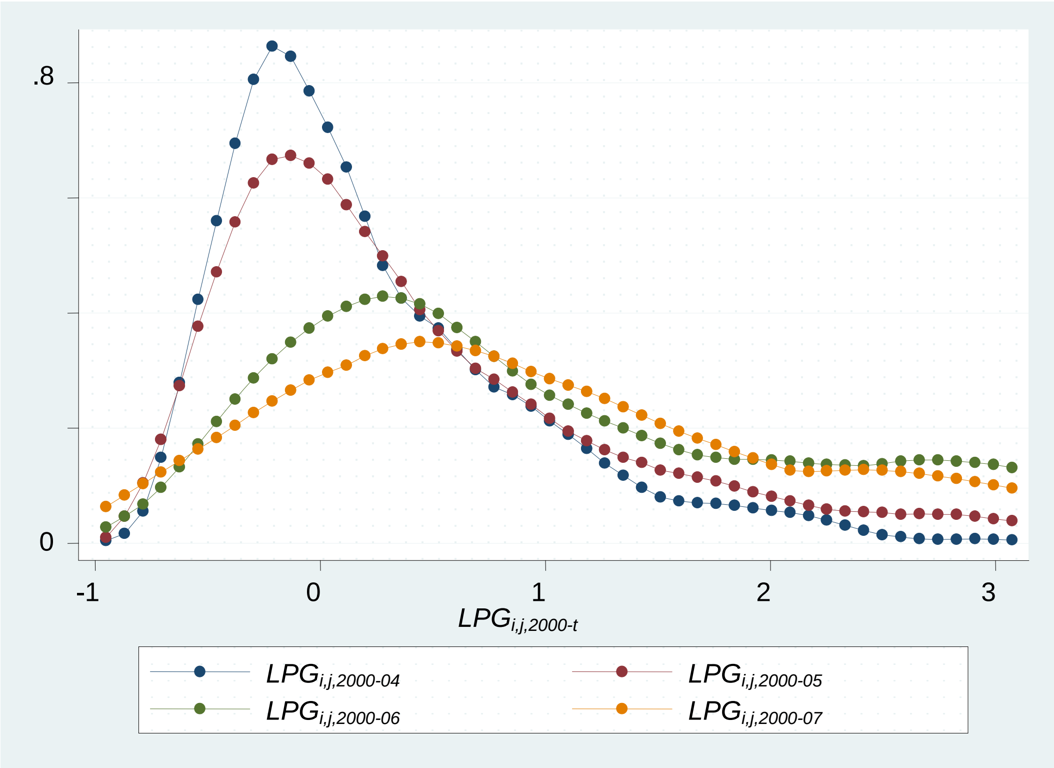


Figure 5.7. Distribution of Firm Productivity Growth over the Period 2004-2007: Electrical Machinery and Apparatus

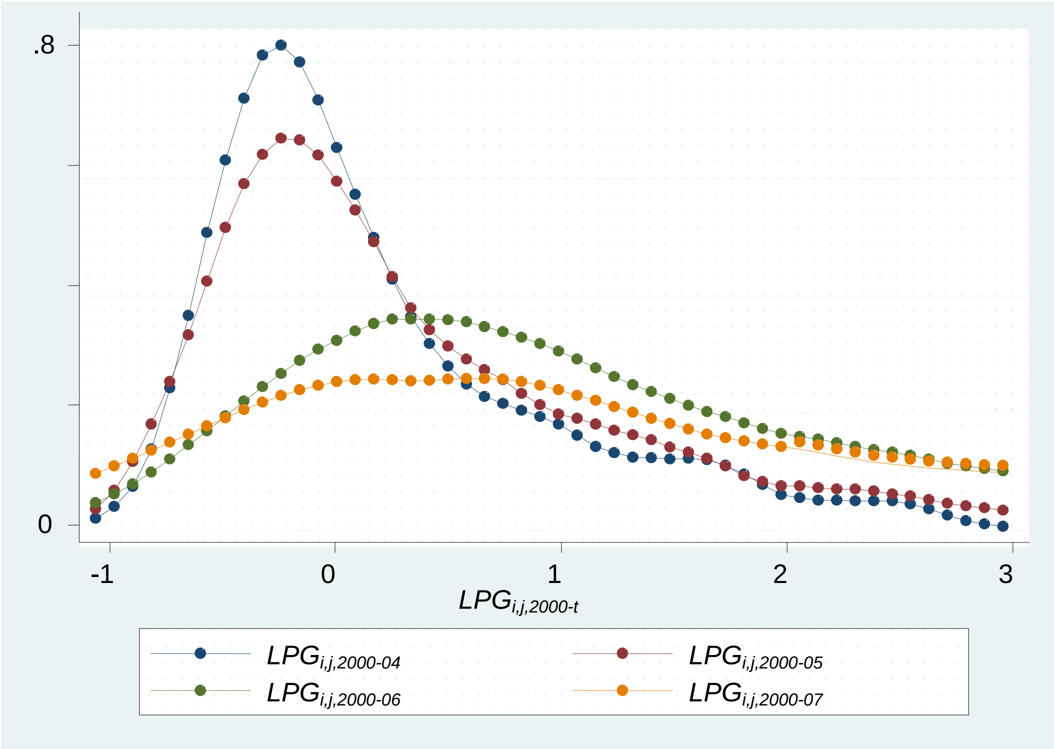


Figure 5.8. Distribution of Firm Productivity Growth over the Period 2004-2007: Food-and-Beverage

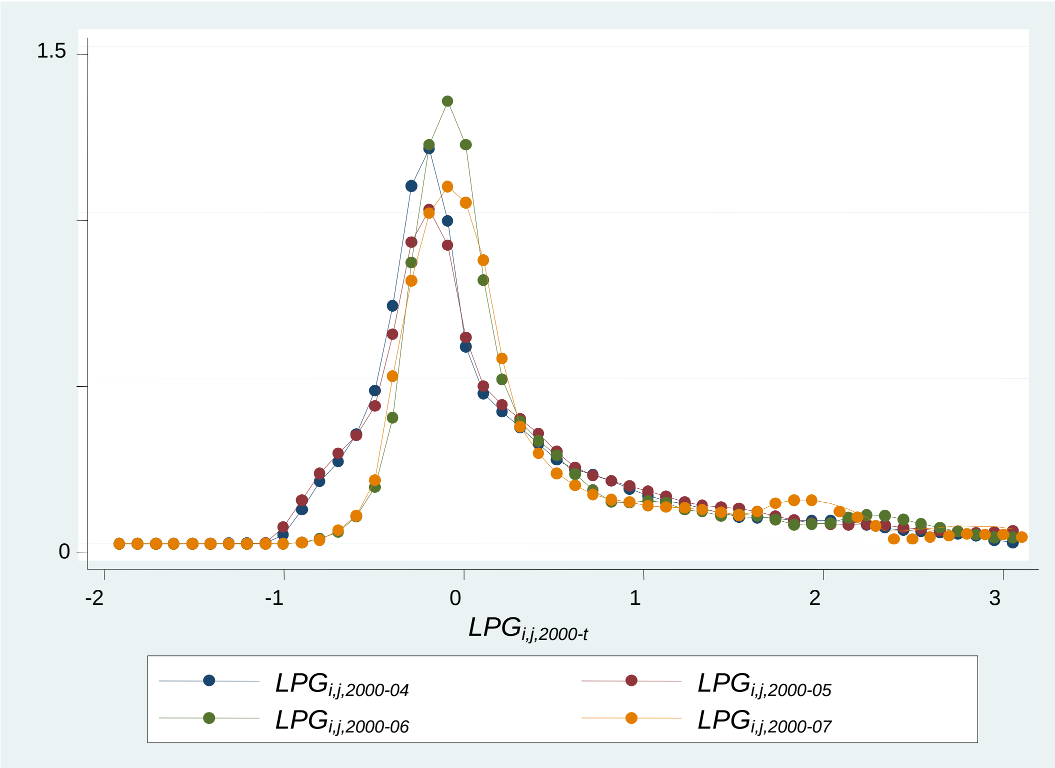
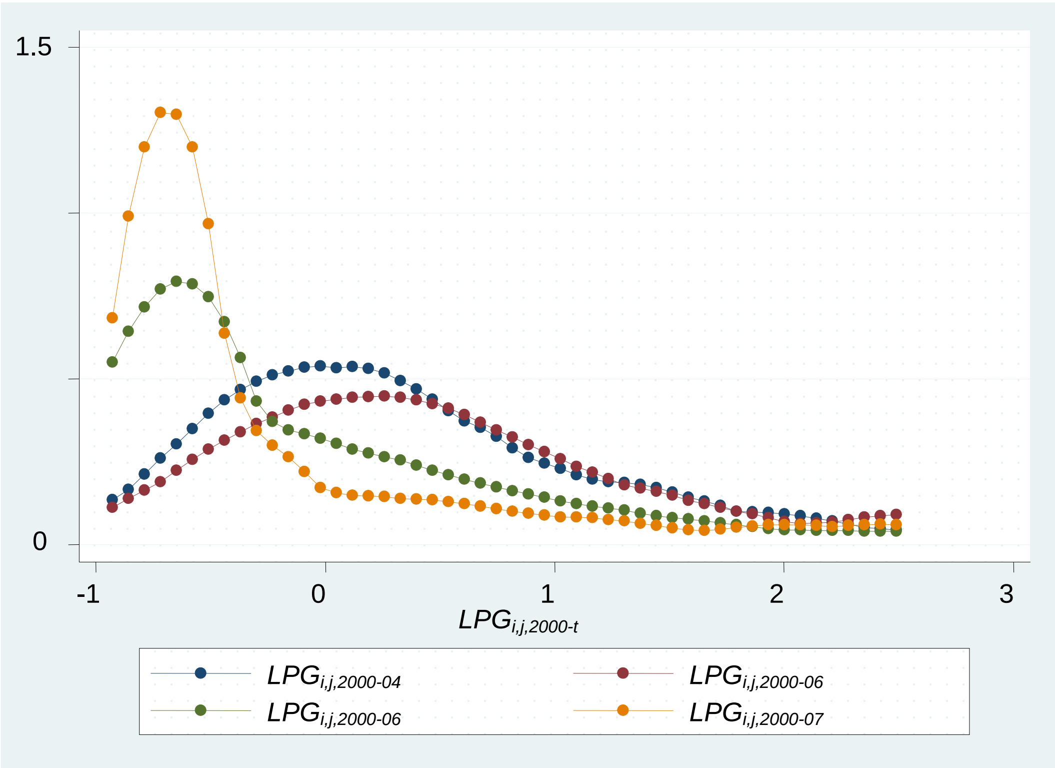


Figure 5.9. Distribution of Firm Productivity Growth over the Period 2004-2007: Tobacco Products



In order to gauge the impact of firm entry on productivity change at the firm level, the following equation is estimated,

$$LPG_{i,j,t} = \delta_0 + \delta_1 ' EN_{j,\overline{2000-t}} + \delta_2 ' X_{j,\overline{2000-t}} + \delta_3 ' Z_{i,j,t} + \eta_{i,t} \quad (3)$$

where $Y_{i,j,t}$ is the matrix of firm-level characteristics.[6]

The estimation adopts a quartile-regression approach. This allows us to estimate the effect of firm entry in a specific quartile, which is appropriate for the analytical framework. The estimation aims at testing the other hypothesis, namely that the higher entry rate affect productivity growth at firm level differently across groups of firms with different initial productivity levels.

Table 5.2 presents the regression results of model (3). The estimations control for few firm characteristics, namely size ($SIZE_{i,j,t}$) and foreign ownership ($DFOR_{i,j,t}$, or a

6 Definition and measurement of the control variables are presented in Appendix.

dummy variable that identifies firms with any foreign ownership share). They also include the same industry level variables as those included in the previous estimations.

The result supports the prediction of Bustos' (2005) model which hypothesizes that an increase in productivity from market reform depends on the initial productivity level of the firm prior the reform. The results also show that the increase in productivity, as a result of the higher rate of firm entry, only materialize for firms which have acquired some intermediate level of productivity. The estimated coefficient of EN_{2000-t} changes from negative and statistically significant in the result of the 25th quartile regression to positive and statistically significant in the 50th quartile regression, although the latter is only statistically significant at the 10 percent level. The result suggests that the impact of higher levels of firm entry is to lower the productivity of firms located at the bottom of the productivity distribution. In contrast, the more open industry increases the productivity of firms located at the higher end of the distribution (i.e., located near the median of the distribution). There is, however, no indication that a higher rate of firm entry changes the productivity of firms located at the much higher end of the productivity distribution. The estimated coefficient of the 75th quartile regression is statistically insignificant, although the sign of the coefficient is positive.

Table 5.2. Firm Entry and Firm Level Productivity Growth: Quartile Regression

Independent variable	Dependent Variable: $LPG_{i,j,t}$		
	25th	50th	75th
	(5.3)	(5.4)	(5.5)
$EN_{j,t-1}$	-0.004 (3.70)**	0.004 (1.82)+	0.001 (0.19)
$SIZE_{i,j,t}$	0.00004 (9.47)**	0.0001 (14.29)**	0.0001 (15.94)**
$DFOR_{i,j,t}$	0.282 (29.50)**	0.522 (24.86)**	0.717 (22.86)**
Avg. $PCM_{j,2000\text{-}t}$	0.269 (5.34)**	1.132 (10.31)**	1.421 (8.99)**
Avg. $ES_{j,2000\text{-}t}$	0.00002 (5.32)**	0.00004 (4.70)**	0.0006 (5.02)**
Avg. $KR_{j,2000\text{-}t}$	-1.51[a] (25.98)**	-1.45[a] (9.92)**	-1.99[a] (8.26)**
Avg. $HHI_{j,2000\text{-}t}$	-0.697 (15.18)**	-0.825 (7.75)**	-0.879 (5.32)**
Year dummy 2005	0.045 (6.63)**	0.118 (7.94)**	0.251 (11.38)**
Year dummy 2006	0.151 (15.92)**	0.28 (13.58)**	0.511 (16.62)**
Year dummy 2007	0.295 (32.29)**	0.572 (28.70)**	1.142 (38.28)**
Industry dummy variables	Included	Included	Included
Constant	-0.159 (13.33)**	-0.113 (4.32)**	0.445 (12.01)**
Observations	27,555	27,555	27,555

Notes: 1) Robust Z statistics in parentheses.
2) Significance level: ** significant at 1%; * significant at 5%; + significant at 10%.
a) The coefficient was multiplied by 10^{-06} to improve presentation.

Overall the finding reflects the mechanics of Bustos' model. It suggests that the marginal benefit created by a reduction in the cost of exporting, as a result of the trade and investment liberalization, is much larger for firms with an 'intermediate' productivity level (i.e., the firms which are located at the centre of the distribution) than those operating with a productivity level at the very higher end of the distribution. Indeed, this is what is predicted by Bustos' model, as reviewed in Section 3.

6. Summary and Conclusion

This study examines whether the high firm entry level in Vietnamese manufacturing over the years of the early 2000s affects the productivity growth of firms and industry. The rapid growth in firm entry has likely has been the result of investment and trade liberalization occurring in the country during the 1990s and early 2000s. The study utilizes rich firm level data of Vietnamese manufacturing over the period 2000-07.

The empirical analyses establish a positive relationship between firm entry and productivity growth at industry level over the period covered by the study. Descriptively, there has been a quite positive correlation in the trends of number of firms and productivity change over the period. The econometric analysis finds that the extent of firm entry during the period 2000-03 did increase the industry-level productivity growth over the subsequent period (i.e., the period 2004-07). These findings support the prediction of the Melitz (2003) model, which underlines the importance of firm heterogeneity in shaping productivity change at industry level. They therefore suggest that there has been a reallocation of resources in the sectors within Vietnamese manufacturing towards the more productive firms as a result of a much higher flow of firm entry.

The examination of the distribution of productivity growth at firm level over the period 2004-07 suggests that many firms have become more productive over this period. The number of firms located near the centre of the productivity growth distribution, or median, gets smaller over the time. This inference is clearer with the observation at a more disaggregated level. The change, for example, is very clear to see in the textiles and garments sector.

This observation is confirmed by the formal econometric testing. The adopted quartile regression approach shows that the impact of firm entry varies across firms at different locations in the productivity growth distribution. The test suggests that the impact of a higher extent of firm entry lowers the productivity of firms located at the bottom of productivity distribution. At the same time, firm entry is suggested to increase the productivity of firms located in the centre of the distribution, or at the median of the distribution. These findings support the prediction of Bustos' (2005) model on the different impacts of trade liberalization across firms. They indicate that the increase in productivity, as a result of a higher rate of firm entry affected by the investment and trade liberalization, only materializes for the firms that have acquired some intermediate level of productivity.

The findings of this study add to the literature relating to the positive impact of trade and investment policy reform. Therefore, they lend support for the continuation of the policy reform and for maintaining an open trade and investment regime for industrial development. More importantly, this study underlines the positive impact of a policy reform that works through firm dynamics. Here, unlike the traditional argument of simply improving growth, favorable firm dynamics stemming from trade and investment policy reform are suggested to be able to form a population of more productive firms, having a greater chance of survival. Having these types of firms would certainly be favorable to the overall economy, given the more competitive environment in a more globalised economy.

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APPENDIX

Definition of the Firm- and Industry-level Control Variables for the Estimation of Model (2) and (3).

- Size ($SIZE_i$) is proxied by number of employees. The other common alternatives, such as output or profits, are not used as they tend to be more sensitive to changes in the business cycle. Previous studies found mixed results on the relationship between profitability and business cycles.
- Foreign-firm dummy variable ($DFOR_i$) is defined based on the existence of a foreign ownership share in firm *i*. Thus, $DFOR_i$ equals 1 if firm *i* has any positive foreign ownership and zero otherwise.
- Foreign ownership intensity in industry *j* is defined by utilizing the information of $DFOR_i$. Thus, it is defined as,

$$FOR_j = \frac{NFOR_j}{NTP_j}$$

$$= \frac{\sum_i \left(DFOR_i = 1 \right)}{NTP_j}$$

where: $NFOR_j$ = total number of foreign firms in industry j

NTP_j = total number of plants in industry j in year $t-1$

- Export intensity in industry *j* is defined as the following,

$$EXP_j = \frac{X_j}{Q_j}$$

where X_j is the exports of industry j and Q_j is the production of industry j.

- The Herfindahl Index (HHI_j) is defined based on the market share of firm *i* in industry *j*,

$$HHI_j = \sum_i \left(\frac{VA_i}{\sum VA_i} \right)^2$$

where VA_i is the value added of plant i in industry j.

- Import penetration (IMP) for industry j is defined as

$$IMP_j = \frac{M_j}{Q_j}$$

where Q_j and M_j are the domestic production and imports in industry j, respectively.

- Trade protection ($TARIFF$)

This study uses the average nominal tariff rate to proxy $TARIFF$. The data for the tariff rate are derived from UN COMTRADE for the period of 2000-07.

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CHAPTER 5

Micro Study: Philippines
Does Trade Protection Improve Firm Productivity? Evidence from Philippine Micro Data

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This paper examines the impact of trade policy changes on firm productivity in the Philippines, characterized by an incomplete liberalization process and reversal of policy in midstream. Though the Philippines implemented substantial trade reforms from the 1980s up to the mid-1990s, it adopted a selective protection policy in the early 2000s. The regression results show that among firms in the purely importable sector, trade protection is negatively associated with firm productivity. For firms in the mixed sector, a negative relationship is also present, but is not statistically significant. Among firms in the purely exportable sector, the evidence is weak due to the strong bias of the system of protection against exportable. Coinciding with policy reversal, the aggregate productivity of the purely importable and mixed sectors both declined from 1996 to 2006. In contrast, the productivity of the purely exportable and non-traded sectors increased during the same period. This paper shows that the selective protection policy not only reversed the productivity gains from the previous liberalization, but undermined the output restructuring from less productive to more productive firms that was already underway as the protection of selected sectors allowed inefficient firms to survive.

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1. Introduction

The old theory of international trade tells us that welfare gains from trade arise from specialization based on comparative advantage. In the new trade theory, gains result from economies of scale and product varieties that are available to consumers. Empirical evidence shows that an additional source of gains arises from improved productivity. In these studies, the assumption of firm heterogeneity within an industry has been adopted in contrast to traditional models that rely on the representative firm assumption. In the presence of 'within-industry' firm heterogeneity, trade liberalization may lead to improved productivity through the exit of inefficient firms and the reshuffling of resources and outputs from less to more efficient firms. Melitz (2002) points out that trade opening may induce a market share reallocation towards more efficient firms and generate an aggregate productivity gain, without any change at the firm level. Although increases in the exposure to trade always generate more import competition, exit is always driven not by competition from imports but by the entry of firms motivated by the higher relative profits accruing to exporters. Melitz further notes that since entry into new export markets is costly, then exposure to trade affects firms with different productivity levels in several ways. The new export markets offer increased profit opportunities exclusively to the more productive firms who can pay the export market entry costs. Therefore, it is the pull of the export markets rather than the push of import competition that forces the least productive firms to exit.

Studies indicating that productivity improves following liberalization include Pavcnik (2000) for Chile, Fernandes (2003) for Columbia, Topalova (2003) and Chand and Sen (2000) for India, Amiti and Konings (2004) and Muendler (2002) for Indonesia along with Schor (2003) for Brazil and Ozler and Yilmaz (2001) for Turkey. In India, Krishna and Mitra (1998) also found evidence of a significant favorable effect of reforms on industrial productivity. In another study using effective protection rates (EPRs) and import coverage ratios as trade liberalization variables, Goldar and Kumari (2003) found the coefficient on EPR to be consistently negative and statistically significant. However, the coefficient on the nontariff variable was found to be positive (contrary to an expected relationship) but insignificant. In Korea, Kim (2000) employed legal tariff rates, quota ratio, and nominal protection rates as trade liberalization variables. He found that trade liberalization had a positive impact on productivity performance, although the productivity increase was not significant because the extent of trade liberalization was not substantial enough. Earlier works by Haddad (1993), Harrison (1994), and Tybout and Westbrook (1995) for the Ivory Coast and Mexico also showed a positive link between liberalization and productivity growth.

There are however, studies that showed the opposite. For instance, Bernard and Jones (1996) found weak support for productivity improvements after trade liberalization. The theoretical literature on trade and productivity provides conflicting predictions on the impact of trade liberalization on productivity. On the one hand, trade liberalization can lead to productivity gains through increased competition, the exit of inefficient firms and reallocation of market shares in favor of more efficient firms, increasing scale efficiency, or through learning by exporting effects. On the other hand, as Rodrik (1988, 1992) argued, there are no reasons to believe that protection discourages productivity improvement. In fact it is import liberalization that retards productivity growth by shrinking domestic sales and reducing incentives to invest in technological efforts. Thus whether liberalization really improves efficiency in less developed countries is ambiguous and has remained an empirical question.

As with many developing countries and transition economies, the Philippines opened up its domestic economy to international trade starting in the 1980s. The government implemented several trade liberalization programs during the 1990s. The unilateral reforms in the 1980s were initiated through a World Bank structural adjustment loan, while those in the 1990s were carried out in line with the country’s commitments under the General Agreement on Tariffs and Trade-World Trade Organization (GATT-WTO), and the Association of South East Asian Nations Free Trade Area Common Effective Preferential Tariff Scheme (AFTA-CEPT).

After more than two decades of trade liberalization in the country, there is still very little firm-level empirical research on the impact of trade reforms on productivity. One major reason for the paucity of micro-level trade and productivity studies in the country is the absence of firm-level panel data. Most of the studies carried out in the past were largely based on macro-level analysis and ex-ante assessment using economy-wide CGE models.

This paper will focus on the assessment of the impact of trade policy changes on firm productivity in the Philippine manufacturing industry using micro level data. The Philippines presents an interesting case due to its adoption of selective protection amidst an incomplete trade liberalization process. Though substantial reforms were carried out from the late 1980s to the mid-1990s, it reversed its trade policy in the early 2000s. A firm-level panel dataset covering the manufacturing industry was created based on the survey and census data of the National Statistics Office for the period 1996 to 2006 (with missing years for 1999, 2001, and 2004). The paper is divided into 6 sections. After the introduction, section 2 discusses the various episodes of trade policy reforms and analysis of the performance and structure of the manufacturing industry. Section 3 provides a brief review of the trade and productivity studies in the Philippines. Section 4 presents the methodology and description of the data used in the paper. Section 5 analyzes the results, and section 6 summarizes the findings and policy implications of the paper.

2. Trade Policy Reforms in the Philippines

2.1. Trade Policy Reforms: 1980s-2000s

Since the early 1980s, the Philippines have liberalized its trade policy by reducing tariff rates and removing import quantitative restrictions (see Table 1). The first tariff reform program (TRP 1) initiated in 1981, substantially reduced the average nominal tariff and the high rate of effective protection that characterized the Philippine industrial structure. TRP I also reduced the number of regulated products with the removal of import restrictions on 1,332 lines between 1986 and 1989.

Table 1. Major Trade Policy Reforms in the Philippines (1980s-early 2000s)

Year	Trade Reform	Description
1980	**Tariff Reform Program I** EO 609 and EO 632-A (January 1981)	TRP 1 reduced the level and dispersion of tariff rates from a range of 0 to 100 percent in 1980 to a range of 10 percent to 50 percent and removed quantitative restrictions beginning in 1981 and ending in 1985
1990	EO 413 (July 1990)	EO 413 aimed to simplify the tariff structure by reducing the number of rates to 4, ranging from 3 percent to 30 percent over a period of one year, but was not implemented.
1991	**Tariff Reform Program II** EO 470 (July 1991)	TRP II reduced the tariff range to within a three percent to 30 percent tariff range by 1995
1992	EO 8	EO 8 translated to tariffs, the quantitative restrictions for 153 agricultural products and tariff realignment for 48 commodities
1995	**Tariff Reform Program III**	
	EO 264 (August 1995)	EO 264 further reduced the tariff range to three percent and ten percent levels, reduced the ceiling rate on manufacture goods to 30 percent while the floor remained at 3 percent, and created a four-tier tariff schedule: 3 percent for raw materials, 10 percent for locally available raw materials and capital equipment, 20 percent for intermediate goods, and 30 percent for finished goods
	EO 288 (December 1995)	EO 288 modified the nomenclature and import duties on non-sensitive agricultural products
1996	EO 313 (March 1996)	EO 313 modified the nomenclature and increased the tariff rates on sensitive agricultural products
	RA 8178	RA 8178 lifted the quantitative restrictions on 3 products and defined minimum access volume for these products
1998	EO 465 (January 1998)	EO 465 corrected remaining distortions in the tariff structure and smoothened the schedule of tariff reduction in 23 industries identified as export winners
	EO 486 (June 1998)	EO 486 modified the rates on items not covered by EO 465
1999	EO 63 (January 1999)	EO 63 adjusted the tariff rates on 6 industries Freezing of tariff rates at 2000 level until 2001
2001	EO 334 (January 2001)	EO 334 adjusted the tariff structure towards a uniform tariff rate of 5 percent by the year 2004
	EO 11 (April 2001)	EO 11 corrected the EO 334 tariff rates imposed on certain products
	EO 84 (March 2002)	EO 84 extended existing tariff rates from January 2002 to 2004 on various agricultural products
	EO 91 (April 2002)	EO 91 modified the tariff rates on imported raw materials, intermediate inputs, and machinery and parts
2003	EO 164 (January 2003)	EO 164 maintained the 2002 tariff rates for 2003 covering a substantial number of products
	EO 241 (October 2003)	EO 241 and EO 264 adjusted tariff rates on finished products and raw materials and intermediate goods, respectively.
	EO 264 (December 203)	

Source: Aldaba (2005).

The second phase of the tariff reform program (TRP II) was launched in 1991. TRP II introduced a new tariff code that further narrowed down the tariff range with the majority of tariff lines falling within the 3 to 30 % tariff range. It also allowed the tariffication of quantitative restrictions for 153 agricultural products and tariff realignment for 48 commodities. With the country's ratification of the World Trade Organization (WTO) in 1994, the government committed to remove import restrictions on sensitive agricultural products except rice, and replace these with high tariffs.

The government initiated another round of tariff reforms (TRP III) in 1995 as a first major step in its plan to adopt a uniform 5 % tariff by 2005. This further narrowed down the tariff range for industrial products to within 3 and 10 % range and reduced the ceiling rate on manufactured goods to 30 % while the floor remained at 3 %. It also created a four-tier tariff structure: 3 % for raw materials and capital equipment which were not locally available, 10 % for raw materials and capital equipment which were locally available, 20 % for intermediate goods, and 30 % for finished goods.

In 1996, Republic Act 8178 legislated the tariffication of quantitative restrictions imposed on agricultural products and the creation of tariff quotas. Tariff quotas imposed a relatively lower duty up to a minimum access level (or in-quota rate) and a higher duty beyond this minimum level (or out-quota rate). This brought down the percentage of regulated items from about 4 % in 1995 to 3 % of the total number of product lines in 1996. By 1997, most quantitative restrictions were lifted, with the important exception of rice.

Executive Order 465 was legislated in January 1998 to further refine the tariff structure and gradually implement the tariff reduction on 23 industries identified as export winners. EO 486, a comprehensive tariff reform package, was signed to modify the rates on product lines not covered by EO 465. However, after 6 months, Executive Order 63 was issued to increase the tariff rates on textiles, garments, petrochemicals, pulp and paper, and pocket lighters. It also froze tariff rates at their 2000 levels. In January 2001, EO 334, which was to constitute TRP IV, was passed to adjust the tariff structure towards a uniform tariff rate of 5 % by the year 2004, except for a few sensitive agricultural and manufactured items. This was never implemented, as a series of executive orders were passed to either postpone or increase tariff rates on selected products. In 2003, a comprehensive tariff review was carried out which culminated in the legislation of Executive Orders 241 and 264. These twin Executive Orders modified the whole tariff structure such that the tariff rates on goods that are not locally produced goods were made as low as possible while the tariff rates on locally produced goods were adjusted upward.

2.2. Structure of Protection: 1998-2004

As discussed in the preceding section, significant progress was made to reduce tariffs and remove import restrictions from the 1980s up to the mid-1990s. It is evident from Table 2 that the overall level of tariff rates is already low. The average tariff rate for all industries is 6.82 % as of 2004. Agriculture has the highest average tariff rate of 11.3 %. Unlike the rest of the sectors where ad valorem tariffs are applied, tariff quotas are used in agriculture. The average for manufacturing is almost the same as the average for all sectors at 6.8 %. Fishing and forestry has an average rate of 6 % while mining and quarrying is the lowest at 2.5 %.

Table 2. Average Tariff Rates: 1998-2004

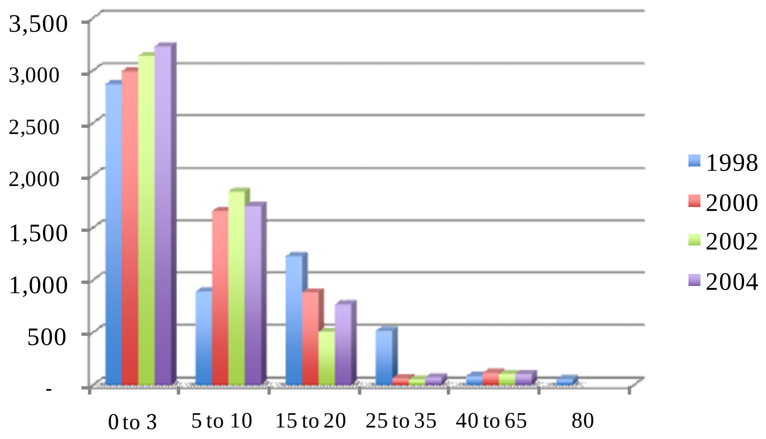
	1998	1999	2000	2001	2002	2003	2004
All Industries	11.32	10.25	8.47	8.28	6.45	6.6	6.82
Coefficient of variation	0.96	0.91	0.99	1.04	1.17	1.06	1.07
% of tariff peaks	2.24	2.24	2.48	2.5	2.69	2.53	2.71
No. of tariff lines	7,366						7,382
Agriculture	15.9	13.2	11.5	12.3	10.4	10.4	11.3
Coefficient of variation	1.07	1.14	1.3	1.23	1.31	1.22	1.17
Fishing & forestry	9.4	8.9	6.7	6.7	5.8	5.7	6
Coefficient of variation	0.63	0.7	0.66	0.62	0.45	0.48	0.57
Mining & quarrying	3.3	3.3	3.1	3.2	2.8	2.7	2.5
Coefficient of variation	0.42	0.41	0.24	0.23	0.38	0.4	0.48
Manufacturing	11.38	10.35	8.5	8.28	6.39	6.57	6.76
Coefficient of variation	0.93	0.88	0.95	1	1.13	1.03	1.03

Table 3 shows the declining weighted average tariff rates by more detailed industry sectors from 1988 to 2004. High tariffs on tobacco and garments were substantially reduced from the highest level of 50% in 1988 to 10 and 15% respectively, in 2004. Other highly protected manufacturing sectors such as leather products, textiles and furniture, also experienced the same. In terms of frequency distribution, Figure 1 shows that in 2004, more than 50% of the total numbers of tariff lines were already clustered in the 0 to 3% tariff range while 29% were in the 5 to 10% range. 13% were in the 15 to 20% tariff range, 1% in the 25 to 35% tariff range, and 2% in the 40 to 65% tariff range. Between 2002 and 2004, the number of lines in the 15 to 20% tariff range fell but those in the 25 to 35% range increased.

Table 3. Weighted Average Tariff Rates

PSIC	Description	1988	1994	1998	2002	2004
01	Growing of Crops	42	38	28	20	21
02	Farming of Animals	25	21	25	20	19
03	Agricultural and Animal Husbandry	30	19	3	3	2
05	Forestry, Logging and Related Activities	21	16	3	3	3
06	Fishing, Aquaculture and Service	35	29	12	7	7
10	Metallic Ore Mining	26	6	3	3	3
11	Non-Metallic Mining and Quarrying	16	11	4	3	3
15	Food Products & Beverages	36	32	29	21	21
16	Tobacco Products	50	50	20	7	10
17	Textile	41	33	16	9	11
18	Wearing Apparel	50	50	25	15	15
19	Leather, Luggage, Handbags and Footwear	46	44	19	8	11
20	Wood, Wood Products & Cork	36	27	15	7	8
21	Paper and Paper Products	33	23	13	6	5
22	Publishing, Printing and Reproduction of Recorded Media	23	18	17	7	6
23	Coke, Refined Petroleum & other Fuel	16	11	4	3	3
24	Chemicals and Chemical Products	27	19	8	4	5
25	Rubber and Plastic Products	37	29	14	8	9
26	Other Non-Metallic Mineral products	37	23	12	5	7
27	Basic Metals	20	16	8	4	4
28	Fabricated Metal Products, Except Machinery and Equipment	31	26	13	7	7
29	Machinery and Equipment, n.e.c.	23	13	5	2	2
31	Electrical Machinery and Apparatus, n.e.c.	31	19	8	4	4
33	Medical, Precision and Optical Instruments, Watches and Clocks	23	18	6	3	3
34	Motor Vehicles, Trailers and Semi-Trailers	34	25	17	12	12
36	Furniture	47	33	21	12	13
37	Manufacturing , n.e.c.	37	26	11	5	6

Figure 1. Frequency Distribution of Tariff Rates



Note, however, that a lower level of tariff rates does not always imply that the tariff schedule is less distorting. The economic and trade distortions associated with the tariff structure depend not only on the size of tariffs but also on the dispersion of these tariffs across all products. In general, the more dispersion in a country's tariff schedule, the greater the distortions caused by tariffs on production and consumption patterns. Common measures of dispersion used are percentage of tariff peaks and coefficient of variation. Tariff peaks are represented by the proportion of products with tariffs exceeding three times the mean tariff, while the coefficient of variation is the ratio of the standard deviation to the mean.

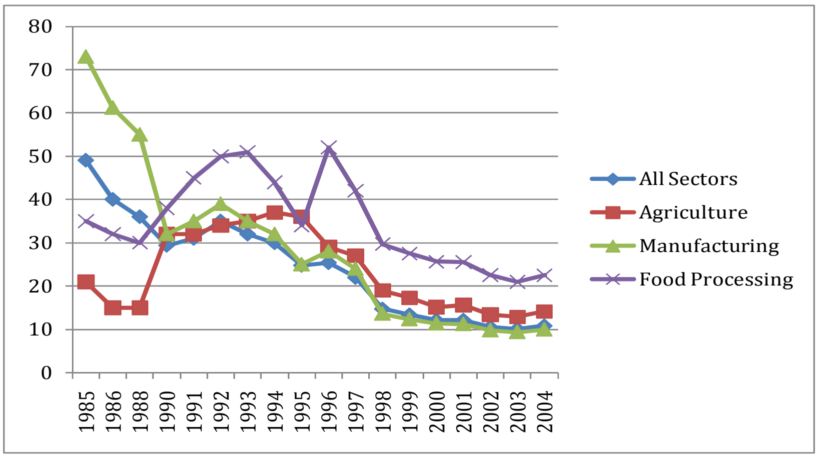
As Table 2 shows, while the average tariff rate for all industries dropped from 11.32 % in 1998 to 6.82 % in 2004, tariff dispersion widened as the coefficient of variation went up from 0.96 to 1.07. The ad valorem tariffs for mining and quarrying as well as those for fishing and forestry show the most uniformity, while those for agriculture and manufacturing exhibit the widest dispersion. Growing of crops (21%) and farming of animals (19%) along with food manufacturing (21%) have the highest average tariffs (see Table 3). The first 2 sectors are inputs to food manufacturing. Meanwhile, electrical and non-electrical machinery have the lowest average tariff rates ranging from 2 to 4%.

Table 2 also indicates an increase in the percentage of tariff peaks (tariffs that are greater than three times the mean tariff) from 2.24 in 1998 to 2.71 in 2004. The sectors with tariff peaks consisted mostly of agricultural products with in- and out- quota rates.

The sectors with tariff peaks consisted of sugarcane, sugar milling and refining, palay, corn, rice and corn milling, vegetables such as onions, garlic, and cabbage, roots and tubers, hog, cattle and other livestock, chicken, other poultry and poultry products, slaughtering and meat packing, coffee roasting and processing, meat and meat processing, canning and preserving fruits and vegetables, manufacture of starch and starch products, manufacture of bakery products excluding noodles, manufacture of animal feeds, miscellaneous food products, manufacture of drugs and medicines, manufacture of chemical products, and manufacture and assembly of motor vehicles.

Compared to tariff rates, effective protection rates (EPRs)[2] provide a more meaningful indicator of the impact of the system of protection. EPRs measure the net protection received by domestic producers from the protection of their outputs and the penalty from the protection of their inputs. Figure 2 shows that average effective protection rates for all sectors declined from 49% in 1985 to 36% in 1988. In 1995, this further dropped to around 25% and to 15% in 1998 and to 10.9% in 2004.

Figure 2. Effective Protection Rates (1985-2004)



Note that while the average effective protection rates for all sectors declined, substantial differences in average protection across sectors still prevail. With the tarification of quantitative restrictions in agricultural products in 1996, a shift in relative protection occurred which resulted in higher protection for the agriculture sector relative

[2] EPRs are rates of protection of value added, are more meaningful than actual tariff rates and implicit tariff rates (representing excess of domestic price of a product over its international price) since it is value added rather than the value of the product that is contributed by the domestic activity being protected.

to the manufacturing industry. Though the two sectors had almost the same EPR in 1993, in succeeding years, the agriculture sector received much higher protection than the manufacturing sector. In 1995, agriculture had an EPR of 36 % while manufacturing had 25 %. This gap was narrowed in 1997 as agriculture EPR dropped to 27 % while manufacturing EPR was 24 %. Within manufacturing, wide disparities in effective protection have also been present. Food processing has remained the most highly protected sub-sector over the last twenty years.

Table 4 presents the average EPR for the years 1998 to 2004. Though the average EPR for all industries is already relatively low, protection continues to be uneven as indicated by the high levels of coefficients of variation, particularly in manufacturing. After falling from 3.68 in 2000 to 2.54 in 2001, it increased to 2.64 in 2004. Among the major economic sectors, agriculture continued to enjoy the highest level of protection from 1998 to 2004. Protection of importable also remained relatively higher than exportable. Manufacturing exportable continued to register negative EPRs indicating that they were penalized by the system of protection.

Table 4. Average Effective Protection Rate

	1998	1999	2000	2001	2002	2003	2004
All Sectors	**14.75**	**13.41**	**12.13**	**12.18**	**10.55**	**10.11**	**10.88**
Importable	25.64	23.45	21.21	21.11	18.82	18.05	19.09
Exportable	3.45	2.99	2.72	2.92	1.98	1.88	2.36
CV	2.82	2.91	3.21	2.19	2.13	2.23	2.27
Agriculture, Fishing, & Forestry	**18.98**	**17.29**	**15.12**	**15.63**	**13.38**	**12.86**	**14.15**
Importable	22.67	20.35	19.01	19.48	17.97	17.26	18.09
Exportable	15.36	14.29	11.31	11.85	8.89	8.55	10.3
CV	0.75	0.71	0.77	0.83	0.88	0.82	0.77
Mining	**2.52**	**2.6**	**2.65**	**2.67**	**2.41**	**2.36**	**2.28**
Importable	3.86	3.8	3.44	3.33	2.77	2.71	2.57
Exportable	2.01	2.15	2.35	2.42	2.28	2.23	2.17
CV	0.79	0.76	0.68	0.66	0.68	0.69	0.69
Manufacturing	**13.61**	**12.34**	**11.37**	**11.23**	**9.79**	**9.36**	**9.96**
Importable	27.3	25.1	22.48	22.17	19.53	18.72	19.87
Exportable	-1.57	-1.81	-0.96	-0.89	-1.02	-1.02	-1.04
CV	3.27	3.4	3.68	2.54	2.45	2.58	2.64

Note: CV or coefficient of variation is the ratio of the standard deviation to the mean.
Source: Manasan, R. & V.Pineda (1999), Aldaba (2005).

Table 5 presents weighted average effective protection rates (EPRs) by more detailed industry sectors. In 2004, the calculated EPRs ranged from negative rates to 35%. Export-oriented sectors such as machinery and equipment (-0.08%), and basic metals (-2%) were penalized by the system of protection as indicated by their negative EPRs (which may be due to tariffs on their inputs being higher than tariffs on the final outputs). The other penalized sectors included wearing apparel; leather; electrical machinery & apparatus, nec; medical precision and optical instruments; and other manufacturing sectors.

Table 5. Average Effective Protection Rates

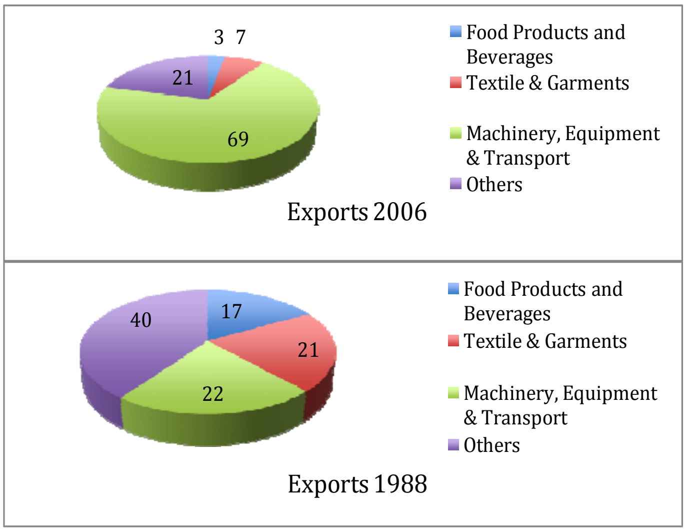
PSIC	Description	1988	1994	1996	1998	2002	2004
01	Growing of Crops	9.58	23.28	26.5	17.82	11.34	12.67
02	Farming of Animals	16.55	12.27	12.63	40.38	35.67	35.11
05	Forestry, Logging and Related Activities	-20.23	11.52	10.89	3.15	2.91	2.65
06	Fishing, Aquaculture and Service Activities Incidental to Fishing	5.24	19.3	4.66	11.11	5.99	6.66
10	Metallic Ore Mining	0.16	-2.19	-1.25	2.16	2.44	2.33
11	Non-Metallic Mining and Quarrying	17.2	14.02	6.16	3.3	2.37	2.19
15	Manufacture of Food Products and Beverages	27.9	37.25	42.37	29.7	22.54	22.49
16	Manufacture of Tobacco Products	61.12	52.68	31	20.02	6.57	11.21
17	Manufacture of Textile	44.24	18.72	11.8	12.07	6.67	7.7
18	Manufacture of Wearing Apparel	0	24.17	14.41	-3.84	-1.8	-2.44
19	Tanning and Dressing of Leather; Manufacture of Luggage, Handbags and Footwear	0.77	22.09	13.19	-0.72	-0.85	-0.47
20	Manufacture of Wood, Wood Products and Cork, Except Furniture; Manufacture of	26.94	17.9	20.02	2.96	0.68	0.91
21	Manufacture of Paper and Paper Products	177.5	24.06	19.63	6.89	2.6	2.57
22	Publishing, Printing and Reproduction of Recorded Media	436.8	19.92	18.52	6.79	2.65	1.71
23	Manufacture of Coke, Refined Petroleum and other Fuel Products	40.4	15.33	4.54	2.04	1.84	1.83
24	Manufacture of Chemicals and Chemical Products	226.58	14.64	9.45	5	2.88	3.45
25	Manufacture of Rubber and Plastic Products	40.08	25.79	19.8	2.87	0.77	0.88
26	Manufacture of Other Non-Metallic Mineral products	48.03	25.72	13.62	14	5.34	7
27	Manufacture of Basic Metals	70.76	11.77	6.18	-2.41	-1.68	-1.72
28	Manufacture of Fabricated Metal Products, Except Machinery and Equipment	71.1	31.87	28.09	8.99	4.2	5.11
29	Manufacture of Machinery and Equipment, n.e.c.	41.88	1.65	2.31	-0.24	-0.14	-0.08
31	Manufacture of Electrical Machinery and Apparatus, n.e.c.	9.6	12.76	7.42	-2.08	-0.54	-0.68
33	Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks	19.96	21.05	15.6	-1.02	-0.55	-0.59
34	Manufacture of Motor Vehicles, Trailers and Semi-Trailers	25.5	26.31	19.6	18.55	15.84	15.7
36	Manufacture and Repair of Furniture	1.3	13.59	13.69	27.99	15.96	16.33
37	Manufacturing , n.e.c.	-58.73	13.45	9.61	-1.23	-0.71	-0.75

In absolute terms, the average EPR for all industries is already low. However, the average figures hide a lot of variations. The country's effective protection has continued to discriminate in favor of some industries and against others, and in favor of sales in the domestic market against sales in other markets. This implies that there is a strong incentive to misallocate resources. There are two elements of bias in the effective protection structure, one is the bias in favor of agriculture and food manufacturing, and two, anti-export bias (artificial incentive to produce for the domestic market) or penalty imposed on exports as they continue to receive negative protection. That these industries have continued to survive suggests that they are economically efficient. This is in contrast to those sectors that have received relatively higher protection but have not exported to any significant extent. To address the problem of exporters being disadvantaged by the system of protection, the government has provided incentive mechanisms such as duty drawbacks, bonded manufacturing warehouses, and export processing zones to allow exporters duty-free importation of inputs.

2.3. Exports and Imports

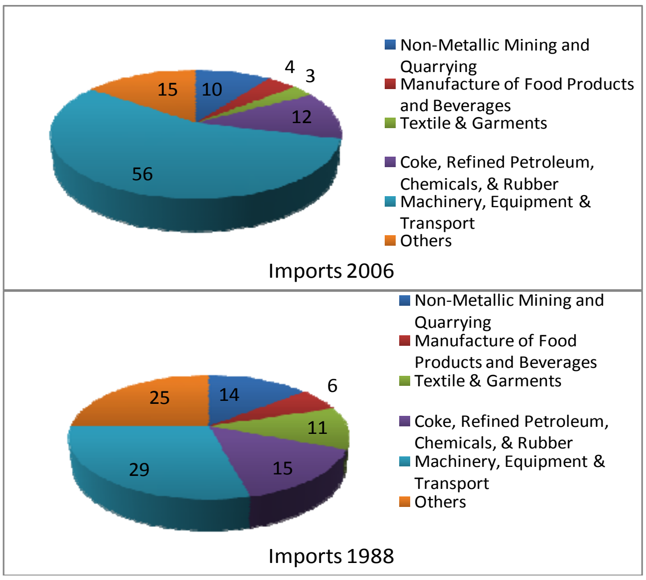
Figures 3A and 3B present the structure of exports and imports by 2-digit level PSIC. In 1988, 60% of our exports consisted of electrical machinery & apparatus, nec (22%), food and beverages (17%), and wearing apparel and textile (21%). Over the years, however, the Philippine export base has become less diversified. In 2006, 69% of the country's exports relied on only 1 sector: machinery equipment & transport. Meanwhile, the shares of traditional exports such as food and beverages along with wearing apparel and textile, declined to 3% and 7%, respectively.

Figure 3A. Merchandise Export Structure 1988 and 2006



In 1988, Philippine imports were composed of machinery equipment & transport which represented the bulk of the total with a share of 29%, chemicals had a share of 15%, while non-metallic mining & quarrying had 14%. Textiles and garments registered a share of 11% and food and beverages had 6%. Following the changes in the country's export structure, in 2006, the share of machinery & transport increased significantly to 56% while non-metallic mining & quarrying share declined to about 10%, chemicals also dropped to 12% and textiles & garments dropped to 3%.

Figure 3B. Merchandise Import Structure 1988 and 2006



Source: Foreign Trade Statistics, National Statistics Office.

2.4. Overall Manufacturing Performance and Structure

Table 6 presents the value added growth rate from the 1980s to the 2000s. The share of the industrial sector to total output decreased from its peak of about 28 % in the 1980s to roughly 26% during the 1990s and the 2000s. Within the industrial sector, the manufacturing sub-sector represents the most important sub-sector, accounting for about 26% of the total output in the 1980s, 25% in the 1990s, and 24% in the 2000s.

Table 6. Average Value Added Growth Rates and Structure

Year	Average Growth Rate			Average Value Added Share		
	1980-89	1990-99	2000-08	1981-89	1990-99	2000-08
Agric, Fishy, &Forestry	1.3	1.5	3.9	**23.5**	**21.6**	**19.3**
Industry Sector	0.9	2.1	4.7	**27.6**	**26.4**	**25.5**
Mining & Quarrying	3	-1.4	11.8	1.7	1.3	1.5
Manufacturing	0.9	2.3	4.3	**25.9**	**25.1**	**24**
Service Sector	2.3	3.7	5.5	**48.9**	**52**	**55.1**
Construction	-1.4	2.9	3.8	7.5	5.6	4.6
Electricity, Gas and Water	5.3	5.3	4.4	2.6	3.1	3.2
Transport, Com'n & Storage	3.7	4.4	8.3	5.3	6	8.2
Trade	3	3.5	5.6	13.9	15.3	16.6
Finance	2.3	5.6	6.9	3.5	4.4	5.2
Real Estate	2.5	2.2	3.7	5.4	5.5	4.7
Private Services	5.5	3.6	6.8	6.3	7	8
Government Services	3.2	3.6	2.6	4.6	5.2	4.6
TOTAL GDP	**1.7**	**2.8**	**5**	**100**	**100**	**100**

Source: National Income Accounts, NSCB.

The share of agriculture, fishery, and forestry has gradually declined from around 24% in the 1980s to 22 % in the 1990s and to 19% in the 2000s. The services sector has been the best performer in all three decades. However, in the most recent period, both agriculture and industry posted average growth of 3.9% and 4.7%, respectively. The services average growth rate increased continuously from 2.3% in the 1980s to 3.7% in the 1990s and 6% in the 2000s.

In terms of employment contribution, the services sector has become the largest provider of employment in the most recent period (Table 7). The share of the labor force employed in the sector consistently increased from around 40% in the 1980s to 47% in the 1990s and to 53 % in 2000-2008. The share of industry to total employment has been almost stagnant from the 1980s to 1990s and dropped to 9.8% in the most recent period. Manufacturing has not generated enough employment to absorb new entrants to the labor force. Its share dropped from 10% during the 1980s-1990s to 9.5% during the years 2000-2008. While the share of agriculture has been declining, the sector has remained an important source of employment.

Table 7. Employment Growth Rate and Structure

Economic Sector	Average Growth Rate			Average Share		
	1981-89	1990-99	2000-08	1980-89	1990-99	2000-08
Agriculture, Fishery and Forestry	**1.2**	**0.7**	**1.8**	**49.6**	**42.8**	**37**
Industry	2.5	1.7	0.7	10.6	10.6	9.8
Mining and Quarrying	5.3	-4.6	8.7	0.7	0.5	0.4
Manufacturing	**2.5**	**2.1**	**0.4**	**9.9**	**10.2**	**9.5**
Services	**4.8**	**4.2**	**3.3**	**39.8**	**46.6**	**53.2**
Electricity, Gas and Water	**5.7**	**5.7**	**-0.9**	**0.4**	**0.4**	**0.4**
Construction	**4.9**	**5.3**	**2.8**	**3.5**	**5**	**5.1**
Wholesale & Retail Trade	6.2	3.8	4.5	12.5	14.6	18.2
Transport, Storage &Com	4.9	6.1	3.1	4.4	5.9	7.4
Finance, Ins, Real Estate & Business Services	3.2	6.2	7.8	1.8	2.2	3.2
Community, Social & Personal Services	4.1	3.6	2	17.1	18.5	18.8
TOTAL EMPLOYED	2.7	2.5	2.5	100	100	100

Source: National Income Accounts, NSCB.

Table 8 compares the levels and trends in the productivity of labor across the different economic sectors from the 1980s to the current period. The results indicate that labor productivity is low, and disparities across the three major sectors are wide. Industry has the highest labor productivity, which declined from the 1980s to the 1990s but with significant improvement in the current period. The average labor productivity in manufacturing declined between the eighties and the nineties, however, an increase is observed in the 2000s as the sector registered an average level of 94,598 pesos.

Table 8. Average Labor Productivity (in Pesos at 1985 Prices)

Economic Sector	1980-89	1990-99	2000-08	1980-89	1990-99	2000-08
Agriculture, Fishery, & Forestry	**15180**	**15940**	**19184**	**0.2**	**0.9**	**2.1**
Industry Sector	**83770**	**78536**	**96595**	**-1.4**	**0.6**	**4**
Mining & Quarrying	82202	92967	149166	3.9	4.9	4.8
Manufacturing	83984	77976	94598	-1.5	0.5	4
Service Sector	**39705**	**35237**	**37848**	**-2.3**	**-0.5**	**2.3**
Electricity, Gas and Water	**230344**	**218604**	**311680**	**2.4**	**0.2**	**6.6**
Construction	**70613**	**35403**	**32580**	**-6.2**	**-1.9**	**1.4**
Trade	35793	33010	33289	-2.8	-0.2	1.4
Transportation, Communication & Storage	38101	32759	40517	-0.8	-1.5	5
Financing, Insurance, Real Estate & Business Services	159772	142512	113441	-0.1	-2.1	-1.6
Community, Social & Personal Services	20222	20731	24414	0.4	0.1	3.2
TOTAL GDP	32100	31524	36654	-1	0.4	2.5

Source: National Income Accounts, NSCB and Labor Force Survey, NSO.

Table 9 shows a more detailed structure of the value manufacturing added. Consumer products such as food manufacturers and beverage industries continue to dominate the sector, although its share dropped from 57 % in the 1980s to 50 % during the 1990s up the current period. The share of intermediate goods such as petroleum and coal products and chemical and chemical products accounted for 31 % in the 1980s. This increased to 35 % in the 1990s but fell to only 27 % in the recent period. The share of textile manufacturers dropped continuously from 4 % to 2 % between the 1980s and 2000s.

Table 9. Average Value Added Structure and Growth

Industry Group	Average Growth Rate			Average Value Added Share		
	1980-89	1990-99	2000-08	1981-89	1990-99	2000-08
Consumer Goods	**0**	**2**	**5**	**57**	**50**	**50**
Food manufactures	-1	2	6	44	36	39
Beverage industries	7	2	4	4	4	4
Tobacco manufactures	1	1	-6	3	3	1
Footwear wearing apparel	6	2	2	5	6	5
Furniture and fixtures	2	2	7	1	1	1
Intermediate Goods	**2**	**2**	**2**	**31**	**35**	**27**
Textile manufactures	0	-5	0	4	3	2
Wood and cork products	-5	-4	-4	2	2	1
Paper and paper products	4	-1	2	1	1	1
Publishing and printing	3	1	0	1	2	1
Leather and leather prod.	-3	5	0	0	0	0
Rubber products	1	-2	0	2	1	1
Chemical & chemical	-1	2	3	7	6	6
Petroleum & coal	6	4	3	12	17	14
Non-metallic mineral	2	2	3	2	3	2
Capital Goods	**2**	**6**	**6**	**10**	**13**	**19**
Basic metal industries	10	-2	13	3	2	2
Metal industries	4	0	7	2	2	2
Machinery ex. electrical	0	6	2	1	1	2
Electrical machinery	7	13	6	3	6	12
Transport equipment	-5	2	5	1	1	1
Miscellaneous manufactures	8	5	7	2	2	3
Total Manufacturing	1	2	4	100	100	100

Source: National Income Accounts, National Statistical Coordination Board.

The share of capital goods increased substantially from 10 % in the 1980s to 19 % in the 2000s. This shift may be attributed to the growing importance of the electrical machinery sub-sector whose share rose from 3 % in the 1980s to 12 % in the 2000s. The share of transport equipment, meanwhile, remained constant at 1 % during the periods under study. In terms of growth, capital goods grew at an average rate of 2 % during the 1980s. In the 1990s and 2000s, it posted an average rate of 6 % in each period. Intermediate goods registered a growth rate of 2 % in each period under study, while consumer goods growth rate increased from 2 % in the 1990s to 5 % in the recent period.

3. Review of Philippine Literature on the Link between Manufacturing Trade and Productivity

The Philippine Institute for Development Studies carried out a number of trade studies examining the impact of trade liberalization on resource allocation (Medalla *et al.*, 1995; Tan, 1997; Pineda, 1997; and Medalla, 1998). The results of these studies are summarized in Medalla (1998). Using effective protection rates (EPR) as trade policy variable and domestic resource costs (DRC) as resource allocation variable, Medalla (1998) concluded that trade reforms have a positive and significant effect on resource allocation. The DRC calculations showed that between 1983 and 1992, the reduction in effective protection rates in the manufacturing industry were accompanied by a substantial reduction in the average domestic resource costs. Moreover, the share of efficient manufacturing firms increased considerably while the share of the inefficient ones declined in terms of both value of output and number of firms. In terms of value added, the share of efficient industry sectors rose while the share of inefficient sectors dropped. These results are clear indications that the previous trade reforms resulted in a more efficient resource allocation as resources moved from inefficient activities towards more efficient ones.

Studies on trade and productivity are few and mostly based on macro level analysis with total factor productivity calculations obtained using the growth accounting framework. These studies focus mainly on the effects of increased trade on productivity. Kajiwara (1994) regressed export growth and TFP growth covering the period 1984-1988. The results showed a negative and highly significant coefficient on the TFP growth rate which indicated that improving productivity does not lead to increases in exports. Kajiwara explained that while trade liberalization made the domestic market more competitive and improved the structural efficiency of the manufacturing industry, the core of manufactured exports remained dominated by consignment manufacturing, a production activity which had very little linkage with the domestic industry.

Urata (1994) examined the impact of trade liberalization and foreign direct investment on productivity in the Philippines as part of a cross-country study including

Korea, Taiwan, Thailand, Malaysia, Indonesia, and India. Using TFP and nominal and effective tariff rates as measures of level of protection, the study found that for five countries, Korea, Thailand, Malaysia, Indonesia, and Philippines; trade liberalization has a positive impact on TFP growth, but the relationship is not always stable or statistically significant.

Austria (1998) and Cororaton and Abdula (1999) looked at the determinants of TFP with exports and imports among the explanatory variables. Cororaton and Abdula used lagged values of imports and exports while Austria used imports and exports as a percentage share of GDP. The results of both papers showed that the coefficient on exports is positive and insignificant; however, the coefficient on imports is negative and highly significant. Cororaton and Abdula explained that the highly significant negative impact of imports on productivity was due to the inappropriateness of the technology adopted by industries and failure to integrate it with the forward and backward linkages of the economy, and to ensure proper use of resources. Meanwhile, Austria pointed out that the country's imports of machinery and transport equipment, which embody the production techniques necessary to increase productivity, account for a small proportion of total imports. Moreover, Austria noted that the lack of manpower skills to operate these machines has led to declining productivity.

Hallward-Driemeier, M. *et al.* (2002) conducted a cross-country study covering the Philippines, Indonesia, Korea, and Thailand to examine the patterns of manufacturing productivity. The study used plant-level data based on a survey conducted in the late 1990s. This covered, for the Philippines, 424 registered firms with at least 20 employees in the food, textile, garment, chemical, and electronic sectors. TFP was derived from a Cobb-Douglas production function based on two specifications, Levinsohn-Petrin and the more conventional OLS procedure. Their results show that exporters are significantly more productive than non-exporters that sell only in the domestic market and the productivity gaps are larger the less developed the domestic market is (Philippines and Indonesia). The results also show that access to world markets leads firms to undertake investments that increase their productivity and these effects are more powerful in economies with product markets that are less well-integrated.

4. Empirical Framework and Data Description

4.1. Methodology

Following Pavcnik (2000), the paper will first estimate total factor productivity using the methodology of Levinsohn and Petrin (2003). Second, the estimated aggregate TFP is decomposed to understand the factors that underlie the changes in TFP growth and examine the importance of the contribution of resource reallocation within industries to productivity growth. Third, the correlation between trade liberalization and productivity is examined in a regression framework by industry trade orientation and by using effective protection rate as a trade proxy. Pavcnik used dummy variables as a measure of trade policy. In the case of the Philippines, applying trade orientation dummy variables might not correctly capture the changes in tariffs and protection since the trade liberalization program was carried out in various stages at an uneven pace across industries from the early 1980s to the 1990s. This is different from Chile's trade liberalization experience that occurred in one big bang from 1974 to 1979 with the adoption of a uniform 10% tariff in 1979. In other studies that measure the impact of trade liberalization on productivity, nominal tariffs are applied. Amiti and Konings (2004) used both input and output tariffs in Indonesia while Topalova (2003) employed nominal tariffs on finished goods in India.

Effective protection rates take into account both the tariff on the firm's output and the tariffs on the inputs that the firm uses. EPRs are important because tariffs vary considerably along the production stage generally exhibiting an escalating structure with inputs having lower protection while final goods receive higher protection. For instance, in 2004, the tariff rate on completely knocked down (CKD) packs was 3%, the average tariff rate on other parts and components was about 5% while the tariff rate on completely built units (CBUs) was 30%. The calculated EPR was around 76%.

In the analysis of the impact of trade liberalization on productivity, a firm-level panel dataset covering an eight-year period from 1996 to 2006 is employed (1999, 2001 and 2004 are missing). As earlier discussed, major tariff reform programs were implemented in 1980, 1991, and 1995. The first major step towards the plan to adopt a uniform 5 % tariff by 2005 started in 1995. In 1996, the government legislated the tariffication of quantitative restrictions imposed on agricultural products and the creation of tariff quotas. Note, that these are inputs to food manufacturing. Further reforms were pursued in 1998, although these were not implemented as the government adopted a policy of selective protection.

Domestic firms are differentiated depending on the trade orientation of their industry sector. Each industry sector is classified into traded or non-traded, based on the sector's import penetration ratio and export intensity ratio calculated from the 2000 Input-Output Table. Appendix 1 contains a complete list of manufacturing sectors by trade orientation. A sector is classified as non-traded if export and import ratios are zero or less than 1%, such as slaughtering and meat packing, ice cream, mineral water, and custom tailoring and dressmaking. A traded sector is categorized into three: purely importable, purely exportable, or mixed.

A purely exportable sector is characterized by zero or minimal imports and substantial exports or an export ratio of at least 10 %. Examples are tobacco leaf flue-curing, articles made of native materials, wood carvings, fish drying, knitted hosiery, crude coconut oil, rattan furniture, and jewelry. A purely importable sector is characterized by minimal exports and significant imports or an import ratio of at least 10 %. This includes meat and meat products, coffee roasting and processing, butter and cheese, animal feeds, starch and starch products and the manufacture and assembly of motor vehicles. A mixed sector has substantial imports and exports such as motor vehicle parts and components, semi-conductors, parts and supplies for radios, tvs, communication appliances and house wares, garments, carpets and rugs, furniture, along with sugar, glass, chemicals, cigarettes, soap and detergents, iron and steel, and drugs and medicines. Notice that a lot of the products under both the mixed and purely importable sectors are also among the tariff peak products (refer to section II.B). Moreover, aside from tariff protection, certain products under these sectors also received additional protection through safeguard measures that are imposed on importation of cement, glass, chemicals, and ceramic tiles.

4.1.1. TFP Estimation

Total factor productivity or TFP, defined as the residual of a Cobb-Douglas production function, is used as the performance measure. To address the simultaneous problem in the input choice when estimating the production function by ordinary least squares (OLS)[3], a semi-parametric estimator with an instrument to control for unobserved productivity shocks is applied. For this instrument, Olley and Pakes (1996) use investment while Levinsohn and Petrin (2003) suggest the use of intermediate inputs. Due to the large number of missing investment observations, the Levinsohn and Petrin approach is applied in the analysis.[4] Given the availability of fuel and electricity data, this variable is employed as a proxy for productivity shocks.

In order to estimate the production function, data on value added (output less cost of materials and energy) and two factors of production, labor and capital, are used. All variables are expressed in logarithmic form. The production function estimated for firm i in industry j at time t is written as:

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \mu_{it} \text{ Equation (1)}$$

where y_{it}: log of output (measured as value added) in year t

k_{it}: log of firm i's capital stock

l_{it}: log of labor input

μ_{it}: error term which is assumed to be additive in two unobservables, ω_{tt} and η_{it}. This can be written as $\mu_{it} = \omega_{it} + \eta_{it}$ where ω_{it} is an efficiency term (or productivity level) known by the firm[5] but not by the econometrician. η_{it} is an unexpected productivity shock with zero mean unobserved by both the firm and the econometrician.

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[3] The problem with this approach was pointed out in Marschak and Andrews (1944). They noted that plants with large positive productivity shock may respond by using more inputs. To the extent that this occurs, OLS estimates of production functions will yield biased estimates and by implication, biased estimates of productivity. The usual solution to this econometric endogeneity is to use an instrumental variables estimator. Olley and Pakes applied semi-parametric econometric methods to solve the endogeneity problem.

[4] The Olley and Pakes methodology can only be applied to firms reporting non-zero investment. This usually leads to a sizeable number of observations that must be dropped from the estimation because they violate the strict monotonicity condition necessary for the validity of the Olley and Pakes procedure. The Levinsohn and Petrin approach avoids this problem.

[5] The fact that ω_{it} is known by the firm when it takes the decision whether to stay in the market and produce, and if deciding to produce, which input combination to use, makes the OLS estimate of the production function biased. The error term is not uncorrelated with the explanatory variables, the key assumption for OLS to produce unbiased estimates. There is not only a simultaneity bias but also a selection bias. The former is due to the fact that unobserved efficiency level is taken into account when the firm decides what input combination and quantities it will produce. The latter is attributed to the fact that the firm chooses whether to stay in the market or exit after it knows its productivity level ω_{it} that is unobservable to the econometrician. (See Schor, 2003).

Using equation (1), a production function is estimated for 11 industry-sectors with the Levinsohn and Petrin methodology. The estimates of firm i's TFP is obtained by subtracting firm i's predicted y from its actual y at time t. To make the estimated TFP comparable across industry-sectors, a productivity index is created. Following Pavcknik (2000), the index is obtained by subtracting a productivity of a reference firm in a base year from an individual firm's productivity measure:

$$prod_{it} = y_{it} - \hat{\beta}_k k_{it} - \hat{\beta}_l l_{it} - (y_\tau - \hat{y}_\tau) \text{ Equation (2)}$$

Where

$$y_\tau = \overline{y}_{it} \text{ and } \hat{y}_\tau = \hat{\beta}_k \overline{k}_{it} + \hat{\beta}_l \overline{l}_{it}$$

The bar over a variable indicates a mean over all firms in a base year. Here, 1996 is used as base year. Hence, y_τ is the mean log output of firms in the base year 1996 and $\hat{y}_\tau$ is the predicted mean log output in 1996. This productivity measure represents a logarithmic deviation of a firm from the mean industry in a base year.

4.1.2. TFP Decomposition

To see whether the reallocation of resources and outputs from less to more efficient firms contributes substantially to productivity gains, aggregate productivity measures are computed for each year and decomposed as follows:

$$\Omega_t = \sum_i s_{it} prod_{it} = \overline{prod}_t + \sum_i (s_{it} - \overline{s})(prod_{it} - \overline{prod}_t) \text{ Equation (3)}$$

The bar over a variable denotes a mean over all firms in a given year. Ω_t is the industry-level productivity and is a weighted average of firm-level productivities, s_{it} is firm i's weight in year t and $prod_{it}$ is the estimate of firm-level productivity.

In the decomposition, the first term represents the part of industry-level productivity growth due to within plant productivity growth. The second term, a covariance term, captures the reallocation effect as output shares are reallocated from less productive to more productive firms. A positive covariance term indicates that more output is produced by the more efficient firms. If trade liberalization induces reallocation of resources within industries from less to more productive firms, the covariance term should be positive and increasing over time.

4.1.3. Trade and Firm-level Productivity Link

To examine the impact of trade liberalization on productivity, the following regression framework is employed:

$$\text{prod}_{it} = \alpha_0 + \alpha_1 \text{trlib} + \alpha_2 z_{it} + \varepsilon_{it} \quad \text{Equation (4)}$$

where *Prod* is the total factor productivity measure for firm i at time t relative to an average firm in firm i's industry in the base year. *Trlib* is trade policy variable proxied by nominal tariff and effective protection rates. Z_{ikt} is a set of firm characteristics including employment as a size measure and firm exit indicator. Time trend, industry indicators, and firm indicators will be included in the regression. To directly explore the relationship between trade liberalization and firm productivity, the firms are pooled based on their trade orientation. A negative sign on *Trlib* is expected indicating that lower protection is associated with higher productivity. This provides evidence that trade liberalization leads to productivity gains among domestic manufacturers differentiated into four groups: purely importable, purely exportable, mixed, and non-traded.

Trade liberalization affects both final and input tariffs. Reducing tariffs on final goods will increase competition forcing firms to trim their fat, reduce agency problems and adopt innovative processes leading to productivity increases. Reducing tariffs on inputs will enable firm's access to high quality intermediate goods and to adopt new production methods leading to efficiency increases. The effective protection rate tries to capture both effects.

Gains from trade liberalization could also arise from reallocation effects with more efficient firms gaining market share and increasing average industry productivity. The coefficient on the exit indicator is thus expected to be negative, indicating that exiting firms have lower productivity than continuing firms.

4.2. Data

The data used in the paper are from the Annual and Census of Establishments of the National Statistics Office. The Census of Manufacturing Establishments is conducted every five years and includes all manufacturing establishments. The Annual Survey is conducted annually and covers a subsample of firms in operation. The establishment or firm refers to an economic unit engaged, under single ownership or control, in one or predominantly one kind of economic activity at a fixed single location. The datasets contain consistent firm level information on revenues, employment, compensation, physical capital, and production costs. Data on exports and foreign capital participation are not consistently reported.

Firms are categorized by industry according to the 5-digit Philippine Standard Industrial Classification (PSIC) of 1994. However, datasets prior to 1998 used the 1977 PSIC. The 1994 PSIC Code introduced new sectors by breaking-up previously aggregated codes. At the same time, it also combined together certain sectors which used to be classified under separate codes in the 1977 PSIC. To match the 1977 and 1994 Philippine Standard Industrial Classification (PSIC) Codes, a common standard coding system was created. The amended 1994 PSIC of the National Statistical Coordination Board was used as a basis in coming up with the harmonized codes.

The panel dataset is created by linking the establishment control numbers (ECNs) or identification codes of firms. However, due to changes in firm ECNs in 1996, datasets prior to this year could not be matched with the data from 1996 onwards. The firm-level panel dataset built covers the period 1996 to 2006, with three missing years in between (1999, 2001, and 2004). The years 2000 and 2006 are both census years while the remaining six years are surveys. The panel dataset is unbalanced and covers all firms with two or more overlapping years during the period 1996-2006. Firms with missing zero or negative values for the variables used to estimate TFP as well as those with duplicates were dropped. Firms with less than 10 workers were also excluded. Firm exit is indicated by firms that are no longer included in the 2006 census as well as those whose 2-digit PSIC codes have changed. Initially, the number of observations totaled 27,818 but after removing observations with missing or negative values as well as duplicates, the total was reduced to 22,500 (see Appendix 2).

The data on economic activity are complemented with annual effective protection rates (EPRs). These used were sourced from Manasan and Pineda (1999) for EPRs covering the 1990s and Aldaba (2005) for EPRs in the more recent period. The calculated EPRs in these papers are all coded based on the Input-Output codes. In determining the trade orientation of industries (traded or non-traded), the 2000 input-output table is used on the basis of sector level exports, import, and total output.

5. Trade Protection and Productivity: What Can Be Learned from Micro Data?

5.1. TFP and TFP Decomposition

The analysis is based on an unbalanced panel dataset covering eight years during the period 1996 to 2006. Table 10 presents the variables and descriptive statistics. Value added by sector was deflated using the gross domestic product (GDP) by industrial origin implicit price index, for capital assets, GDP fixed capital formation index was used, and for fuel and electricity, the wholesale price index for fuel, lubricants and related materials was applied. Table 11 shows the estimates of the coefficients of the production function using the Levinsohn-Petrin method. These input coefficients are then applied to construct a measure of firm productivity. For each year, the aggregate industry productivity measures are calculated. These are then decomposed into two components: (i) within firm productivity and (ii) reallocation of resources and market shares from less to more efficient firms.

Table 10. Descriptive Statistics

Variable	Definition	Obs	Mean	Std. Dev.
Tot workers	Total number of workers	22500	259.4827	627.1911
Capital	Book value of assets	22500	157000000	889000000
Value added	Output –(raw materials+electricity& fuel)	22500	202000000	1260000000
Fuel elect	Fuel and electricity	22500	33100000	1550000000
Epr	Effective protection rate	22500	8.450309	15.97052
Tar	Tariff rate	22500	12.42712	8.913147

Table 11. Estimated Production Functions

Sector	Description	Capital	Labor
1	Food, beverages, tobacco	0.1209807***	0.5496299***
	Standard error	0.0277454	0.0273871
	Number of observations	4754	
2	Textile	0.1213055***	0.75908***
	Standard error	0.0340724	0.038312
	Number of observations	1149	
3	Garments	0.1652882***	0.6739292***
	Standard error	0.0505077	0.0267207
	Number of observations	2215	
4	Leather & leather products	0.3313098***	0.7494902***
	Standard error	0.1181212	0.0578855
	Number of observations	568	
5	Wood, paper products, & publishing	0.1295727***	0.5809723***
	Standard error	0.0394782	0.0346143
	Number of observations	2452	
6	Coke, petroleum, chemicals, rubber & plastic	0.1442959***	0.6266484***
	Standard error	0.0406107	0.0419769
	Number of observations	2794	
7	Non-metallic products	0.1944391***	0.5718431***
	Standard error	0.070396	0.0478595
	Number of observations	1031	
8	Basic metals & fabricated metal	0.1101153**	0.5723843***
	Standard error	0.0496199	0.0415097
	Number of observations	1943	
9	Machinery, equipment & transport	0.1007086***	0.6016929***
	Standard error	0.0292542	0.0220874
	Number of observations	4090	
10	Furniture	0.2238909***	0.6444838***
	Standard error	0.0815305	0.0400102
	Number of observations	844	
11	Other manufactured products	0.0327132	0.7433052***
	Standard error	0.1006939	0.0586069
	Number of observations	660	

Note: * 10% level of significance, **5% level of significance, ***1% level of significance.

Table 12 presents the results of the decomposition in terms of the contribution of unweighted productivity and covariance growth (between output and productivity) to aggregate productivity growth. The unweighted productivity component is a measure of within firm productivity growth while the covariance component measures the reshuffling of resources in favor of more productive firms. The growth figures are normalized and interpreted as growth relative to 1996. From 1996 to 2006, aggregate productivity gains are evident in leather, textile, furniture, other manufacturing, and basic metals and fabricated metal sectors. Leather grew by 9.5%, textile by 2.4%, other manufacturing by 2.9%, furniture by 1.9% and basic metals by 1.3%. In these sectors, growth was driven mainly by growth in the covariance component indicating a reallocation of market shares and resources from the less productive to the more productive firms. In the leather sector, the covariance grew by 17%, 6.3% in other manufacturing areas, 4.6% in textile, 2% in basic and fabricated metal, and 1.7% in furniture. Except for furniture, all the sectors posted negative unweighted mean productivity growth.

Table 12. Aggregate Productivity Growth Decomposition

Code	description	Year	Aggregate productivity	Unweighted productivity	Covariance
1	food, beverages, & tobacco	1996	0	0	0
		1997	0.4456	0.54735	-0.10168
		1998	3.0068	2.59885	0.40802
		2000	-0.8192	0.70045	-1.51967
		2002	-1.8349	0.80495	-2.63986
		2003	-2.2529	1.40055	-3.65345
		2005	-1.3558	-0.11777	-1.23805
		2006	-1.4387	-1.93472	0.49602
2	textile	1996	0	0	0
		1997	1.7962	0.71022	1.08594
		1998	1.011	0.84162	0.16932
		2000	0.9479	0.29292	0.65497
		2002	-0.4619	-0.21031	-0.25165
		2003	1.1993	0.49042	0.7088
		2005	6.0031	-0.71472	6.71781
		2006	2.3518	-2.26561	4.61733

(**Table 12.** ***Continued***)

Code	description	Year	Aggregate productivity	Unweighted productivity	Covariance
3	garments	1996	0	0	0
		1997	1.1206	0.647	0.47361
		1998	2.4573	1.1334	1.32394
		2000	0.5061	0.9195	-0.4134
		2002	0.4899	-1.69075	2.18071
		2003	0.6202	-0.34748	0.96772
		2005	-0.746	-1.9897	1.24373
		2006	-0.9928	-2.5954	1.60258
4	leather	1996	0	0	0
		1997	-1.34725	0.1061	-1.45333
		1998	0.8141	-0.9926	1.80669
		2000	0.634	-2.0482	2.68219
		2002	7.197	-3.1659	10.36288
		2003	12.1027	-4.82032	16.92295
		2005	8.0915	-5.75065	13.8421
		2006	9.5435	-7.69629	17.23975
5	wood, paper, & publishing	1996	0	0	0
		1997	0.6098	-0.18835	0.79821
		1998	0.286	0.6708	-0.3848
		2000	-2.4618	-1.72184	-0.73992
		2002	-1.0602	-1.1114	0.05119
		2003	-3.8456	-0.20203	-3.64358
		2005	-3.6436	-1.32284	-2.32074
		2006	-5.3884	-1.40469	-3.98371
6	coke, petroleum, chemicals & rubber	1996	0	0	0
		1997	-0.611	0.3368	-0.94784
		1998	-2.6792	-0.86638	-1.81286
		2000	2.9396	-0.04676	2.98633
		2002	-6.6506	-0.67928	-5.97139
		2003	4.1851	-1.66832	5.85343
		2005	-1.1094	-2.58193	1.47251
		2006	-4.7642	-2.13054	-2.63366
7	non-metallic products	1996	0	0	0
		1997	0.1131	-0.05724	0.17031
		1998	1.4701	0.5215	0.94862
		2000	-1.1175	0.3424	-1.46001
		2002	-7.3836	-2.00975	-5.37392
		2003	-2.196	1.2883	-3.48432
		2005	0.3894	-0.66352	1.05283
		2006	-0.6473	-2.37125	1.72388

(Table 12. *Continued*)

Code	description	Year	Aggregate productivity	Unweighted productivity	Covariance
8	basic metal & fabricated metal products	1996	0	0	0
		1997	-0.2004	1.32661	-1.52696
		1998	-4.3883	0.24961	-4.63793
		2000	-1.7683	0.17731	-1.94565
		2002	-3.1787	-1.16508	-2.01367
		2003	-2.7001	0.72681	-3.42692
		2005	-4.4682	-0.05965	-4.40855
		2006	1.3205	-0.70002	2.02053
9	machinery & equipment, motor vehicles & other transport	1996	0	0	0
		1997	0.3735	1.05154	-0.67812
		1998	-4.9195	1.36814	-6.28774
		2000	0.9015	0.50724	0.39427
		2002	-2.004	1.88764	-3.89168
		2003	-2.7507	2.97624	-5.72693
		2005	-1.6976	2.07454	-3.77218
		2006	-0.858	0.82884	-1.68693
10	furniture	1996	0	0	0
		1997	1.1589	0.43804	0.7209
		1998	1.6444	0.50134	1.14312
		2000	3.1225	-0.83565	3.95822
		2002	3.4577	0.18164	3.2761
		2003	2.0269	0.81994	1.20695
		2005	2.5903	-0.14386	2.73416
		2006	1.864	0.20054	1.66347
11	Other manufacturing	1996	0	0	0
		1997	-0.1807	-0.34956	0.16884
		1998	3.0145	0.53862	2.47583
		2000	0.2715	-1.56496	1.83647
		2002	1.4867	-1.05729	2.54396
		2003	0.6263	-2.15807	2.78441
		2005	1.1844	-3.02796	4.21237
		2006	2.8653	-3.44865	6.31391
	All manufacturing	1996	0	0	0
		1997	-0.2289	0.52691	-0.75581
		1998	-1.5939	0.94821	-2.54213
		2000	-0.4444	0.04361	-0.48812
		2002	-4.8621	-0.20471	-4.65744
		2003	-1.0019	0.61681	-1.61874
		2005	-2.5331	-0.62714	-1.90597
		2006	-3.3701	-1.47782	-1.89236

(**Table 12. *Continued***)

Code	description	Year	Aggregate productivity	Unweighted productivity	Covariance
	Non-traded (NT)	1996	0	0	0
		1997	1.0615	1.0713	-0.0099
		1998	-2.0268	0.6031	-2.63
		2000	1.7744	1.9616	-0.1872
		2002	1.2714	1.8996	-0.6282
		2003	3.7791	3.1779	0.6012
		2005	12.8997	3.8971	9.0026
		2006	3.9191	0.7626	3.1564
	Purely importable (PM)	1996	0	0	0
		1997	0.9131	0.6038	0.3093
		1998	2.1644	2.3049	-0.1404
		2000	-2.8248	0.0552	-2.8799
		2002	-4.4221	0.65	-5.072
		2003	-1.7409	2.3334	-4.0742
		2005	-1.5688	0.0233	-1.592
		2006	-0.9943	-0.9624	-0.0318
	Purely exportable (PX)	1996	0	0	0
		1997	4.7958	1.0313	3.7645
		1998	12.0972	2.7059	9.3914
		2000	4.2568	0.1134	4.1434
		2002	9.1702	0.0232	9.147
		2003	4.2675	0.0232	4.2443
		2005	3.479	-0.5855	4.0645
		2006	3.7554	-1.2888	5.0442
	Mixed sector (MX)	1996	0	0	0
		1997	-0.4724	0.437	-0.9094
		1998	-2.524	0.7156	-3.2397
		2000	0.0477	-0.0164	0.0641
		2002	-5.3206	-0.3946	-4.9259
		2003	-1.099	0.3881	-1.4871
		2005	-3.0772	-0.8372	-2.24
		2006	-3.9225	-1.5295	-2.3931

Out of the 11 manufacturing sectors, six sectors covering food, beverages, tobacco, garments, wood, paper, and publishing; coke, petroleum, chemicals and rubber; non-metallic products; basic metal and fabricated metal products as well as machinery and equipment, motor vehicles and other transport registered negative productivity growth rates from 1996 to 2006. On the whole, the manufacturing sector's aggregate productivity declined by 3.4% from 1996 to 2006.

The manufacturing sector was divided into four groups: non-traded, purely importable, purely exportable, and mixed. Both the non-traded and purely exportable sectors posted positive growth rates from 1996 to 2006, most of which was contributed by growth in the covariance component. The non traded sector grew by 3.9% during this period, of which 3.2% was due to the reallocation of market share from less efficient to more efficient firms. The purely exportable sector grew by 3.8%, of which 5% was contributed by the reshuffling of market shares towards more efficient firms. The purely importable and mixed sectors declined by 1% and 3.9%, respectively from 1996 to 2006. In both groups, unweighted productivity growth and covariance growth rates were negative.

5.2. Impact of Trade Liberalization on the Different Groups: 1996-2006

To examine the direct effects of trade liberalization on productivity growth in the presence of firm heterogeneity, equation 4 is applied to the non-traded, purely importable, purely exportable and mixed sectors. Evidence points out that the reshuffling of output share and resources among firms with different productivity levels is an important source of trade-induced productivity gains (Melitz 2002). In particular, the productivity of firms exposed to international trade (exporters and import-competing firms) grew much more than that of firms in the non-traded sectors (Epifani 2003). As Chile's experience shows (Pavcnik 2000), the reallocation of resources and market share towards more productive firms is a critical determinant of productivity growth and this can be largely due to trade liberalization.

Melitz (2002) shows that trade can contribute to the Darwinian evolution of industries by forcing the least efficient firms to contract or exit while promoting the growth of the more efficient ones. Exposure to trade will induce only the more productive firms to enter the export market and will simultaneously force the least productive firms to exit, while the less productive firms continue to produce only for the domestic market. The entry of firms in response to the higher relative profits earned by exporters leads to the exit of the least productive domestic firms. Through trade liberalization, additional inter-firm reallocations towards more productive firms occur which can generate industry productivity growth, without necessarily affecting intra-firm efficiency.

Tables 13, 14, and 15 present the results of the regression using pooled OLS, random effects, and fixed effects techniques respectively. Two trade policy proxies are applied, effective protection rate and nominal protection measured by tariff rate on finished goods. Using effective protection rate as trade proxy, Table 13 shows that based on pooled OLS technique, the coefficient on l*nepr* is negative and highly significant for the purely importable, mixed and non-traded sectors. For the purely exportable sector, a significant (at the 5% level) positive sign is obtained. This tends to imply that since exportable are penalized by the protection system, increasing their protection would improve the sector's productivity.

Table 13. Regression Results (Equation 4): OLS Method

	(1)EPR as trade proxy (*lnepr*)				(2)Tariff rate as trade proxy (*lntar*)			
Explanatory Variable	NT	PM	PX	MX	NT	PM	PX	MX
trade proxy	-0.122*** (0.036)	-0.076*** (0.015)	0.065*** (0.028)	-0.057*** (0.009)	-0.036*** (0.010)	-0.024*** (0.003)	0.002 (0.013)	-0.034*** (0.002)
exit indicator	0.004 (0.008)	0.003 (0.007)	-0.001 (0.006)	-0.010*** (0.002)	0.003 (0.008)	0.005 (0.007)	-0.001 (0.006)	-0.010*** (0.002)
lnworkers	0.051*** (0.002)	0.064*** (0.002)	0.041*** (0.002)	0.044*** (0.001)	0.051*** (0.002)	0.064*** (0.002)	0.041*** (0.002)	0.043*** (0.001)
sector indicators	yes	yes	yes	yes	yes	yes	yes	yes
year indicators	yes	yes	yes	yes	yes	yes	yes	yes
firm indicators	no	no	no		no	no	no	no
R-squared	0.4117	0.3787	0.267	0.2887	0.4111	0.3854	0.2648	0.3033
N	1024	2296	1738	17442	1024	2296	1738	17442

Note: Robust standard errors in parentheses. * 10% level, **5% level of significance, ***1% level of significance.

NT: Non-traded, PM: Purely Importable, PX: Purely Exportable, MX: Mixed Sector.

With respect to the *exit indicator*, the coefficient is negative and highly significant only for the mixed sector. For the purely importable and non-traded sectors, the coefficient on *exit* is positive but insignificant. For the purely exportable sector, the coefficient is negative but not statistically significant. The coefficient on *lnworkers* is positive and highly significant for all groups.

Next, equation 4 is tested using the random effects method. In general, the same results are obtained as shown in Table 14. The coefficient on the trade variable, *lnepr*, is negative and highly significant for both purely importable and mixed sectors. It is also negative for the non-traded sector but insignificant. For the purely exportable sector, a positive sign is also obtained but is not statistically significant. The coefficient on the exit variable is negative and highly significant for firms in the mixed sector while the coefficient on *lnworkers* is positive and highly significant for all groups. A test for random effects was performed based on the Breusch and Pagan Lagrangian multiplier test. The result rejected the null hypothesis that random effects are not needed.

Table 14. Regression Results (Equation 4): Random Effects Method

	(1)EPR as trade proxy (*lnepr*)				(2)Tariff rate as trade proxy (*lntar*)			
Explanatory Variable	NT	PM	PX	MX	NT	PM	PX	MX
trade proxy	-0.049 (0.043)	-0.073*** (0.017)	0.037 (0.027)	-0.031*** (0.009)	-0.013 (0.011)	-0.024*** (0.005)	-0.004 (0.012)	-0.022*** (0.002)
exit indicator	0.001 (0.006)	0.006 (0.006)	-0.0005 (0.005)	-0.006*** (0.002)	0.001 (0.006)	0.007 (0.006)	-0.0003 (0.005)	-0.007*** (0.002)
lnworkers	0.046*** (0.003)	0.047*** (0.003)	0.033*** (0.003)	0.036*** (0.001)	0.046*** (0.003)	0.047*** (0.003)	0.033*** (0.003)	0.035*** (0.001)
sector indicators	yes		yes		yes	yes	yes	yes
year indicators	yes		yes		yes	yes	yes	yes
within	0.0721	0.0009	0.0004	0.0026	0.0711	0.0012	0.0002	0.002
between	0.3971	0.4028	0.2956	0.3451	0.3981	0.4007	0.2966	0.362
overall	0.407	0.3728	0.2652	0.2809	0.4064	0.379	0.2631	0.296
N	1024	2296	1738	17442	1024	2296	1738	17442
Breusch-Pagan Test	chi2(1) = 10314.56 Prob > chi2 = 0.0000				chi2(1) = 9850.85 Prob > chi2 = 0.0000			

Note: Robust standard errors in parentheses. * 10% level, **5% level of significance, ***1% level of significance.

NT: Non-traded, PM: Purely Importable, PX: Purely Exportable, MX: Mixed Sector.

Equation 4 is then estimated using the fixed effects method. The results in table 15 show that the coefficient on *lnepr* is negative and significant at the 5% level only for the purely importable sector. For the purely exportable, mixed and non-traded sectors, the coefficients are positive but not statistically significant. The coefficient on the *exit* variable is negative and statistically significant only for the mixed sector. The coefficient on *lnworkers* is positive and highly significant for the mixed and non-traded sectors. For the purely importable sector, the coefficient on *lnworkers* is negative and highly significant indicating that relatively smaller firms are more productive. It also indicates that firms in the purely importable sector are downsizing to improve their efficiency. The Hausman test was applied and the result rejected the null hypothesis that the coefficients estimated by the efficient random effects estimator are the same as the ones estimated by the consistent fixed effects estimator. This justifies the use of the results obtained through the fixed effects method.

Table 15. Regression Results (Equation 4): Fixed Effects Method

	(1)EPR as trade proxy (*lnepr*)				(2)Tariff rate as trade proxy (*lntar*)			
Explanatory Variable	NT	PM	PX	MX	NT	PM	PX	MX
trade proxy	0.059 (0.067)	-0.052** (0.030)	0.036 (0.042)	0.007 (0.014)	0.024 (0.019)	-0.016 (0.010)	0.008 (0.015)	0.003*** (0.004)
exit indicator	0.001 (0.007)	0.007 (0.006)	-0.003 (0.007)	-0.004** (0.002)	0.001 (0.007)	0.008 (0.006)	-0.002 (0.007)	-0.004** (0.002)
lnworkers	0.034*** (0.009)	-0.002 (0.007)	-0.015*** (0.008)	0.005*** (0.002)	0.034*** (0.008)	-0.001 (0.007)	-0.015*** (0.008)	0.005*** (0.002)
sector indicators	yes	yes	yes		yes	yes	yes	yes
year indicators	yes	yes	yes		yes	yes	yes	yes
within	0.0768	0.0186	0.0319	0.0107	0.0786	0.0185	0.0311	0.0108
between	0.3399	0.0034	0.1396	0.0342	0.2956	0.0014	0.1667	0.0317
overall	0.3564	0.0038	0.1555	0.0229	0.3154	0.0016	0.1729	0.021
N	1024	2296	1738	17442	1024	2296	1738	17442
Hausman Test	chi2=788.23 Prob > chi2 = 0.0000				chi2=788.96 Prob > chi2 = 0.0000			

Note: Robust standard errors in parentheses. * 10% level, **5% level of significance, ***1% level of significance.

NT: Non-traded, PM: Purely Importable, PX: Purely Exportable, MX: Mixed Sector.

Using tariff rate as a trade proxy, the results are on the whole the same as those obtained using effective protection rate. In terms of magnitude, the coefficients on *lnepr* are higher than the coefficients on *lntar*. Note that the tariff rates applied above are only for the firm's final output while effective protection rates take into account the tariff rates on both inputs and outputs of the firm.

5.3. Policy Reversal

Amidst an incomplete trade liberalization process, the government adopted a policy of selective protection in 2003. Two pieces of legislation were passed which increased the tariffs on goods that were domestically produced, and reduced those on goods that were not locally manufactured. To examine the impact of the reversal, Equation 4 is estimated by dividing the years into two periods to roughly cover the years before and after the policy reversal. Tables 16 and 17 show the fixed effects results (Appendix 3 contains the results using OLS and random effects methods).

Table 16. Period 1996-2002 Fixed Effects Results

	(1)EPR as trade proxy				(2)Tariff rate as trade proxy			
Explanatory Variable	NT	PM	PX	MX	NT	PM	PX	MX
trade proxy	0.083	-0.044*	0.04	-0.007	0.011	-0.005	-0.016	0.007
	(0.066)	(0.031)	(0.050)	(0.014)	(0.020)	(0.011)	(0.022)	(0.004)
exit indicator	-0.009	0.015*	0.006	-0.002	-0.009	0.015**	0.006	-0.002
	(0.008)	(0.007)	(0.008)	(0.002)	(0.008)	(0.007)	(0.008)	(0.002)
lnworkers	0.016*	-0.003	-0.012	0.008**	0.016*	-0.002	-0.013	0.008**
	(0.012)	(0.010)	(0.012)	(0.004)	(0.012)	(0.010)	(0.012)	(0.004)
sector indicators	no	yes	no	yes	no	yes	no	yes
year indicators	yes	yes	yes	yes	yes	yes	yes	yes
within	0.046	0.037	0.04	0.011	0.041	0.034	0.039	0.012
between	0.261	0.007	0.195	0.047	0.27	0.006	0.22	0.033
overall	0.26	0.008	0.145	0.046	0.281	0.006	0.17	0.034
N	519	1364	912	9660	519	1364	912	9660
Hausman Test	chi2=271.91 Prob > chi2 = 0.0000				chi2=334.18 Prob > chi2 = 0.0000			

Note: Robust standard errors in parentheses. * 10% level, **5% level of significance, ***1% level of significance.

Table 17. Period 2003-2006 Fixed Effects Results

	(1)EPR as trade proxy				(2)Tariff rate as trade proxy			
Explanatory Variable	NT	PM	PX	MX	NT	PM	PX	MX
trade proxy	0.025	0.152	0.092	-0.007	0.021	0.01	-0.004	0.008
	(0.866)	(0.145)	(0.262)	(0.053)	(0.056)	(0.017)	(0.035)	(0.007)
exit indicator	0.003	-0.028	-0.004	-0.0001	0.003	-0.028	-0.004	0.00001
	(0.020)	(0.021)	(0.016)	(0.004)	(0.021)	(0.022)	(0.016)	(0.004)
lnworkers	0.029	-0.020*	-0.024***	-0.010***	0.029	-0.020**	-0.025***	-0.010***
	(0.016)	(0.013)	(0.009)	(0.004)	(0.015)	(0.013)	(0.009)	(0.004)
sector indicators	yes	no	no		yes	no	no	yes
year indicators	yes	yes	yes		yes	yes	yes	yes
within	0.047	0.02	0.025	0.01	0.047	0.018	0.025	0.01
between	0.357	0.209	0.274	0.074	0.313	0.261	0.269	0.088
overall	0.344	0.188	0.234	0.083	0.301	0.25	0.237	0.095
N	505	932	826	7782	505	932	826	7782
Hausman Test	chi2=401.13 Prob > chi2 = 0.0000				chi2=422.08 Prob > chi2 = 0.0000			

Note: Robust standard errors in parentheses. * 10% level, **5% level of significance, ***1% level of significance.
NT: Non-traded, PM: Purely Importable, PX: Purely Exportable, MX: Mixed Sector.

Prior to the policy reversal, the coefficient on *lnepr* is negative and significant at 10% level for the purely importable sector. For the mixed sector, the coefficient on *lnepr* is also negative but not statistically significant. Its coefficient on *lnworkers* is positive and highly significant. After the announcement of the selective protection policy, the coefficient on *lnepr* for the purely importable sector turned positive, but insignificant. For the mixed sector, the coefficient on *lnepr* is still negative and insignificant. The purely importable sector registered positive aggregate productivity growth rates in 1997 and 1998. The sector grew by 2.2% from 1996 to 1998, most of which was due to within productivity growth. For the whole period, the sector's productivity declined by about 1% from 1996 to 2006. For the mixed sector, aggregate productivity declined by around 4% between 1996 and 2006.

It is possible that with the selective protection policy, the early productivity improvements arising from the mid-1990's liberalization were not sustained due to the increase in protection in the early 2000s. As Table 12 shows, the aggregate productivity was positive immediately after 1996 till the late 1990s for food, beverages and tobacco, which grew by 3% from 1996 to 1998.[6] Garments also grew by 2.5% during the same span of years along with wood and metallic products. Petroleum, chemicals and rubber grew by 2.9% from 1996 to 2000, while machinery equipment and transport also grew by 0.9% during the same period. Thereafter, aggregate productivity growth in these sectors turned negative.

With respect to the coefficient on *lnworkers*, this turned negative and highly significant, which might indicate that firms were downsizing to improve their efficiency. For the purely exportable and purely importable sectors, the coefficient on *lnworkers* is also negative and significant at the 1% level for the former and at 10% level for the latter. Meanwhile, the coefficient on *exit* remained insignificant before and after the policy reversal. Note however, that for the purely importable sector, the coefficient on exit was positive and significant at the 10% level during the period 1996-2002 indicating that exiting firms have higher productivity than continuing firms. This might signal an economic distortion in production and misallocation of resources due to the wide differences in protection. In the next period, however, this was no longer significant.

5.4. Summing Up

The results provide some evidence in support of the hypothesis that trade liberalization leads to productivity gains and protection leads to productivity losses. This is confirmed by the negative and significant coefficient on *lnepr* (see Table 15) for the purely importable sector. While the coefficient on *lnepr* is statistically insignificant for the mixed sector, its coefficient on the *exit* indicator is negative and significant at the 5% level. The fourth tariff reform program was designed to further modify tariffs towards a more uniform structure. However, it was never implemented in 2001 and instead, a selective protection policy was adopted. As such, the gains in terms of productivity improvement arising from trade reforms were not as large as expected. The selective protection policy reversed the gains from previous trade liberalization episodes and weakened the whole process of restructuring and reshuffling of resources from less productive to more productive firms as protection of selected industries

[6] The Asian Financial Crisis in 1997-1998 might have led to negative aggregate productivity growth in the early 2000s.

allowed inefficient firms to survive. Hence, from 1996 to 2006, the aggregate productivity growth of the purely importable and mixed sectors dropped by 1% and 3.9%, respectively while the aggregate productivity of the non-traded sector rose by 3.9%.

Based on the fixed effects results, the purely exportable sector's productivity seems to be unaffected by trade reforms. As Table 12 shows, the sector's aggregate productivity grew by 3.8% from 1996 to 2006, 5% of which was due to the reallocation of market shares towards more efficient firms. As discussed earlier, the protection system has continued to impose a penalty on exporters and to address this, the government has allowed exporters to import their raw materials and input tax and duty free through export processing zones and other schemes such as, tax credit, duty drawback and bonded manufacturing warehouse programs. However, not all exporters are able to avail of these schemes which are costly, particularly for small and medium-sized firms. This may possibly explain the lack of significant correlation between the productivity of exporters and trade reforms. Moreover, given the bias of the protection system towards importables and against exportables, the incentive to misallocate resources has remained, and prevented the movement of resources towards exportables.

6. Conclusions and Policy Implications

The more recent empirical literature on trade and productivity shows that in the presence of firm heterogeneity, trade liberalization allows more productive firms to expand while less efficient firms either exit or shrink. With the exit of inefficient firms, resources (labor and capital) will be freed and will move to other industries where they can be used more productively. Trade liberalization drives the process of restructuring and reshuffling of resources within and across sectors of the economy such that unprofitable activities contract while profitable ones expand. In general, more recent studies show that the productivity of firms exposed to international trade, i.e., exporters and import-competing firms, grows much more than that of firms in the non-traded sectors (Epifani 2003).

The results of the paper provide some evidence in support of the hypothesis that trade liberalization leads to productivity gains and conversely, protection leads to productivity losses. This is confirmed by the negative and significant coefficient on *lnepr* for the purely importable sector. For the mixed sector, the coefficient on *lnepr* is also negative but statistically insignificant. With respect to its coefficient on the *exit* indicator, it has the correct negative sign that is significant at the 5% level.

The fourth tariff reform program was designed to further modify tariffs towards a more uniform structure. However, it was never implemented and instead, the government adopted a selective protection policy. Simultaneously, the government resorted to alternative instruments of protection as seen in the growing application of contingent protection measures[7] such as safeguard measures and anti-dumping duties. Tariff Commission reports show that between 2000 and 2006, safeguard measures were granted in cement, ceramic tiles, chemicals, float glass, figured glass, and glass mirrors. As such, the gains in terms of productivity improvement arising from initial trade reforms dissipated. It also weakened the whole process of restructuring and reshuffling of resources from less productive to more productive firms, as the protection of selected industries allowed and prolonged the survival of inefficient firms.

Reversing the policy towards selective protection in midstream was costly in terms of the productivity losses in both the purely importable and mixed sectors. The productivity estimates show that right after the substantial trade reforms carried out till the mid-1990s, there were aggregate productivity gains observed in the purely importable sector as its growth increased by 2.2% from 1996 to 1998. Overall, its aggregate productivity growth declined by 1% from 1996 to 2006. For the mixed sector, aggregate productivity dropped by 3.9% during the same period.

In contrast, the purely exportable sector which was penalized by the protection structure and the non-traded sector were the ones that grew as their aggregate productivity increased by 3.8% and 3.9%, respectively from 1996 to 2006. For the purely exportable sector, 5% of its aggregate productivity growth was due to the reallocation of market shares towards more efficient firms. In the case of the non-traded sector, 3.2% was due to the reallocation effect and 0.8% due to within productivity

[7] These are not included in the calculation of effective protection rates.

growth.

The policy of selective protection has substantially reduced the credibility of trade reforms. Rodrik (1989) points out that the primary need for a government engaged in trade liberalization is to establish and bolster its credibility. Allowing the possibility of providing protection amidst the transition process sends a signal to firms that the government will not commit itself to a given policy reform. This can negatively affect the performance of firms and can lead to so-called time-inconsistency problems. The firms do not adjust because they expect to obtain further protection in the future. When the future comes, it may not be politically optimal for the government not to grant such protection.

The preceding analysis suggests a thorough review of the protection structure. The diverse tariff protection and bias against exports must be corrected to complete the liberalization process. Engaging in tariff reforms that do not reduce the level of dispersion of the tariff structure will convey relatively small benefits. Hence, the government needs to reduce the highest tariffs as there are costs involved in terms of inefficiencies in resource allocation. There is also a need to simplify the tariff structure by limiting the number of tariffs and reducing both tariff levels and their dispersion by adopting a more uniform tariff structure. A uniform tariff policy will address the current distortion in the protection system where intermediate inputs such as sugar, petrochemicals, glass, iron and steel have higher tariffs than their final user products.

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Appendix Tables

Appendix 1. Trade Orientation of Industry Sectors

Purely Importable
Rice and corn milling
Flour, cassava and other grains milling
Coffee roasting and processing
Soft drinks and carbonated water
Newspapers and periodicals
Manufacture of other non-metallic mineral products, n.e.c.
Manufacture of metal containers
Manufacture of ophthalmic goods
Manufacture of stationers', artists' and office supplies
Meat and meat products processing
Butter and cheese manufacturing
Other dairy products
Manufacture of refined coconut oil and vegetable oil
Manufacture of animal feeds
Manufacture of starch and starch products
Tanneries and leather finishing
Manufacture of agricultural machinery and equipment
Manufacture and assembly of motor vehicles
Purely Exportable
Tobacco leaf flue-curing and redrying
Manufacture of articles made of native materials
Commercial and job printing and other allied industries
Manufacture of wood carvings
Fish drying, smoking and manufacturing of other seafood products
Production of crude coconut oil, copra cake and meal
Manufacture of desiccated coconut
Hosiery, underwear and outerwear (knitted)
Manufacture and repair of rattan furniture including upholstery
Manufacture of jewelry and related articles

(Appendix 1. Continued)

Mixed
Manufacture of bakery products except noodles
Noodles manufacturing
Sugar milling and refining
Malt liquors and malt
Cigarette manufacturing
Cigar, chewing and smoking tobacco
Manufacture of carpets and rugs
Cordage, rope, twine and net manufacturing
Embroidery establishments
Manufacture and repair of other furnitures and fixtures, n.e.c.
Manufacture of paper and paperboard containers
Manufacture of soap and detergents
Manufacture of perfumes, cosmetics and other toilet preparations
Manufacture of asphalt, lubricants and miscellaneous products of petroleum and coal
Cement manufacture
Manufacture of structural concrete products
Manufacture of communication and detection equipment
Manufacture of appliances and house wares
Manufacture of primary cells and batteries and electric accumulators
Rebuilding and major alteration of motor vehicles
Milk processing
Fish canning
Other crude vegetable oil, fish and other marine oils and fats (except coconut oil)
Manufacture of cocoa, chocolate and sugar confectionery products
Miscellaneous food products
Alcoholic liquors and wine
Textile, spinning, weaving, texturizing and finishing
Fabric knitting mills
Manufacture of artificial leather and impregnated and coated fabrics
Manufacture of leather footwear and footwear parts
Sawmills and planning of wood
Manufacture of veneer and plywood
Manufacture of wooden and cane containers and small cane wares
Manufacture of pulp, paper and paperboard
Manufacture of articles of paper and paperboard
Printing and publishing of books and pamphlets
Rubber tire and tube manufacturing
Manufacture of other rubber products, n.e.c.
Manufacture of basic industrial chemicals

(Appendix 1. Continued)

Mixed
Manufacture of fertilizers
Manufacture of synthetic resins, plastic materials and other man-made fiber except glass
Manufacture of pesticides, insecticides, etc.
Manufacture of paints, varnishes and lacquers
Manufacture of drugs and medicines
Manufacture of miscellaneous chemical products
Manufacture of plastic furniture, plastic footwear and other fabricated plastic products
Petroleum refineries including LPG
Manufacture of flat glass
Manufacture of glass container
Manufacture of other glass and glass products
Manufacture of structural clay products
Blast furnace and steel making furnace, steel works and rolling mills
Iron and steel foundries
Non-ferrous foundries
Cutlery, hand tools, general hardware
Structural metal products
Manufacture of wire nails
Manufacture of non-electric lighting and heating fixtures
Manufacture of metal and wood-working machinery
Engines and turbines, except for transport equipment and special industrial machinery and equipment
Manufacture of pumps, compressors, blowers and air conditioners
Machine shops and manufacture of non-electrical machinery and equipment, n.e.c.
Radio and TV receiving sets, sound recording and reproducing equipment including records and tapes
Manufacture of motor vehicles parts and accessories
Manufacture, assembly of motorcycles and bicycles
Assembly, rebuilding & major alteration of railroad equipment, aircraft, & animal& hand-drawn vehicle
Manufacture of professional, scientific measuring and controlling equipment
Manufacture of photographic and optical instruments
Manufacture of musical instruments
Manufacture of surgical, dental, medical and orthopedic supplies
Manufacture of toys and dolls except rubber and plastic toys
Canning and preserving of fruits and vegetables
Manufacture of flavoring extracts, mayonnaise and food coloring products
Manufacture of made-up textile goods except wearing apparel
Manufacture of ready-made clothing
Manufacture of other wearing apparel except footwear
Millwork plants
Manufacture of misc wood, cork and cane products

(Appendix 1. Continued)

Mixed
Manufacture and repair of wooden furniture including upholstery
Manufacture of products of leather and leather substitutes except footwear and wearing apparel
Manufacture of rubber footwear
Manufacture of pottery, china and earthen wares
Non-ferrous smelting and refining plants, rolling, drawing and extrusion mills
Manufacture, assembly and repair of office, computing and accounting machines
Manufacture of electrical, industrial machinery and apparatus
Manufacture of parts and supplies for radio, TV and communication
Manufacture of semi- conductor devices
Insulated wires and cables
Manufacture of current-carrying wiring devices, conduits and fittings
Shipyards and boatyards
Manufacture of watches and clocks
Manufacture and repair of furniture and fixtures, made primarily of metal
Manufacture of sporting and athletic goods
Miscellaneous manufacturing
Non-traded
Slaughtering and meat packing
Ice cream, sherbets and other flavored ices
Manufacture of ice, except dry ice
Bottling of Mineral Water
Manufacture of fiber batting, padding, upholstery fillings including coir, linoleum and other hard surfaced floor coverings
Custom tailoring and dressmaking shops
Manufacture of hardboard and particle board
Wood drying and preserving plants
Metal stamping, coating, engraving mills
Manufacture of other fabricated wire and cable products except insulated wire and cable
Manufacture of fabricated metal products except machinery and equipment
Manufacture of electrical lamps, fluorescent tubes and other electrical apparatus and supplies, n.e.c.

Appendix 2. Number of Firms in the Panel

Year	Number of firms per year	Number of firms that exited by 2006
1996	2603	5
1997	2642	826
1998	2627	204
2000	2135	471
2002	2448	857
2003	2207	610
2005	3508	593
2006	4330	--
Total	22500	3566

Appendix 3. Regression Results

Table 3.1. OLS Results: Period 1996-2002

	(1)EPR as trade proxy				(2)Tariff rate as trade proxy			
Explanatory Variable	NT	PM	PX	MX	NT	PM	PX	MX
trade proxy	-0.129***	-0.060***	0.119***	-0.050***	-0.027***	-0.019***	0.056***	-0.033***
	(0.033)	(0.016)	(0.032)	(0.010)	(0.012)	(0.004)	(0.021)	(0.003)
exit indicator	-0.001	0.006	-0.001	-0.010***	-0.001	0.007	-0.002	-0.010***
	(0.009)	(0.008)	(0.008)	(0.003)	(0.010)	(0.008)	(0.009)	(0.003)
lnworkers	0.048***	0.064***	0.039***	0.043***	0.048***	0.064***	0.040***	0.043***
	(0.003)	(0.002)	(0.003)	(0.001)	(0.003)	(0.002)	(0.003)	(0.001)
sector indicators	yes	yes	yes	yes	yes	yes	yes	yes
year indicators	yes	yes	yes	yes	yes	yes	yes	yes
firm indicators	no	no	no		no	no	no	no
R-squared	0.448	0.424	0.28	0.279	0.442	0.426	0.276	0.292
N	519	1364	912	9660	519	1364	912	9660

Note: Robust standard errors in parentheses. * 10% level, **5% level of significance, ***1% level of significance.

Table 3.2. Random Effects Results: Period 1996-2002

	(1)EPR as trade proxy				(2)Tariff rate as trade proxy			
Explanatory Variable	NT	PM	PX	MX	NT	PM	PX	MX
trade proxy	-0.028	-0.065***	0.065**	-0.032***	-0.009	-0.019***	-0.005	-0.020***
	(0.038)	(0.018)	(0.032)	(0.009)	(0.012)	(0.006)	(0.018)	(0.003)
exit indicator	-0.005	0.011*	0.004	-0.005***	-0.005	0.012**	0.004	-0.005***
	(0.007)	(0.006)	(0.007)	(0.002)	(0.007)	(0.006)	(0.007)	(0.002)
lnworkers	0.041***	0.054***	0.035***	0.038***	0.042***	0.054***	0.034***	0.038***
	(0.004)	(0.004)	(0.004)	(0.001)	(0.004)	(0.004)	(0.004)	(0.001)
sector indicators	yes	yes	yes	yes	yes	yes	yes	yes
year indicators	yes	yes	yes	yes	yes	yes	yes	yes
within	0.029	0.004	0.007	0.005	0.029	0.004	0.006	0.004
between	0.439	0.444	0.295	0.31	0.438	0.442	0.289	0.325
overall	0.436	0.42	0.278	0.274	0.434	0.422	0.268	0.286
N	519	1364	912	9660	519	1364	912	9660
Breusch-Pagan Test	chi2(1) = 4551.05 Prob > chi2 = 0.0000				chi2(1) = 4373.08 Prob > chi2 = 0.0000			

Note: Robust standard errors in parentheses. * 10% level, **5% level of significance, ***1% level of significance.

Table 3.3. OLS Results: Period 2003-2006

	(1)EPR as trade proxy				(2)Tariff rate as trade proxy			
Explanatory Variable	NT	PM	PX	MX	NT	PM	PX	MX
trade proxy	-0.11	-0.127***	-0.024	-0.072***	-0.059***	-0.031***	-0.040*	-0.036***
	(0.084)	(0.031)	(0.113)	(0.017)	(0.026)	(0.005)	(0.022)	(0.003)
exit indicator	0.011	-0.004	0.0005	-0.011***	0.01	-0.002	0.002	-0.010***
	(0.013)	(0.015)	(0.009)	(0.003)	(0.013)	(0.015)	(0.009)	(0.003)
lnworkers	0.055***	0.064***	0.044***	0.044***	0.055***	0.065***	0.044***	0.043***
	(0.004)	(0.003)	(0.003)	(0.001)	(0.004)	(0.003)	(0.003)	(0.001)
sector indicators	yes	yes	yes	yes	yes	yes	yes	yes
year indicators	yes	yes	yes	yes	yes	yes	yes	yes
firm indicators	no	no	no		no	no	no	no
R-squared	0.3826	0.3235	0.254	0.3016	0.3871	0.3359	0.2572	0.3162
N	505	932	826	7782	505	932	826	7782

Note: Robust standard errors in parentheses. * 10% level, **5% level of significance, ***1% level of significance

Table 3.4. Random Effects Results: Period 2003-2006

	(1)EPR as trade proxy				(2)Tariff rate as trade proxy			
Explanatory Variable	NT	PM	PX	MX	NT	PM	PX	MX
trade proxy	-0.064	-0.118***	-0.043	-0.060***	-0.039	-0.029***	-0.023	-0.031***
	(0.092)	(0.036)	(0.129)	(0.019)	(0.028)	(0.006)	(0.021)	(0.003)
exit indicator	0.007	0.001	-0.001	-0.006*	0.006	0.001	-0.0001	-0.006*
	(0.012)	(0.013)	(0.009)	(0.003)	(0.012)	(0.013)	(0.009)	(0.003)
lnworkers	0.052***	0.053***	0.039***	0.040***	0.052***	0.053***	0.039***	0.040***
	(0.004)	(0.004)	(0.004)	(0.001)	(0.004)	(0.004)	(0.004)	(0.001)
sector indicators	yes	yes	yes	yes	yes	yes	yes	yes
year indicators	yes	yes	yes	yes	yes	yes	yes	yes
within	0.043	0.006	0.016	0.003	0.042	0.006	0.015	0.003
between	0.408	0.349	0.294	0.347	0.411	0.36	0.298	0.364
overall	0.381	0.32	0.253	0.3	0.385	0.333	0.256	0.315
N	505	932	826	7782	505	932	826	7782
Breusch-Pagan Test	chi2(1) = 1782.12 Prob > chi2 = 0.0000				chi2(1) = 1728.07 Prob > chi2 = 0.0000			

Note: Robust standard errors in parentheses. * 10% level, **5% level of significance, ***1% level of significance.

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CHAPTER 6

Impact of Trade and Investment Liberalization On Productivity in Organized Manufacturing in India

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Over recent years India has witnessed wide-ranging economic reforms in her policies governing international trade and FDI flows. Consequently, both trade and FDI flows have risen dramatically since 1991. Using firm-level panel data this paper finds that significant productivity improvements have taken place in the period since 2000. The paper further explores the important determinants of productivity improvements across a range of different categories. As per the findings of the paper, some of the important determinants of productivity measured by total factor productivity (TFP) include imports of raw materials and capital goods, size of operation, quality of employment captured by wage rates and technology imports measured by royalty payments. It also emerges that R&D in organized manufacturing remains at a nascent stage possibly because of the inadequate emphasis this sphere has been given by the private sector. However, further exploration of this issue is required in order to draw any firm conclusions. Broadly, foreign firms have catered to the Indian domestic market and as a result, India is yet to develop as an export platform. Finally, the import-export linkage is not shown to be significant in the sample of import-dependent firms. However, the paper emphasizes that the issue of productivity gains needs to be kept in a balanced perspective. Towards the end, the paper makes some broad policy suggestions in the realm of regional integration focusing on trade in goods and services, investment cooperation, R&D cooperation and human resource development in order to harness regional sources of demand impulses.

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[1] Senior Fellow, RIS, New Delhi. The author would like to place on record his gratitude to Biswajit Dhar for initiating this work. Special thanks are due to Shujiro Urata, Chin Hee Hahn, Dionisius Narjoko for their useful comments and other participants of the ERIA Workshops for the Microdata Project FY2009, including the discussants of this paper. Useful insights received during discussions with B N Goldar are gratefully acknowledged. Thanks are also due to Pragya and Jagdish for their dedicated research assistance. However, usual disclaimers apply.

1. Introduction

The recent economic growth dynamism of India has placed her amongst the set of 'emerging economies' in the global economic arena. This economic growth which has witnessed a trajectory shift coupled with strides made in per capita GDP has made the Indian economy both a source of demand for goods and services as well as their supplier. This has also engendered a spate of initiatives in the realms of telecommunications, IT and physical infrastructure. Consequently, production, trade and investment activities in various sectors have received an impetus through both domestic and international means. Because of this, the importance of international trade in goods and services and inward and outward foreign direct investment (FDI) have assumed greater importance in the Indian context than ever before.

One of the primary reasons for such a dynamic economic growth paradigm is considered to be economic liberalization which has been achieved through a whole host of economic reforms ushered in, in the domains of domestic industrial policy, trade policy, exchange rate policy and FDI policy, among others. In the past, India pursued a policy of import-substitution that helped to strengthen its extensive industrialization process. However, such a policy had two important side-effects, namely the economy becoming high-cost and inefficient which was characterized by low-quality high-priced products due to a lack of foreign competition. Hence, the necessity of economic reforms was realized. These were reflected in domestic de-licensing measures, simplification of administrative procedures, tariff liberalization, removal of quantitative restrictions, decontrol of the exchange rate regime, increased foreign equity participation in an increasing number of sectors with rationalized entry procedures and removal of performance requirements, to name but a few prominent policy steps. Export- and FDI-orientation with import openness substituted the earlier regime of import substitution and protection vis-à-vis global competition.

The economic effects of these reforms were experienced in the realms of increased exports and imports of goods and invisibles, remittances, and FDI inflows and outflows which together have certainly contributed to the economic growth process. More importantly to be noticed is the growth in the per capita income spread over a large populace enjoying increased purchasing power which is often referred to as the emergence of a new middle class in India. This in turn, has provided a fresh basis for further global integration of the Indian economy whereby other countries became attracted to the Indian market and foreign investors became attracted to the Indian investment arena. India has adopted a cautious approach towards this situation with emphasis on bilateral and regional economic cooperation agreements of varying depths without undermining its basic commitments towards the completion of ongoing WTO negotiations. It also adopted a cautious approach towards capital account convertibility.

While the above have augured well for the economic growth process, it still remains a somewhat debatable issue as to what extent this has resulted in productivity gains in the economy as a whole. More importantly, the evidence with respect to productivity gains has remained a contentious and unresolved issue at the firm level primarily due to a lack of adequate research focus. Furthermore, the firm-level determinants of productivity especially in terms of the role of trade and investment liberalization have remained largely unexplored in the mainstream literature on the subject.

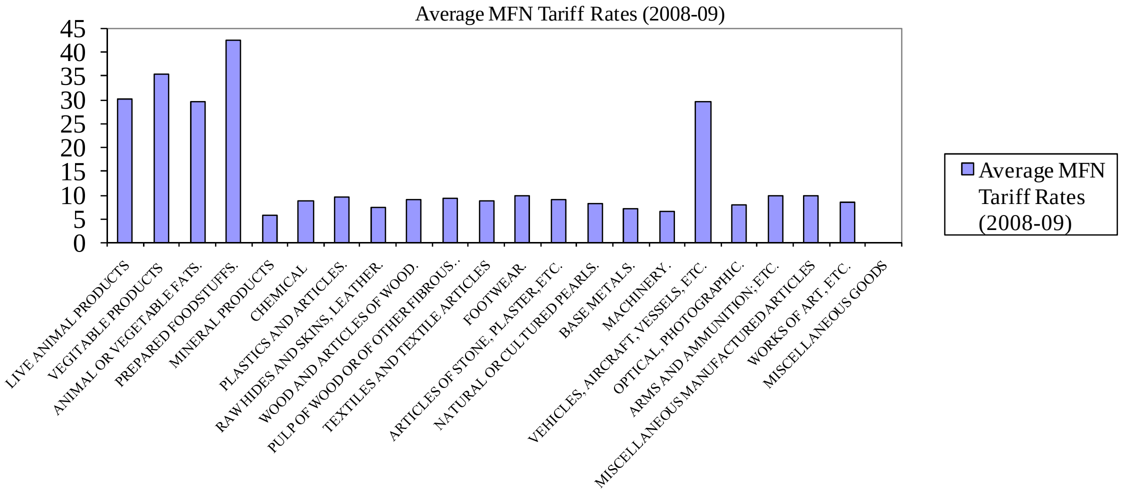
Against this backdrop, Section 2 documents broad macro trends in tariff liberalization, increased trade flows and rising FDI inflows in India, with the latter being indicators of a more liberal policy regime over time. Section 3 presents a brief literature-survey on the subject, including those relating to the Indian context. The analytical framework is presented in Section 4. Section 5 details the methodology and Section 6 presents an analysis of results. In Section 7, the issue of productivity has been placed in a balanced perspective. Finally, Section 8 presents broad conclusions and makes some policy recommendations.

2. Broad Trends: Tariffs, Trade and FDI

In this section, we document some broad macro trends in the Indian economy in terms of tariff liberalization and the associated trade flows, primarily the import flows. Since the FDI regime has also undergone considerable liberalization in India, the broad FDI inflows are additionally highlighted.

As mentioned above, India has undergone massive tariff liberalization, especially since 1991. The current tariff levels are relatively low in most sectors, except in the agriculture and automobile sectors (Chart 1).

Chart 1.



To further elaborate the point made above, an attempt has been made to identify the sectors, as per the standard industry classifications, that have displayed different degrees of tariff liberalization over the period 1990-2008, and are classified in three categories (Table 1) of high, medium and low tariff liberalization.

Table 1. Level and Extent of Sectoral Tariff Liberalization in India (1990-2008)

NIC98	Description
High Liberalisation	
142	Mining and quarrying n.e.c.
369	Manufacturing n.e.c.
173	Knitted and crocheted fabrics and articles
182	Dressing, dyeing of fur and articles of fur
131	Mining of Iron Ores
323	Sound or video recording, associated goods
132	Non-ferrous metal ores mining, except uranium, tho
243	Man-made fibers
313	Electricity distribution and control apparatus
319	Other electrical equipment n.e.c.

(Table 1. Continued)

271	Basic Iron & Steel
292	Special purpose machinery
241	Basic chemicals
353	Aircraft and spacecraft
	Medium Liberalisation
181	Wearing apparel, except fur apparel
333	Watches and clocks
315	Electric lamps and lighting equipment
332	Optical instruments, photographic equipment
272	Basic precious and non-ferrous metals
192	Footwear
314	Accumulators, primary cells, primary batteries
361	Furniture
251	Rubber products
331	Medical appliances except optical instruments
293	Domestic appliances, n.e.c.
141	Quarrying of stone, sand and clay
261	Glass and glass products
291	General purpose machinery
252	Plastic products
172	Other textiles
242	Other chemical products
342	Coach work for motor vehicles, trailers, semi-trail
101	Mining and agglomeration of hard coal
231	Coke oven products
311	Electric motors, generators and transformers
289	Other fabricated metal products
269	Non-metallic mineral products n.e.c.
222	Printing and printing services
191	Tanning of leather, leather products
201	Saw milling and planning of wood
202	Wood, cork, straw and plaiting materials
312	Electricity distribution and control apparatus
281	Structural metal products, steam generators, etc
359	Transport equipment n.e.c.
210	Paper and paper product
343	Parts, accessories for motor vehicles and their en
351	Building and repair of ships & boats
171	Spinning, weaving and finishing of textiles.
103	Extraction of agglomeration of peat
221	Publishing

(Table 1. Continued)

352	Railway, tramway locomotives and rolling stock
Low Liberalisation	
341	Motor Vehicles
50	Fishing, operation of fish hatcheries
155	Beverages
154	Other food products
153	Grain products, prepared animal feeds, etc.
152	Dairy Product

The exact basis for this categorization is presented in Table 2 which presents a dynamic overview of import-weighted tariff liberalization in different industrial sectors. Between 1990 and 2008, most of the sectors experienced a gradual decline in tariff levels, indicating that liberalization has been wide-ranging over time.

Table 2. India's Industry-wise Import Weighted Tariff (1990-2008)

NIC98	Description	1990	1992	1997	1999	2001	2004	2005	2007	2008
152	Dairy Product	55.3	60	24.2	16.7	35.3	34.4	32.9	34.6	29
153	Grain products, prepared animal feeds, etc.	58.1	37.2	23.5	32	35	30	32.2	32.9	28.8
154	Other food products	92.8	67.1	27.7	41.3	46.3	80.5	83.4	55.8	40.1
155	Beverages	329.5	326.8	96.9	142	154	56.4	62.1	103.4	133.7
171	Spinning, weaving and finishing of textiles.	54.8	35.9	32	33.3	29.1	27.2	17.5	15.2	13.3
172	Other textiles	90.7	58.6	40	40	28.4	26.2	15	12.5	10.4
173	Knitted and crocheted fabrics and articles	100	65	40	40	30.1	29.5	15	12.5	4.6
181	Wearing apparel, except fur apparel	100	65	40	40	34.7	30	15	12.5	9.3

(Table 2. Continued)

182	Dressing, dyeing of fur and articles of fur	100	35.6	20.2	26.1	13.2	15.4	13.2	12.5	4.6
191	Tanning of leather, leather products	60.4	60.1	0.8	25.5	25.5	25.4	15	12.5	10
192	Footwear	100	65	40	40	35	30	15	12.5	10
201	Saw milling and planing of wood	60	60	28.7	17.2	25.6	25.2	14.7	12.5	10
202	Wood, cork, straw and plaiting materials	58.7	60	30	37.6	35	30	15	12.5	10
210	Paper and paper product	34.6	45.9	12.4	20.5	19	17.2	12.7	10.9	7.4
221	Publishing	33.6	21.9	32.2	35.4	31.5	16.5	5.2	12.4	8.9
222	Printing and printing services	59.6	20.6	22	26.1	26.6	25.8	15	12.5	9.2
231	Coke oven products	40	1.3	10	15	15	15	15	12.5	5
241	Basic chemicals	75.9	60.7	25.1	28.3	29.9	25.6	14.2	11.8	6.4
242	Other chemical products	76.9	57.6	30.1	33.4	32.3	28.6	14.9	12.3	9
243	Man-made fibers	100	61.5	29.6	35.1	20	20	15	12.5	6.3
251	Rubber products	93.7	62	39.7	40	34.7	29.8	14.8	12.4	9.8
252	Plastic products	87.8	65	29.8	34.8	34.8	29.9	15	12.5	10
261	Glass and glass products	87.7	63.8	39.9	39.9	34.3	29.8	15	12.5	9.8
269	Non-metallic mineral products n.e.c.	58.3	58.8	35.1	33.3	32	28.4	15	12.5	8.5
271	Basic Iron & Steel	79.8	62.6	29.4	34.3	34.5	37.7	19.3	18	6.2

(Table 2. Continued)

272	Basic precious and non-ferrous metals	84.6	61.1	36.7	38.9	34	29	15	12.5	8.4
281	Structural metal products, steam generators, etc	48.4	54.1	28.4	32.4	32	26.8	15	12.5	9.1
289	Other fabricated metal products	77.7	58.5	28.8	30.9	34.7	29.3	15	12.5	10
291	General purpose machinery	66.7	47.7	20.8	25.6	27.9	26.4	15	12.5	7.5
292	Special purpose machinery	76.8	45.9	20.3	25.7	25.8	25.4	15	10.8	6
293	Domestic appliances, n.e.c.	87.3	45.3	36.1	36.3	32.6	28.8	15	12.5	9.5
311	Electric motors, generators and transformers	55.9	34.7	20.3	25	25.1	25	15	12.5	7
312	Electricity distribution and control apparatus	35	49.9	30	34.5	34.4	29.6	15	12.5	6
313	Electricity distribution and control apparatus	100	65	40	38.9	23.4	28.8	14.2	12.1	6.7
314	Accumulators, primary cells, primary batteries	100	65	39.6	39.9	35	30	15	12.5	10
315	Electric lamps and lighting equipment	100	64.8	40	40	35	30	15	12.5	9.8
319	Other electrical equipment n.e.c.	93.2	54.9	27.1	31.4	30.7	27.8	14.8	12.3	6.6

(Table 2. Continued)

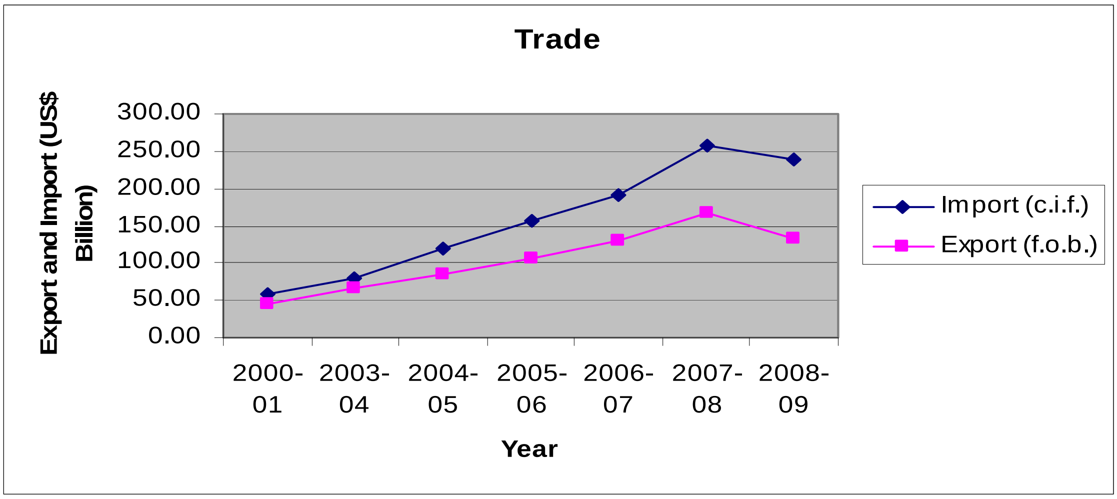
323	Sound or video recording, associated goods	100	65	26.1	31.4	29.3	27.5	15	5.9	5.2
331	Medical appliances except optical instruments	56.6	56.8	20.7	25.3	23.4	22.9	12.6	10.4	6.1
332	Optical instruments, photographic equipment	76.2	57	35.2	36.1	31.8	27.3	14.3	11.8	7.5
333	Watches and clocks	100	65	29.8	30.1	30.2	28.8	15	12.5	9.6
341	Motor Vehicles	114.7	63.3	38.7	38.1	51	60.9	49.3	39.8	37
342	Coach work for motor vehicles, trailers, semi-trailers	82.8	58.3	40	40	35	30	15	12.5	10
343	Parts, accessories for motor vehicles and their en	44.2	65	35.3	38.4	35	30	15	12.5	9.6
351	Building and repair of ships & boats	37.7	40	3.9	40	28.2	28.2	15	12.5	8.7
352	Railway, tramway locomotives and rolling stock	34.9	40	25.1	27.5	28.6	26.1	15	12.5	10
353	Aircraft and spacecraft	36.3	42.6	1.9	11.4	8.4	5.1	3.6	3.8	3.2
359	Transport equipment n.e.c.	94.3	64.4	40	40	36.3	32	16.4	16.1	17.8
361	Furniture	100	65	40	40	35	30	15	12.5	10
369	Manufacturing n.e.c.	135.3	36	37.9	38.9	34.7	29.9	15	12.5	2.8

Source: RIS based on World Bank, TRAINS-WITS and Government of India, Annual Survey of Industries, various issues.

Note: Indian industry classification NIC-98 is similar to that of ISIC-Rev. 3.

Tariff liberalization, almost across the board in the industrial sector, has been associated with increased import flows, with a greater rise in imports than exports (Chart 2). Given a certain level of import intensity of exports and taking into account the fact that the availability of competitively-priced raw material, intermediate and capital goods imports in the international market would have made final products more competitive might have, to an extent, resulted in an increase in exports as well. This chart tracks trends in merchandise trade. It suggests a steady trend between 2000 and 2008 except for a marginal decline in 2009 possibly due to the global economic meltdown.

Chart 2.

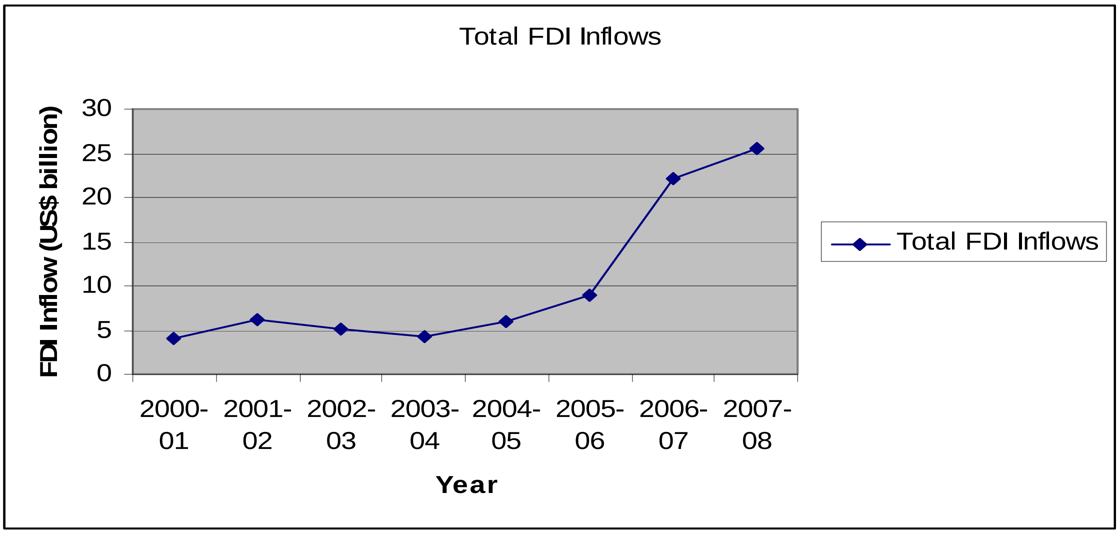


Source: Economic Survey 2008-2009.

As evident from Chart 3, FDI inflows have also increased in recent times, of which liberalization of the FDI policy regime has been one of the major determinants. The rise in FDI has been especially steep since 2005.

Given the above broad macro trends relating to trade and FDI policy liberalization and their possible impact on increased trade and FDI flows, it is important to examine their implications for productivity gains, if any, especially at the micro level – a dimension often omitted from the macro analysis, sometimes due to data limitations. In so doing, we first present a brief survey of literature relating to these linkages.

Chart 3.



3. Literature Survey

One of the broad definitions of productivity includes efficient use of resources, technological progress, and efficient management. Productivity is a crucial factor required for sustainable economic growth. Even without an increase in the use of inputs such as labor, capital, or intermediate inputs, production and thus the economy will grow if there are increases in productivity (Urata, 1994).

One of the channels through which trade is linked to productivity improvements is when a market finds a conglomeration of both efficient and inefficient firms, but only the efficient ones, empowered by total factor productivity, venture into export markets. However, Melitz (2003) argues that the reallocation of productive factors may generate aggregate productive gains and this may not ensure improvement in production efficiency at the individual firm level. Kawai (1994) explores the relationship between trade liberalization and productivity. He concludes that first of all, not only capital accumulation but also productivity changes are important factors in explaining the diversity of growth patterns among developing countries. Second, differences in trade policy are an important factor in explaining the disparities in growth rates of developing countries. Third, trade policy can work positively or negatively on productivity through several routes.

To examine how trade liberalization affects firm and industry-level productivity, as well as social welfare, Long *et al.* (2007) develop an oligopolistic model of international trade with heterogeneous firms and endogenous R&D. Four effects of trade liberalization on productivity are categorized: (i) a direct effect through changes in R&D investment; (ii) a scale effect due to changes in firm size; (iii) a selection effect due to inefficient firms leaving the market; and (iv)a market-share reallocation effect as efficient firms expand and inefficient firms reduce their output. Among the robust results that hold for any market structure is that trade liberalization (i) increases (decreases) aggregate R&D for low (high) trade costs; (ii) increases expected firm size if trade costs are high; and (iii) raises expected social welfare if trade costs are low.

Does trade liberalization increase aggregate productivity through reallocation toward more productive firms or through productivity increases at individual firms is a question asked by Gibson (2006). Using a trade model with heterogeneous firms, it argues that aggregate productivity gains come from firm-level productivity increases. The paper considers how trade liberalization affects technology adoption by individual firms. If technological improvements are not costly - for example, if they occur through dynamic spillover effects - then trade liberalization has the potential to generate large increases in productivity.

In a sector-specific study, Ruan and Gopinath (2008) test the hypothesis that an industry's average productivity increases with liberalized trade in the context of the processed food industry. They find that countries with faster productivity growth than the global average benefit from trade liberalization by acquiring a larger share of global markets and resources.

Pavcnik (2000) empirically investigates the effects of trade liberalization on plant productivity in the case of Chile and finds evidence of within-plant-productivity improvements that can be attributed to a liberalized trade policy, especially for the plants in the import-competing sector. In many cases, aggregate productivity improvements stem from the reshuffling of resources and output from less to more efficient producers. Das (2002) explores the relationship between trade liberalization and industrial productivity in developing countries, drawing upon a large number of studies in Latin America, Africa and Asia, finding a somewhat ambiguous nature of the trade liberalization-productivity linkage. Ferreira and Rossi (2003) show that trade liberalization in Brazil has yielded positive effects for productivity growth. It has been shown in empirical studies that tariff liberalization alone has yielded a 6% hike in total-factor productivity.

Amiti and Konings (2005) estimate the effects of trade liberalization on plant productivity. They distinguish between productivity gains arising from lower tariffs on final goods relative to those on intermediate inputs. Lower output tariffs can produce productivity gains by inducing tougher import competition whereas cheaper imported inputs can raise productivity via learning, variety or quality effects. Using the Indonesian manufacturing census data from 1991 to 2001, which includes plant-level information on imported inputs, their results show that the largest gains arise from reducing input tariffs.

Thus, theory and much empirical evidence suggest that increased openness should lead to increases in productivity. These increases occur on both the export and import side and are driven by technology transfer and increases in competition, resulting in the exit of inefficient firms and sectors, the growth of firm-level productivity, and an increasing share of more productive firms in the market. However, the evidence in the case of Morocco by Augier *et al.* (2009) indicates that productivity growth over 1990-2002 for key manufacturing sectors has been minimal despite liberalization. They conclude that while the mechanisms driving trade and productivity linkages and 'creative destruction' are well documented, results reinforce the need to understand more fully the circumstances under which they may or may not arise.

Turning towards the Indian experience of productivity gains, the results are rather mixed and somewhat incomplete as far as firm-level insights are concerned.

Different studies have found a positive relationship between trade liberalization and total-factor productivity during the 1980s and 1990s. These include studies by Goldar (1986), Ahluwalia (1991), and Chand and Sen (2002) for the 1980s. Fujita (1994) concludes in the case of India that the liberalization policies improved the productivity of the manufacturing industries and extends the analysis further by concluding that the improvement in productivity led to the expansion of the export of manufactured products. In addition, he showed that the improvement in productivity involved mainly labor-intensive industries. Golder *et al.* (2004) show that domestically-owned firms tended to catch up with foreign-owned firms in terms of technical efficiency after the reforms were put in place.

Using a panel of firm-level data, Topalova (2004) examines the effects of India's trade reforms in the early 1990s on firm productivity in the manufacturing sector, focusing on the interaction between policy shock and firm characteristics. The paper tries to establish a causal link between variations in inter-industry and inter-temporal tariffs and consistently estimated firm productivity. It finds that reductions in trade protectionism lead to both higher levels and growth of firm productivity. In contrast, there are studies that have found that trade liberalization in India has not resulted in productivity gains (Srivastava, 2001, Balakrishnan *et al.,* 2000, Driffield and Kambhampati, 2003 and Das, 2003).

There have been relatively a few studies focusing on linking TFP and other forms of productivity gains with FDI inflows. Among the group of advanced OECD members, FDI is found to be strongly associated with higher growth (in terms of output and productivity) in various sectors. However, among the group of developing economies, low-skilled and resource - intensive industries are the ones in which a positive link between FDI and growth is observed (Castejón and Woerz, 2005). However, Hale and Long (2007) surveyed the existing literature on the productivity spillovers of FDI presence in China and suggested that many of the empirical estimates of productivity spillover from FDI to domestic firms in China contain an upwards bias. Bijsterbosch and Kolasa (2009) conclude that foreign capital, in the form of FDI inflows, plays an important role in accounting for productivity growth in the Central and Eastern European regions. Veeramani and Goldar (2004) find a direct link between investment climate and TFP, i.e. Indian states perceived as having a better investment climate are the ones showing higher TFP levels, with only one state out of the 25 states sampled not fitting this trend.

The above-mentioned literature survey reveals that there is tremendous scope to further explore the issues of trade and investment liberalization in India and fill some of the important gaps in the existing literature, especially in the context of their implications for productivity improvements or a lack thereof t at the firm-level. Further, evidence is sparse in terms of the Indian experience at the firm-level relating to the determinants of TFP gains. This paper attempts at doing some value addition to the existing knowledge on the subject inasmuch as, at the policy level, it tries to combine trade and investment liberalization. The period of analysis covered in the paper is also different as it covers a much more recent period of trade and investment liberalization i.e., 2000-2008. It also explores the issue of determinants of TFP gains at firm level in the context of a liberalized trade and FDI regime. At the conceptual level while the paper first attempts to extend the analytical framework to include both trade and investment liberalization and their implications for productivity, it further examines the evidence of productivity improvements from a fresh perspective. Some of the variables that have been included in the analysis as well as the estimations are also new. The estimation is also carried out in terms of several analytical categories as explained in the subsequent section.

4. Analytical Framework

Trade and FDI openness have the potential to infuse foreign competition into the domestic economy, especially in a country such as India which followed a protectionist policy in general and an import substitution policy in particular. The competitive pressures thus exerted have forced domestic producers to become more efficient and productive, manifested in increased availability of lower-priced and higher-quality products. These in turn help the economy to become more export-oriented as well. As mentioned earlier, inefficient firms are forced to exit, whereas newer firms enter the production arena in a liberalized trade and FDI policy environment.

Trade liberalization enables firms to use high-quality parts, components, and machinery at lower prices resulting in improved productivity. Liberalization of FDI contributes positively to the recipient countries, as multinational enterprises (MNEs) bring in not only technologies and management know-how, but also financial resources to be used for fixed investment. All of these resources, which are in short supply in the recipient countries, contribute to improvements in productivity which leads to an increase in production and exports, as it tends to enhance competitiveness. In the second round, increased production enables firms to reap benefits from economies of scale. On the other hand, with increased foreign exchange earnings from increased exports, firms' capability to import high-quality components and equipment also rises, resulting in turn in higher productivity (Urata, 1994).

In addition, firm-level productivity is jointly determined by the trade, FDI and technology regimes, among other factors. The size of the firm could be another important determinant of firm-productivity. Larger firms usually have more options than smaller ones with regard to choices of technology, products and markets. Larger firms may also be better positioned to enter into joint ventures with MNEs (Siddharthan, 2003). Ownership by a foreign firm is yet another factor that could help firms to push productivity frontier favorably due to their well-known inherent advantages. Firms also import technology against royalty and lump sum payments to improve productivity and this could be another determinant of productivity. Import of capital goods is yet another dimension that is crucial for a firm’s productivity. With import liberalization, including those of capital goods in the Indian case, this factor assumes greater importance for raising firms’ productivity. One of the important constraints on growth and hence productivity is the demand constraint. Firms that are export-oriented are able to overcome this constraint.

Given the above, we have taken four scenarios for analysis of firm-productivity (captured by TFP) comprising trade and investment liberalization at the aggregate level including all firms; comparing foreign and domestic-owned firms; export-oriented and domestic-market-oriented firms; import-dependent and domestic-market-dependent firms, in order to bring out similarities and differences among various analytical categories. This was considered crucial since a comparison of this kind would also have important policy implications.

4.1. Firm-level Panel Data Estimation

4.1.1. Trade and Investment Liberalization: Aggregate

The firm-level panel data estimation for the determinants of TFP was carried out by capturing trade and FDI liberalization simultaneously with the help of the following specification:

$$TFP = \alpha + \beta_1 IMP + \beta_2 L + \beta_3 R\&D + \beta_4 Size + \beta_5 XI + \beta_6 Cap + \beta_7 R + \beta_8 Exp + \beta_9 COR + \beta_{10} MNE + \beta_{11} I\text{-}CG + \beta_{12} I\text{-}FG + \mu$$

where *TFP* is total factor productivity, *IMP* is import penetration ratio, *L* is labor, *R&D* is research and development, *Size* is the size of the firm, *XI* is export incentives, *Cap* is capacity building, *R* is royalty and technical fee payments made abroad, *Exp* is exports, *COR* is capital-output ratio, *MNE* is foreign ownership, *I-CG* is imports of capital goods and *I-FG* is imports of final goods.

4.1.2. Foreign-owned vs. Domestic Firms

The above will also be tested in terms of foreign and domestic ownership of firms, in an attempt to observe their behavioral differences. The hypothesis is that foreign-owned firms are more productive due their inherently stronger capacities on various fronts such as technological-edge, managerial expertise, skills, etc. This categorization also helps to isolate the effects of FDI policy liberalization. For our purposes, a firm having equity greater than 51 percent has been categorized as a foreign firm.

4.1.3. Export-oriented vs. Domestic-market-oriented Firms

The scenarios will be tested separately for export-oriented and domestic market –oriented firms with the hypothesis that export-oriented firms may be more productive due to the pressures of global competition. For the domestic-oriented firms, X-Sales Ratio will be taken as zero.

4.1.4. Import-dependent vs. Import-independent Firms

The effects of import tariff liberalization would best be captured by conducting analysis separately for import-dependent firms as compared with import-independent firms. The import dependent firms will be those with an import penetration ratio greater than 0.65.

5. Empirical Strategy

In an improvement over earlier studies on TFP, consistent estimates of the parameters of the industry-level production functions in constructing firm-level productivity measures, using the methodology of Levinsohn and Petrin (2003) were obtained in a similar way to Topalova (2004). The details are presented in the Technical Appendix to this paper.

5.1. Measurement of Variables:

While the dependent variable was used as the estimated TFP, the independent variables included: Size is measured as the number of employees of a company; L is labor measured as wage-rate, thus capturing quality of employment; IMP is the import penetration ratio measured as Import of raw material/(Output + Total Imports) I-CG is imports of capital goods as a ratio of sales; I-FG is imports of final goods as a ratio of sales; XI is export incentives; R&D – R&D ratio of sales, R is royalty and technical fee payments made abroad as a ratio of sales; Cap – Exp on capacity building (training) and welfare expenses as a ratio of sales; COR - Capital-output ratio, EXP is the exports to sales ratio and MNE is defined as the percentage share of the foreign collaborator's equity of the total equity. In a wholly owned subsidiary it will be 100 per cent. The variables were deflated by the wholesale price index.

5.2. Estimation of Equations

We have used both the GLS and the Newey-West estimation procedures. From the basic model of panel data estimation, where the intercept changes for individuals but is constant over time, the slope is constant for individuals and over time:

$$Y_{it} = \beta_{1i} + \sum_{k=2}^{K} \beta_k X_{kit} + e_{it}$$

To estimate the model we can make assumptions about the intercept: $\beta_{1i} = \beta_1 + \alpha_i$. This means that there is a constant portion in the intercept for all individuals (beta) and a portion that changes for each group (alpha). In a fixed effects model, α_i is a fixed parameter→ X_{kit} and α_i are correlated. In a random effects model, α_i is a random variable→ X_{kit} and α_i are uncorrelated.

We use fixed and random-effects models when N is large and T is small. A fixed-effects model is better if we have data on all members of the population. If the population is too large and we have a sample, then a random-effects model is better and it saves us degrees of freedom because some of the parameters are random variables. This is precisely the case with our estimation since the sample is very large. We also estimate GLS specifications that account for various patterns of correlation between the residuals due to the need for varying weights across firms and over time. We also take into account the problem of non-stationary in a panel with the help of the Hadri test.

In the context of linear regression, well-known large sample tests, such as the Wald and LM tests, usually require estimating the asymptotic covariance matrix of the normalized OLS estimator. This estimation may be cumbersome when data have complex dynamic properties. Newey and West (1987) and Gallant (1987) suggested nonparametric kernel estimators that are consistent even when there are serial correlations and conditional heteroscedasticity of unknown forms.

Where firm_identifier is the variable which denotes each firm and time_identifier is the variable that identifies the time dimension, such as year. This specification allows for observations on the same firm in different years to be correlated (i.e. a firm effect). If we want to allow for observations on different firms but in the same year to be correlated we need to reverse the firm and time identifiers. We can specify any lag length up to t-1, where t is the number of years per firm. It was found that the Newey-West estimations were more robust than the GLS estimates as they tackled the problems of multicollinearity and heteroscedasticity.

5.3. Data

Data used for estimation is taken from the Prowess data base which covers approximately 11, 230 firms in the organized sector, including both public and private firms (covering around 70 percent of the economic activity in the organized industrial sector of India). A good summary of the dataset is provided by Topalova (2004). The time period taken was 2000-2008 and the focus was limited to firms engaged in the manufacturing sector.

6. Results

The Newey-West results based on panel data estimation (as opposed to random effects chosen on the basis of Hausman test under GLS[2]) are summarized in Table 3 for the aggregate as well as different categories.

For the *aggregate*, in the first scenario wherein *trade and investment liberalization* have been taken together with the former captured by the imports and the latter in terms of foreign equity participation, it is found that royalties, import penetration ratio, and employment denoted by wage rate, are significantly positive, whereas R&D and size are significantly negative. While the significantly positive variables can be expected to determine TFP, according to the literature, a negative sign for R&D is puzzling. One explanation for this could be the fact that in India R&D was mostly undertaken by the public sector and private sector R&D is only now catching up. On the other hand, our results are in agreement with Amiti and Konings (2005) whereby imported inputs can raise productivity via learning, variety or quality effects. Size being negative has important implications too, indicating that there is ample scope for economic activity levels to be stepped up in India through scale expansion.

In the second scenario of *export-oriented firms*, import penetration ratio, royalties, and employment denoted by wage rate are positive and significant. Additionally, imports of capital goods are also significantly positive. This is important to note as it shows the positive productivity gains appear to be accruing due to import liberalization of both raw materials and capital goods, the latter possibly embodying technology and hence the effect. R&D remains significantly negative even in this scenario.

[2] The Hausman test tests the null hypothesis that the coefficients estimated by the efficient random effects estimator are the same as the ones estimated by the consistent fixed effects estimator. If they are (insignificant P-value, Prob>chi2 larger than .05) then it is safe to use random effects. If a significant P-value is obtained, however, it is advisable to use fixed effects.

The third scenario of *import-dependent firms* has size, employment denoted by wage rate, and import of capital goods as significant. This is interesting as these suggest that import-dependent firms generally do reap productivity gains with greater numbers of workers employed at higher wage rates. This might possibly be due to the technological improvements in their operations assisted by capital goods import regulations which have been extensively liberalized in India. This is evident from the fact that capital goods imports turn out to be positive and significant. An important insight one gets is the significant and negative export to sales ratio, indicating that import-dependent firms have been oriented towards the Indian domestic market and a possible import-export link is yet to be established. In other words, it may be argued that import liberalization especially of capital goods has largely helped consumers in the domestic market.

The fourth scenario of *foreign ownership* has size, employment denoted by wage rate, export incentives, and import penetration ratio as positive and significant. These indicators suggest that foreign firms in India contribute to employment with higher wage rates; which, it should be noted, are responsive to the availability of export incentives and derive benefits from liberalized imports of raw materials as denoted by the import penetration ratio. On the other hand, foreign firms' productivity is negatively related to R&D, capital goods imports and exports. The significant and negative export to sales ratio perhaps indicates that until now, multinationals in India have largely catered to the Indian domestic market and have yet to turn India into a major export platform.

The sum and substance of the results at the aggregate level is that variables capturing import and FDI liberalization effects have contributed to TFP gains. The merit of the scenarios is that it is possible to isolate the effects of trade and investment liberalization on productivity gains in terms of export-orientation, import-dependence and foreign ownership.

Table 3. Determinants of TFP: Summary of Results

Scenario	Trade and Investment Liberalisation: Aggregate	X -Oriented	Import -dependent	Foreign-ownership
	-Size,	-R&D,	Size,	Size,
	-R&D,	R, L,	I-CG,	-R&D,
	R, L,	IMP	L,	-I-CG,
	IMP	I-CG	-X-Sales	XI, L,
				-X-Sales,
				IMP

Note: Only variables that have come out as significant either at 99% or 95% have been mentioned along with their signs.

7. Productivity in Perspective

Having explored the determinants of labor productivity in the contexts of trade and investment liberalization with the help of a detailed micro-data set at the firm level, our aim is to put labor productivity gains into perspective. This can be done on two levels: First, assessing the employment effects of labor productivity and secondly, by studying productivity gains in conjunction with work-hours.

7.1. Impact of Productivity on Employment

The linkage between trade liberalization and employment can be examined through the effects on labor productivity; however the complexity of such a relationship is not always properly understood. It has been argued and confirmed empirically by Das (2007) that trade liberalization to technology linkages may yield higher labor productivity gains. However, translating this into increased demand for labor is dependent upon the possibilities of scale expansion. This is because in the absence of scale expansion, labor productivity gains could result in a lower demand for labor per unit of output production, precisely because labor has become more productive. This provides another perspective of labor productivity gains in an era of trade liberalization.

7.2. Implications of Increased Work-hours on Productivity

Another factor which has gone unnoticed in the literature concerns intensification of labor through increase in work-shifts. It has been found in different sectors where labor productivity has increased at a very high rate that the length of shifts has reportedly increased too (Ghosh, 2009).

Both these dimensions should be kept in mind while envisaging any policy conclusions for productivity gains with the help of trade and investment liberalization policies.

8. Conclusions and Policy Recommendations

India has witnessed wide-ranging economic reforms in her policies governing international trade and FDI flows. Consequently, both trade and FDI flows have risen dramatically since 1991. In the era of reforms, productivity improvements have taken place and the findings of this paper support several other studies on the subject (e.g. Topalova, 2004). The paper further explores the important determinants of productivity improvements across different categories. As per the findings of the paper, some of the important determinants of productivity measured by TFP include imports of raw materials and capital goods, size of operation, quality of employment captured by wage rates and technology imports measured by royalty payments. It also emerges that R&D in organized manufacturing is still at a nascent stage possibly because of the inadequate emphasis this sphere has been given by the private sector. However, further exploration of this issue is required in order to draw any firm conclusions. Broadly, foreign firms have catered to the domestic market and as a result, India is yet to develop as an export platform. Finally, the import-export linkage is not shown to be significant in the sample of import-dependent firms.

While the issue of productivity gains needs to be kept in a balanced perspective, some of the broad conclusions of the paper are that the aggregate-level variables capturing import and FDI liberalization effects have contributed to TFP gains.

Taken together, these conclusions have important policy implications for tariff liberalization, especially for imports of raw materials and capital goods, FDI liberalization and technology imports along with the case for a sound wage rate regime, primarily determined by market forces. Size being negative at the aggregate level has important implication too, indicating that the there is ample scope for the level of economic activity to be stepped up in India by scale expansion with increased employment of skilled human resources. However, in the context of a global slowdown this may mean focusing on domestic sources of scale expansion alongside tapping **regional sources of demand impulses**. Given these findings, **India's** integration with other Asian countries, especially in the framework of the ASEAN+6 could mean enhanced and more structured cooperation agreements in the fields of, but not limited to:

1. Comprehensive Economic Partnership Regional Agreement that includes an FTA in trade in goods; Agreement on Trade in Services; and an Investment Cooperation Agreement (given India's growing purchasing power and market, comparative advantage in services trade and being an attractive investment destination)
2. Comprehensive Regional Agreement on R& D Cooperation (covering Microelectronics, IT, Space Technology, Agricultural technology, pharmaceuticals and advanced materials, some of which are developed in India)
3. Regional Agreement for Human resources Development (for skilling and re-skilling human resources at varying levels of skill-formation – given India's expertise in various dimensions)

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Annex Table 1.

Variable name	Aggregate	X - Oriented	Import - dependent	Foreign-owned
Size	.00165*	0.00003	.000476**	.000172*
	-0.00037	-0.00002	-0.00023	-0.000054
R&D	-.000319**	-.022312*	0.01334	-.2022*
	-0.00015	-0.00813	0.0071	-0.0506
XI	0.01016	-0.00502	0.3331	.02912**
	0.01406	-0.0116	0.40798	0.01328
R	.08593*	.04736*	-0.00499	-0.00817
	0.0203	0.01023	-0.02056	-0.0396
L	8.332*	65.997*	616.99*	66.97*
	2.2707	16.514	179.52	15.631
COR	0.00001	-0.04309	-0.00365	-.6915**
	0.00002	-0.0398	-0.00328	-0.322
Cap Building	0.0004	-0.0008	-152.64**	-147.09*
	0.0003	-0.001	-62.24	-30.755
X-Sales	0.0002	-1.2475*	4.603**	-2.078*
	0.0004	-0.3289	2.2796	-0.685
MNE	0.00204	0.00414	3.0364	
	0.00583	0.0058	3.5638	
IMP	.6974**	.6904*	7.058 (4.5298)	1.1718*
	0.3166	0.1938		0.448
N	3138	2322	616	778
F Stat	22.15*	18.70*	894.18*	27.50*

Newey West Stnd Error in parenthesis.
*Significant at 99%.
** Significant at 95%.

Technical Appendix

Total Factor Productivity Estimation

The objective is to estimate Total Factor Productivity at firm level for manufacturing firms. Much of this literature has been devoted to the estimation of firm productivity levels, obtained as residuals from an estimated production function based on the deflated sales proxy. Different researchers have calculated the productivity index using different production functions, for example, Cobb Douglas, Translog Production Function etc. In a further example, Solow (1957) used Tornquist's Index to measure productivity. Much of the literature is also devoted to using labor productivity (LP) as a measure of productivity. But a drawback of LP is that it does not fully consider firms' productivity and is not an accurate measure of productivity when many firms in the dataset are capital intensive.

Usually, a functional form for the production function is preferred, in the vast majority of cases Cobb-Douglas. An alternative to the Cobb-Douglas function would be a more flexible translog function, which is, in theory, more attractive because it is less restrictive. In practice, however, the restriction of the functional form as in Cobb-Douglas does not tend to make a significant numerical difference. On the other hand, the advantage of employing the Cobb Douglas function is that it is relatively easy to assess whether the estimated coefficients and the resulting returns to scale are broadly in line with common sense.

In a Cobb Douglas production function where labor, capital and material are taken to be inputs.

$$Yt = b_0 + b_l l_t + b_k k_t + b_m m_t + w_t + u_t$$

Where y_t the logarithm of firm's output, l_t and m_t are the logarithm of the freely variable inputs labor and the intermediate input, and k_t is the logarithm of state variable capital. The error has two components, the transmitted productivity component given by w_t and u_t an error term that is uncorrelated with input choices.

The following problem which can be described as one of simultaneity is usually encountered: at least a part of the TFP will be observed by the firm at a point in time early enough so as to allow it to change the factor input decision. If that is the case, then the firm's profit maximization implies that the realization of the error term of the production function is expected to influence the choice of factor inputs. This means that the regressors and the error term are correlated, which makes OLS estimates biased. Awareness of this phenomenon is far from new: it was first pointed out by Marschak and Andrews (1944).

Fixed-effect estimation techniques

A relatively simple solution to this problem can be found if one has sufficient reason to believe that the part of TFP that influences firms' behavior, w_t is a plant-specific attribute, and invariant over time. In that case, including plant dummies in the regression, i.e. a fixed-effect panel regression, will solve the problem caused by w_t and deliver consistent estimates of the parameters. There are two drawbacks to this method: First, a substantial part of the information in the data is left unused. A fixed-effect estimator uses only the across-time variation, which tends to be much lower than the cross-sectional one. This means that the coefficients will be weakly identified. Second, the assumption that w_t is fixed over time may not always be correct, thus invalidating the entire procedure.

The Olley and Pakes approach

As an alternative to fixed-effect regressions, a consistent semi-parametric estimator was developed by Olley and Pakes (1996). This estimator solves the simultaneity problem by using the firm’s investment decision to proxy unobserved productivity shocks.

A key issue in estimation of production function is the correlation between unobservable productivity shocks and input levels. Profit-maximizing firms respond to positive productivity shocks by expanding output, which requires additional inputs. In such cases, OLS estimates lead to a productivity bias. Olley and Pakes use investment as a proxy for these unobservable shocks.

The Levinsohn and Petrin approach

The method suggested by Olley and Pakes (1996) is able to generate consistent estimates for the production function estimates, provided a number of conditions are met. One of these conditions is that there must be a strictly monotonous relationship between the proxy (investment) and output. This means that any observation with zero investment must be dropped from the data in order for the correction to be valid. Depending on the data, this may imply a considerable drop in the number of observations because it will often be the case that not all firms will make a strictly positive annual investment. Levinsohn and Petrin (2003) offer an estimation technique that is very close in spirit to the Olley and Pakes approach. Instead of investment, however, they suggest the use of intermediate inputs rather than investment as a proxy. Typically, many datasets will contain significantly less zero-observations in materials than in firm-level investment. Levinsohn Petrin Procedure uses intermediate input as a proxy for these unobservable shocks.

Data

Data has been taken from the Prowess database by CMIE. It is an unbalanced database from the year 2000-2008 comprising 948 firms. Data has been drawn on the following variables: Sales, Inventory, and Number of employees, Capital employed, Raw material used and Power and Fuel used. Real values of all of these variables have been obtained by deflating the nominal figures by the wholesale price index (Base 1993-94=100). Gross Output is calculated adding Sales and Inventory data. Number of employees is taken as a measure of labor input. Capital employed is taken as a measure of capital input. Raw material is taken as a measure of raw material input. Power and Fuels is taken as a proxy for Energy input.

Methodology

Because complete data for all the firms for all variables were not available many companies must be dropped from the data. The total observations number 3138. After calculating the gross values of all the variables, they are deflated using the WPI index and then converted to logarithmic terms.

We have used the Levinsohn Petrin Procedure in our model in preference to other methods available for various reasons. The most commonly used methods in firm level panel data as mentioned above have drawbacks. The Levinsohn Petrin procedure overcomes these problems. It takes into account the time variation as well as cross-sectional variation. It also deals with the problem encountered in the Olley and Pakes methodology in which firms for whom investment is zero, overtime TFP cannot be calculated. Rather, it takes intermediate input as the proxy variable. The Estimation in the Levinsohn Petrin Procedure takes place in two stages using OLS. First,

$$Yt = b_l l_t + f(k_t, m_t) + u_t \qquad \text{\_\_\_\_\_\_\_\_\_\_\_\_}(1)$$

is estimated where

$$f(k_t, m_t) = b_0 + b_k k_t + b_m m_t + w_t \qquad \text{\_\_\_\_\_\_\_\_\_\_\_\_}(2)$$

This completes the first stage of estimation from which an estimate of b_l and an estimate of f_t (up to the intercept) are estimated.

The second stage identifies the coefficient of b_k. Here function f_t is estimated using OLS. Now w_t is estimated by

$$w_t = f_t - b_k k_t \qquad \text{\_\_\_\_\_\_\_\_\_\_\_\_}(3)$$

Using these values, TFP is estimated from regression

$$w_t = a_0 + a_1 w_{t-1} + a_3 w^2_{t-1} + a_3 w^3_{t-1} + e_t \qquad \text{\_\_\_\_\_\_\_\_\_\_\_\_}(4)$$

Generally, energy is taken as the proxy variable and in our model we have also used the variable “power and fuel” as the proxy variable.

CHAPTER 7

Productivity Spillovers from Foreign Direct Investment: The Case of Vietnam

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There is a common consensus that the presence of foreign multinationals is often associated with advanced technologies or firm-specific features that can spill over to domestic firms. Particularly in the case of Vietnam, the importance of foreign direct investment (FDI) has been widely recognized to be substantial with many externalities that help to promote the development of the domestic sector.

Accordingly, with the use of a panel data set covering the period 2003 to 2007 constructed from Vietnam's "Enterprise Survey" at the firm level, this paper explores major channels of, and estimates factors affecting, the spillover effects of FDI on the productivity of Vietnam's domestic firms. Empirical results reveal the substantially positive effects of FDI, contributing to improving the productivity of Vietnam's domestic firms, emphasizing the importance of narrowing technology gaps and the need to upgrade the labor quality of domestic firms in order to be able to maximize benefits from FDI.

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1. Introduction

Theoretically, the presence of foreign multinationals is often associated with advanced technologies or firms-specific features that can spill over to domestic firms. In other words, FDI can benefit a country, by bringing important inputs such as capital, advanced technology and improved managerial skills. Although hot debate is still underway on whether these effects exist or not, for Vietnam at least the importance of FDI has been recognized as substantial with a wide spectrum of externalities affecting growth.

Supported by achievements in exports and investment, Vietnam has experienced tremendous economic growth. In the years 1998-2006, growth was robust and continuous with an average rate of over 7% annually. Vietnam's economy continued to grow rapidly after its accession to the WTO. In considering Vietnam's achievements, it is noted that the FDI sector has occupied a significant share of the Vietnamese economy, and that its role is becoming increasingly important over time. FDI, as a share of Vietnam's GDP, rose from 13.2% in 2000 to 15.9% in 2006 and to 21.2% in 2007 (CIEM, 2007 and CIEM, 2008).

Attracting FDI is and continues to be a vital component of the reform policy of Vietnam. Vietnam has become a leading recipient of FDI flows, in relation to the size of its economy. With the adoption of a series of measures to attract FDI, motivated by a belief that foreign presence is connected to advanced technology and stimulates an export-led orientation, together with more employment creation, the FDI inflow has rapidly increased over the period particularly in recent years. Starting from a small pledge of about 342 million USD in 1988, FDI rose to 21.348 billion USD in 2007 and 63 billion USD in 2008[2], turning Vietnam into one of the most attractive investment destinations in the world in general, and in the region in particular.

In East Asia in general and in ASEAN in particular, Vietnam is considered as a typical case in which to study the impacts of FDI on a host country. It can be seen that Vietnam's experience in attracting FDI, in association with its rapid economic growth

[2] According to data provided by the General Statistical Office of Vietnam (GSO).

over time, has attracted increasing attention and a growing body of written research on FDI and its impacts on domestic sectors.

Overall, to the best of my knowledge, most current empirical studies on Vietnam's FDI agree that FDI spillovers from foreign firms to local firms in Vietnam are positive in various aspects. There are multiple channels through which local firms in Vietnam can benefit from the presence of foreign firms. Nevertheless, the magnitude of spillovers varies across regions, industries and firms; spillovers are even negative in some cases and aspects. The diversity in findings could be due to various causes, particularly with regard to methods of estimation and to data quality, triggering the need for more research work and comprehensive analysis in this area, as well as with regard to the aspect of the absorptive capacity of domestic firms, enabling them to gain benefits from FDI.

This study, based on empirical data at the firm level in Vietnam covering the period 2003-2007, aims to enrich the existing empirical research on the productivity impacts of FDI spillovers in the case of Vietnam. The paper will explore major channels and estimate factors affecting the spillover effects of FDI on productivity of domestic firms in Vietnam.

2. Literature Review

With the use of micro-data, researchers have conducted a large number of empirical studies aiming to assess the impacts of the presence of MNCs on host countries during different periods of time. It is noted that the analytical frameworks of the majority of researchers are relatively similar. Spillover effects are analyzed through a measurement of the impacts of foreign presence on the output level or labor productivity of domestic enterprises. In this connection, in addition to factors that are assumed to have influence on the productivity of domestic firms or industries, including capital intensity, labor quality, production scales and the competitiveness of the market, a proxy for foreign presence is normally included as an independent variable in a linear or log-linear regression, where the labor productivity of the domestic sector is treated as a dependent variable. Upon estimation, a positive spillover is inferred following the finding of a significant positive sign for the coefficient of the foreign presence, and vice versa. It is clearly proposed in theory that the presence of FDI may have positive productivity spillovers, resulting from the interaction process between foreign firms and domestic-owned firms. For example, domestic-owned firms can imitate the superior technology of foreign firms nearby (the technological imitation effect), or they can benefit from skilled labor turnover (the skill acquisition effect). Furthermore, competition and production linkages among firms are also important channels for such phenomena as technological diffusion (Görg and Greenaway, 2004).

Literature review shows that empirical results of explaining possible channels of FDI spillovers are mixed (Blomstrom and Kokko, 1998; Meyer and Sinani, 2001; Lipsey, 2002; Crespo and Fontoura, 2007). Some studies (e.g. Globerman, 1979; Blomstrom and Persson, 1983; Kolasa, 2007) reveal positive spillovers, while some others indicate negative or negligible effects. It is noted that almost in the recent two decades, empirical papers have focused on explaining these mixed results. Accordingly, an important concluding remark is that the existence, pace and magnitude of productivity spillovers are subjected to the nature and extent of each channel of technological transmission, the nature of both foreign and domestic firms and the condition of host countries.

For instance, the imitation effect is not simply a duplication of technology but subjects on the sophistication of the technology imitated (Blomstrom and Kokko, 1998). Furthermore, the optimal decision choice made by multinational corporation should be to minimize the probability of their technology being imitated (Ethier, 1986). Skill acquisition is limited as foreign firms tend to pay higher wages than domestic firms (Haddad and Harrison, 1993; Lipsey and Sjoholm, 2001). The presence of a positive effect through vertical linkages seems to be obvious, but it depends on the intensity of the input-output linkages. If the buyer’s power is significant, the gain from productivity growth in the upstream sectors will be largely appropriated by the downstream sector (Driffield and Love, 2002; Graham *et al*., 1999). Current literature also focus on the absorptive capability of domestic firms (Kinoshita, 2001; Girma, 2005), the productivity gap (Kokko, 1994), the heterogeneous nature of the ownership of both foreign and domestic firms (Sjöholm, 1999) and the negative market stealing effect (Aitken and Harrison, 1999).

In addition to the aforementioned factors, an arguable reason explaining the mixed results is the bias of estimation in data sources and estimation methods. Hale and Long (2007) suggested three sources of bias for productivity spillover studies, including the aggregation bias (for studies that use aggregated data instead of firm level data), the endogeneity bias (caused by the endogeneity of the FDI variable), and selection bias (caused by using only a sub-sample of domestic-owned firms where there might be non-random sample selection). They concluded that cross-section data and aggregated data potentially produce biased result (upward or downward) unless researchers have appropriate solutions. A meta-analysis study by Görg and Strobl (2000) also suggested the same conclusion. They emphasized that by using cross-section or sectoral data, researchers have been faced with an endogeneity problem that may cause biased estimation.

Among multiple empirical studies, Chen and Demurger (2002) analyses the link between FDI and manufacturing productivity growth in China with the use of industry-level data from 1988-1994. He estimates total factor productivity (TFP) growth by manufacturing sector and relates the estimates to FDI inflows. Empirical results indicate significant differences in TFP growth between FDI-dominated manufacturing sectors and sectors dominated by domestic investment, confirming the prevailing findings on the positive impacts of FDI on economic growth. However, such clear-cut judgment cannot be made for the intermediate and equipment sectors.

Among some studies analyzing both the effects of trade openness and FDI liberalization, Bessonova *et al.* (2003) examines the effects of the liberalization of imports and FDI on Russian firms using firm-level data from 1995-2001. The paper shows that more liberalized trade and increased foreign presence provide positive impacts on domestic firms, reflected in the improvement of the TFP of domestic firms. Several other FDI-related papers using micro-data, such as Caves (1974), Globerman (1979), Blomstrom (1986), Blomstrom and Wolff (1989), Aitken and Harrison (1999), Haskel *et al.* (2004), Kee (2005), and Keller and Yeaple (2008) also confirm the predominant positive impacts of FDI and trade openness.

In the case of Vietnam, quantitative studies on the impacts of FDI have grown over time, particularly in recent years. Among typical FDI-related studies in Vietnam, with the use of panel data at firm level for Vietnamese industries from 2000 to 2004, Le Quoc Hoi (2007) examined wage spillovers from foreign firms to local enterprises both horizontally (intra-industry) and vertically (inter-industry). Empirical results strongly support the presence of wage spillovers from foreign firms to domestic firms in Vietnam. In another research project, with the same data set at firm level from 2000 to 2004, Le Quoc Hoi (2008) uses an estimation model derived from the Cobb-Douglass production function to explore technology spillover effects through horizontal and backward linkages and at the same time to analyze the impact of the characteristics of industries and the foreign and domestic firms on the occurrence and scope of such spillovers. His research shows that while backward linkages produce positive effects on domestic firms, horizontal impacts are negative. At the same time, while domestic-oriented foreign firms produce negative impacts on the productivity of domestic firms, export-oriented foreign firms do not generate significant impacts.

The impacts of FDI on the technical efficiency of local firms are analyzed by Nguyen Dinh Chuc *et al.* (2008), where horizontal spillovers are evaluated through imitation, competition and labor mobility, and horizontal spillovers are evaluated through backward and forward linkages on technical efficiency. The paper concludes that FDI presence measured in terms of output helped to improve production efficiency of domestic manufacturing firms. In this connection, the paper shows that the production efficiency of domestic firms is improved through their increased access to new, improved or less costly intermediate inputs supplied by foreign invested firms. The paper also indicates an upward trend in the production efficiency of local manufacturing firms over time.

Nguyen Phi Lan (2008) conducted a study of FDI technology spillover effects on domestic manufacturing firms' productivity, through both horizontal and vertical linkages, at the same time examining the degree of variance of FDI across regions of Vietnam. The paper uses data from the annual enterprise survey conducted by the Vietnamese Government Statistics Office (GSO) from 2000 to 2005, focusing on manufacturing firms. The most noticeable finding of the paper is that the whole period 2000-2005 witnessed positive impacts from horizontal and backward linkages of FDI on the productivity of the Vietnamese manufacturing firms, while negative impacts were only seen with regard to the forward linkage effects on domestic productivity.

Pham Xuan Kien (2008) uses the data of the Enterprise Survey 2005 by the GSO to test the possible impacts of FDI on labor productivity in Vietnam as a whole. The paper focuses on data at the firm level in four sub-industries: food processing, textiles, garments and footwear, electronics and mechanics, with a total of 441 enterprises including domestic and FDI firms located around the country. The paper finds that the spillovers of FDI to overall labor productivity in Vietnam are unambiguous and strongly positive. This, once again, stresses the crucial role of foreign capital in the economic development of developing economies like Vietnam. Through FDI, the host countries obtain not only the necessary capital, but also obtain modern technology, management skills, and marketing skills. The author agrees with the view that the presence of FDI firms facilitates competition between enterprises in the host country, which induces them to use resources more efficiently, to improve technology as well as management, and in consequence to improve labor productivity as a whole. The negative impacts of skill gaps on overall labor productivity suggest that Vietnam may stimulate FDI firms that tend to apply labor-intensive technologies to employ the labor force, which is abundant and relatively cheap in the short run. However, in the long run, it should focus on narrowing the technology gap between domestic and foreign firms.

Furthermore, the author recognizes that improving the skills of local workers is crucial because it seems that relatively cheap labor will no longer be a competitive factor attracting FDI in the near future. Thus the Vietnamese government should pay attention to improving labor skills through vocational colleges and training programs. The government should also help develop domestic enterprises, particularly small and medium enterprises by providing them with more training in new technologies. The government should help these firms to renew their technologies, machines and so on, so as to catch up and compete with FDI firms in the domestic market as well as to compete with foreign firms in international markets.

A critical review of literature on FDI spillovers in the case of Vietnam thus shows that foreign presence is positive to Vietnam's economic development in various aspects, ranging from the promotion of the transfer of technology and managerial skills from foreign firms to local ones, particularly with regard to those which act as suppliers to foreign partners, to the strengthening of total factor productivity. The presence of foreign firms clearly stimulates the demand for not only efficiency improvement but also for imitation and adaptation of new and advanced technology and knowledge.

3. Research Question

This paper aims to answer the two following research questions:

a. Are there productivity spillovers from FDI to domestic enterprises?
b. Through what major channels does FDI impact on the productivity of domestic firms?

4. Data and Methodology

4.1. Data

The paper uses a panel data set covering the period 2003 to 2007, constructed from the Vietnam Enterprise Survey at firm level. The enterprise data are collected by the GSO for all sectors and industries, as at March 1st annually. The general objectives of the survey are: (i) to collect the business information needed to compile national accounts; (ii) to gather up-to-date information for the business register and sample frames for other business sample surveys; and (iii) to update the statistical database of enterprises. An important strength of the survey lies in its coverage, which includes almost all enterprises in 29 sectors and industries, in three industrial groups (4 sectors in mining and quarrying, 23 in manufacturing, and 2 in electricity, gas and water supply), providing a wide range of information on the property structure of enterprises, output, capital stock, investment, employment, location, wages, sales, etc. However, the survey is still limited in some aspects, such as a lack of some financial information and missing data.

In our panel data constructed from the Vietnam Enterprise Survey over the five year period (2003-3007), domestic-owned firms constitute about 95% of the total number of firms (85% are domestic privately owned firms and 10% are state owned firms (SOEs) and the remaining 5% are foreign firms (including joint-ventures and wholly foreign-owned firms).

By the GSO's definition, foreign firms are enterprises with capital invested by foreigners, irrespective of their percent of capital share. In the data, foreign firms comprise the three following: (i) firms with 100% foreign capital; (ii) joint ventures between the state and foreign investors; and (iii) joint ventures between others and foreign investors. To estimate the production function, among other things, two inputs are considered; these are labor and capital. Capital is calculated as fixed asset value (book value) at the end of the year of survey. It then is adjusted by the GSO's producer price index (PPI) at the 3-digit level together with relevant financial variables. Similarly, labor input is calculated as the average value of total employment of the firm at the beginning and the end of each year.

4.2. Methodology

The model employed in the paper is derived from the Cobb-Douglas production function of the domestic sector in industry *i* with the form as follow:

$$\ln Y_{it} = \beta_0 + \beta_k \ln K_{it} + \beta_l \ln L_{it} + \ln HEFjt + \beta_f FOR + \gamma FOR * FAC_{it} + \varepsilon_{it} \quad (1)$$

Where β_0 constant, t is time, ε is the error term accounting for all other factors influencing productivity, and measurement error. Y denotes the value added of the domestic sector. K, L denotes capital, labor inputs of domestic firms in industry i. FOR indicates the degree of foreign presence in each industry measured by the share of employment of the foreign sector, following the argument of Caves (1974) that this proxy was better than the share of output of the foreign sector.

The characteristics of an industrial sector are also expected to determine the productivity change of a firm in that sector. To take into account the level of concentration in industry *j* we use the Herfindahl index to show the extent of market control of firms in the industry. A higher value of the Herfindahl index implies a high level of industry concentration, thus less competition. The Herfindahl index is constructed as the sum of the squares of output share in the industry and presented as the following:

$$HEF = \sum_{i} \left(\frac{x_{ijt}}{X_{jt}} \right)^2$$

in which x_{ijt} is the output of firm *i* in sector *j* at time *t*. X_{jt} is the total output of sector *j*.

The existing body of literature on FDI research reveals that foreign investors may be attracted to industries with higher productivity, thus the actual relationship between foreign presence and the productivity of domestic firms may overestimate the positive impact of the foreign sector. So, it is possible that ordinary least squares (OLS) estimation may potentially cause an upward bias. With the assumption that the unobserved characteristics of industries are time-invariant, we can estimate the equation (1) with the fixed effect method to account for the bias. However, it may be possible that unobserved features do not affect the productivity of domestic firms, so we will also estimate equation (1) with the random effect method and use the Hausman test to decide which method is better.

In equation (1), the group of factors (FAC) that affects the magnitude of FDI spillover on the productivity of domestic firms (FAC) includes the technology gap between foreign firms and domestic enterprises (PR), capital intensity (CI) and skill intensity (SI).

To examine the effect of the technology gap on technology spillovers, we define the technology gap for each domestic firm as the percentage difference between its labor productivity and that of the average foreign firm in the same industry. A negative value for domestic firm *i* indicate that firm *i* is more productive than the average foreign firm in the same industry and a positive value indicates that firm *i* is less productive than the average foreign firm in the same industry. A positive value shows that a technology gap exists between the domestic firm and the average foreign firm in the same industry.

CI is defined as the percentage difference of the capital-labor ratio between a domestic firm and that of an average foreign firm in each three-digit sector. In this connection, it is noted that foreign firms may be more capital-intensive and larger than domestic firms, and these characteristics may account for some of the productivity differentials between foreign firms and domestic firms. Therefore, the use of this variable can help to control for the impact of capital intensity on productivity.

Furthermore, skill intensity (SI) is taken into account as a factor affecting FDI spillovers, considering that skill intensity is important in helping domestic firms to maximize benefits from FDI spillovers, as shown in Girma and Wakelin (2001). SI is defined as the difference between the wage of a worker in a domestic firm and the average wage payment of a worker in a foreign firm in each industry, given the assumption that payment is closely related to labor quality and may be taken as a measure of skill intensity. With the inclusion of interaction terms between FAC (PR, CI and SI) and foreign presence (FOR), we aim to measure whether these factors affect FDI spillovers from foreign firms to local firms in Vietnam.

5. Empirical Result

Empirical results from foreign presence, and interaction terms between foreign presence and factors affecting the degree of FDI spillovers are presented in Tables 1, 2, 3 and 4. Results are reported with the consistent and efficient estimators between fixed effects and random effects, with the check for validity by, the Hausman test, which indicates that the fixed effect estimation method is better.

Table 1. Productivity Impacts with Foreign Presence

Dependent Variable: Productivity of Domestic Firm		
	Fixed	*Random*
No. of observations	28096	28096
R2	0.84	0.85
Hausman	Prob>chi2 = 0.0000	
_cons	5.957237***	6.399468**
	(0.0660175)	(0.0502461)
log_K	.3502589***	.2792507***
	(0.0050161)	(0.0031955)
log_L	.2938032***	.4169616***
	(0.0120342)	(0.0058458)
Log_HEF	.2068741***	.2166288***
	(0.0018917)	(0.001519)
FOR	.503312***	.442301****
	(0.107223)	(0.0677724)

Note: Figures in parentheses are standard errors.
*** Significant at 1%.
** Significant at 5%.

The positively significant coefficient of FOR in Table 1 shows that foreign presence produced very substantial spillover effects on the domestic sector of Vietnam during the 2003-2007 period. At the same time, it is noted that the impacts of industry concentration, proxied by the Herfindahl index, are considerable with regard to the output growth of domestic firms.

Table 2. Spillovers with Technology Gap in Productivity

Dependent Variable: Productivity of Domestic Sector		
	Fixed	*Random*
No. of observations	27878	27878
R2	0.94	0.85
Hausman	Prob>chi2 = 0.0000	
_cons	5.873633***	6.298005***
	(0.0666459)	(0.0507486)
log_K	.3504812***	.2790592***
	(0.0050213)	(0.0031796)
log_L	.2991367***	.4221275***
	(0.0120523)	(0.0058466)
Log_HEF	.2039082***	.2121936***
	(0.0019291)	(0.0015492)
FOR	.664433***	.506865***
	(0.1086116)	(0.0687719)
FORPR	-.0205722***	-.028842***
	(0.0020395)	(0.0018426)

Note: Figures in parentheses are standard errors.
*** Significant at 1%.
** Significant at 5%.

Looking at Table 2, we can see regression results with interaction terms of foreign presence and technology gap (FORPR). The interaction terms of FOR and technology gap (PR) are negatively significant. This implies that the technology gap remains a constraint to FDI spillovers despite the recent signals that domestic firms have increasingly become accustomed to higher technologies, and that FDI spillovers in recent times seem to be in favor of capital intensive industries compared to labor intensive ones.

Table 3. Spillovers with Capital Intensity

Dependent Variable: Productivity of Domestic Sector		
	Fixed	*Random*
No. of observations	27878	27878
R2	0.84	0.85
Hausman	Prob>chi2 = 0.0000	
_cons	5.880813***	6.298005***
	(0.0665887)	(0.0507486)
log_K	.3632036***	.2790592***
	(0.0051561)	(0.0031796)
log_L	.2851694***	.4221275***
	(0.0120508)	(0.0058466)
Log_HEF	.2073361***	.2121936***
	(0.001895)	(0.0015492)
FOR	.5096791***	.5068652***
	(0.1077299)	(0.0687719)
FORCI	.0090833***	-.028842***
	(0.0009216)	(0.0018426)

Note: Figures in parentheses are standard errors.
*** Significant at 1%.
** Significant at 5%.

Table 3 presents results of the regression with interaction terms between foreign presence and capital intensity (FORCI). Results show a significantly positive sign for the interaction terms FORCI (FOR*CI) during the period 2003-2007. This indicates that differences in capital intensity between foreign companies and local ones had an important implication for the productivity of the latter, implying that the domestic sector may have benefited from FDI spillovers, given the current level of the gap in capital intensity. The positive coefficient of capital intensity also implies that FDI spillover is beneficial for local firms in favor of labor-intensive activities.

Table 4. Spillovers with Skill Intensity

Dependent Variable: Productivity of Domestic Sector		
	Fixed	*Random*
No. of observations	27878	27878
R2	0.84	0.85
Hausman	Prob>chi2 = 0.0000	
_cons	5.960373***	6.413001***
	(0.0663805)	(0.0504503)
log_K	.3516103***	.2799967***
	(0.0050337)	(0.0032036)
log_L	.2911778***	.4110119***
	(0.012138)	(0.0059096)
Log_HEF	.2075826***	.2168819***
	(0.0018998)	(0.0015258)
FOR	.549132***	.401426***
	(0.1209336)	(0.0758376)
FORSI	-.0021147**	-.0026878**
	(0.0044711)	(0.0025378)

Note: Figures in parentheses are standard errors.
*** Significant at 1%.
** Significant at 5%.

Lastly, the FDI spillovers in connection with skill intensity are shown in Table 4. FOR remains positively significant but FORSI is negatively significant. This stresses the importance of improving labor quality so as to assist the domestic sector to maximize benefits from FDI spillovers. Overall, empirical analysis indicates evidence of substantial FDI spillovers in Vietnam.

6. Concluding Remarks

This empirical paper has focused on examining the productivity spillover effect of FDI inflow in Vietnam during the period from 2003-2007. It has contributed to the exploration of major channels for spillover, and estimated the level of the spillover effects affecting the productivity of domestic firms in Vietnam. Empirical results show that there is a strong connection between the spillovers of FDI and the differences in technology, capital intensity and skill intensity between FDI and domestic firms. Overall, the presence of foreign multinationals is substantially positive for the domestic sector, contributing to improved productivity of local firms. Advantages in the capital intensity of foreign firms compared to the local ones have contributed to improving the productivity of the latter. It is noted that, however, technology gaps remain obstacles to FDI spillovers, restricting local firms from improving their productivity. Furthermore, the gap in skill intensity between foreign companies and domestic ones, with the resultant outcome of a negative influence on the output of domestic firms, may signify the need to pay more attention to the quality of the labor force so as to help the domestic sector to maintain and improve its competitiveness.

In this paper, fixed effect estimation has been used to help to control for the possibility that unobserved time-invariant factors in industries may affect FDI operation, thus lessening the possibility of biased estimation. Nevertheless, the existence of mixed effects of FDI in the current literature may arise from the nature of spillover takers or spillover givers, and the conditions required for the spillover process to occur. At the same time, there is a possibility that the omission of linkages between domestic companies and possible contributions of these factors to productivity spillovers as done in our paper as well as in a large number of FDI-related empirical studies might not be the best alternative. These aspects are left for further research.

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Appendix 1. Industrial Sectors

C	**Mining and Quarrying**
C10	Mining of coal and lignite; extraction of peat
C11	Extraction of crude petroleum and natural gas
C12	Mining of metal ores
C13	Other mining and quarrying
D	**Manufacturing**
D15	Food and beverage
D16	Cigarettes and tobacco
D17	Textile Products
D18	Wearing Apparel, dressing and Dying of Fur
D19	Leather Tanning and Dressing
D20	Wood and Wood Products
D21	Paper and Paper Products
D22	Printing, Publishing and Reproduction of Recorded Media
D23	Coke and Refined petroleum products and Nuclear fuel
D24	Chemicals and Chemical products
D25	Rubber and Plastic products
D26	Other Nonmetallic Mineral products
D27	Basic Metals
D28	Fabricated metal products
D29	Machinery and Equipment N.e.c
D30	Office, accounting and computing machinery
D31	Electrical machinery and apparatus N.e.c
D32	Radio, TV, communication equipment
D33	Medical and precision and optical instruments
D34	Motor vehicles trailers and semi-trailers
D35	Other transport equipment
D36	Furniture, N.e.c
D37	Recycling
E	**Electricity, gas and water supply**
E40	Electricity, gas steam and hot water supply
E41	Collection, purification and distribution of Water

Source: Le Thanh Thuy (2005).

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CHAPTER 8

Trade, Productivity, and Innovation: The Case of Malaysia

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This study attempts to explore the relationships between trade, productivity and innovation using firm-level data from three innovation surveys covering the period 1997-2004. It is found that the link between exporting and productivity is a weak one in Malaysia. Productivity is driven mainly by capital intensity and human capital but this may not necessarily translate into export dynamism. Innovation, whether it is product or process innovation, is likely to be the key driver in exporting. Exporters are likely to be larger firms with foreign ownership. There is some evidence that trade liberalization may promote exports but this is less relevant for innovating firms. The main policy implication of these findings is that there should be more emphasis on enhancing innovation capabilities rather than improving productivity per se to ensure export dynamism. The role of small domestic firms and their ability to innovate and venture into exporting needs to be seriously considered.

1. Introduction

Malaysia is a small open economy that has relied heavily on exports as a source of growth. Until the 1960s, the country was a major exporter of primary commodities such as tin and rubber. This changed when the country embarked on an export oriented industrial policy in the late 1960s. As a result, the manufacturing sector and the export of manufactures became increasingly important. Today, the sector's share of GDP is around 30 % and manufactured goods account for more than 80 % of the country's exports. Despite venturing into import-substitution in heavy industries in the 1980s, Malaysia continues to rely heavily on exports of manufactured goods, especially electrical and electronic products. The emphasis in recent years has been on moving up the value chain in manufactured exports. To achieve this, policy makers have emphasized the importance of innovation and productivity. Take, for example, the *Third Industrial Master Plan 2006-2020* (IMP3) which was launched in 2006. The key emphasis of the IMP3 was stated as encouraging the "shift towards higher value-added activities and undertake productivity-driven growth initiatives, as well as adopt and apply higher levels of technology" and human capital development to support these initiatives.[1]

To date, there have been very few empirical studies using firm-level data examining the significance and importance of productivity improvements and innovation in relation to exports. The aim of this paper is to make some contribution in this area by carrying out an empirical analysis of the relationship between trade, innovation and productivity. More specifically, the paper aims to empirically investigate the following issues:

- Trade and productivity trends in the manufacturing sector;
- Sources of productivity in the manufacturing sector, namely, factor accumulation and technological innovation;
- The relationship between exporting, productivity and innovation in the manufacturing sector

[1] Third Industrial Master Plan, Foreword.

The outline of the rest of the paper is as follows. Section 2 provides a brief discussion on the Malaysian economy focusing on the country's manufacturing sector. Section 3 provides a brief literature review on trade, productivity and innovation. Section 4 discusses the methodology and data used in this paper. The empirical results are discussed in Section 5. Section 6 concludes.

2. Malaysia: Trade, Productivity, Productivity and Innovation

The GDP structure of the Malaysian economy has changed significantly over the past 50 years. Today, the services (53%) and manufacturing (28%) sectors dominate the economy (Table 1). The manufacturing sector accounts for at least 67% of the country's exports. About 64 % of manufactured exports come from the electrical and electronic industries. This is the result of the implementation of an export-oriented industrialization policy since the 1960s. A key turning point in the country's industrialization and development process was the Asian financial crisis in 1997/1998. The Malaysian economy was adversely affected by the crisis, albeit to a lesser extent compared to other countries in the region. The period after the financial crisis is characterized by relatively low levels of foreign direct investment as well as lethargic performance of manufactured exports. One of the key concerns / problems is the inability of the country's manufacturing sector to achieve higher levels of productivity and move up the value-chain. This concern is reflected in the country's industrial plans.

Table 1. Structure of the Malaysian Economy, 2008

Sector	GDP Share %	Sector	GDP Share %	Sector	Export Share %
Agriculture	7.3	Consumption	49.7	Machinery & transport	43.2
Mining	8.3	Investment	7.4	Manufactured	8.9
Construction	2.9	Gov. Expenditure	25.6	Misc. Manufactured	8.4
Manufacturing	28.3	Export	89.3	Chemicals	6
Services	53.2	Import	72.1	Mineral Fuels	18.2
				Animal & Vegetable Oils & Fats	8.6
				Others	6.7

Source: Economic Report 2009.

The *Second Industrial Master Plan 1996-2005* (IMP2) was launched during this period with emphasis on strengthening industrial linkages, increasing value-added activities and enhancing productivity.[2] The *Third Industrial Master Plan 2006-2020* (IMP3) had a similar focus, namely with an emphasis on encouraging the "shift towards higher value-added activities and undertake productivity-driven growth initiatives, as well as adopt and apply higher levels of technology" and human capital development to support these initiatives.[3]

Are the concerns related to productivity and innovation as expressed in Malaysia's industrial master plans valid ones? How has the country performed in terms of productivity in recent years?

There have been a number of studies attempting to estimate productivity growth in Malaysia's manufacturing sector over the years. Macro-level computations of Total Factor productivity (TFP) using GDP data indicate that TFP growth rates ranged between 2.0 % to 2.5 % during the period 1970-1980, negative around the first half of the 1980s and 2.0 % to 3.0 % during the period 1988-2000 (with the exception of 1998 in the aftermath of the Asian financial crisis) (see Ab Wahab, 2004). Other studies have also found positive but low TFP growth during the 1980s and 1990s. Mahadevan (2007a), for example, provides evidence that the average annual TFP growth hardly exceeded 1.5 % during many of the sub-periods between 1971 and 2002. During the period 1971-2002, the few manufacturing industries that recorded relatively high TFP growth rates included (Mahadevan 2007a, p.338):

- industrial chemicals (2.47%),
- transport equipment (2.09%),
- electrical machinery (2.01%), and
- other chemicals (1.81%).

Official estimates such as those from the Third Outline Perspective Plan (OPP3) provide a different set of estimates for TFP growth rates. Overall, official estimates of TFP growth rates are much higher than those of Mahadevan (2007a) (Table 2). Furthermore, the estimates obtained for a number of industries have very different signs (-/+) such as wood products, chemicals, rubber and plastic products and transport

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[2] The Third Industrial Master Plan, p.3.
[3] Third Industrial Master Plan, Foreword.

equipment. This likely to be due to differences in estimation methodologies and data used.[4]

Table 2. Estimates of TFP Growth Rates in Manufacturing Industries, 1990-1999 (%)

Industry	Mahadevan (2007a)	OPP3
	1990-1999	1990-1999
Food	0.76	6.5
Beverages	1.02	
Textiles	0.21	5.1
Wearing Apparel	0.82	
Wood Products	-0.74	2
Furniture	0.65	8.4
Paper	0.87	2
Printing and Publishing	0.74	
Chemicals	2.81	-6.3
Rubber Products	0.68	-0.7
Plastic Products	1.04	
Fabricated Metals	0.88	4.5
General Machinery	1.36	12
Electrical Machinery	1.83	6.4
Transport Equipment	1.88	-4.1

Note: Mahadevan (2007a) and OPP3.

Even though there are differences in the estimates of productivity growth, it might still be interesting to examine whether productivity growth is observed to be higher in export-oriented industries. Which industries would fall into such categories? These would include industries in which a significant proportion of output is exported (i.e. more than 60% in 2003). Such industries include (Table 3):

- Textiles – spinning, weaving and finishing (67%)
- General purpose machinery (63%)
- Office and computing machinery (73%)
- Electrical lamps and lighting machinery (69%)
- Electronic components (76%)
- Radio, TV and communication (61-68%)
- Watches and clocks (66%)

[4] For example, Mahadevan (2007a) estimated TFP growth rates using the stochastic frontier approach while the official (OPP3) estimates were estimated using the Cobb-Douglas production function.

Table 3. Percentage Output Exported in Manufacturing, 2000-2004

Industry	2000	2001	2002	2003	2004
Manufacturing total	51	51	47	45	33
Meat, fish, fruits, vegetables, oils, fats	27	32	29	26	18
Dairy	9	12	14	11	6
Grain mill, starch, feeds	3	3	3	3	2
Other food	20	20	25	24	21
Beverages	4	6	5	2	4
Tobacco	21	25	29	25	21
Textiles' spinning, weaving, finishing	72	73	70	67	29
Other textiles	22	19	25	21	13
Knitted & crocheted fabrics, etc.	45	33	59	51	39
Apparel except furs	49	64	64	56	42
Leather	63	58	64	39	47
Footwear	15	20	16	19	13
Wood sawmilling & planning	36	33	35	31	28
Other wood	63	57	61	57	60
Paper	19	21	21	14	12
Publishing	2	1	2	1	2
Printing & recorded media	19	19	19	16	5
Refined petroleum	27	46	42	28	50
Basic chemicals	39	37	35	36	30
Other chemicals (incl. man-made fibers)	20	25	26	29	22
Rubber	55	56	54	54	39
Plastics	26	31	44	39	27
Glass	35	34	58	55	25
Other non-metallic mineral products	16	11	12	10	8
Basic iron & steel	17	15	8	15	8
Basic nonferrous metals	45	42	41	32	15
Metals' casting	11	12	14	16	10
Structural metal products, etc.	18	25	26	23	13
Other fabricated metals, etc.	34	30	27	21	23
General purpose machinery	46	28	39	63	24
Special purpose machinery	38	31	40	38	29
Other domestic appliances	53	5	49	54	5
Office & computing machinery	80	93	81	73	62
Electrical motors, generators, etc.	56	61	53	50	19
Electricity distribution machinery	49	41	38	24	18
Insulated wire & cable	54	44	39	36	21
Accumulators, primary cells & batteries	37	31	44	36	24
Electric lamps & lighting machinery	57	79	75	69	78
Other electrical equipment	38	52	27	37	31
Electronic components	82	78	71	76	46
Radio & tv transmitters, telephony	90	93	93	61	39
Radio & tv receivers, recorders	76	79	77	68	33
Medical machinery, etc.	62	53	49	59	49
Optical & photographic machinery	49	78	90	33	8
Watches & clocks	74	53	74	66	36
Motor vehicles	21	2	3	3	1
Motor vehicle bodies, trailers	3	4	0	1	5
Motor vehicle parts	20	14	12	17	14
Ships & boats	6	5	5	6	8
Motorcycles	9	12	8	8	14
Bicycles & wheelchairs	71	85	83	4	7
Aircraft, other transport machinery	3	6	13	11	7
Furniture	48	49	44	45	41
Miscellaneous manufacturing	41	44	43	33	33
Recycling	41	20	19	57	44

Source: Author's computation based on data from Ramstetter and Shahrazat (2009).

Comparing the two sets of information, there are some indications that productivity levels in a number of export-oriented industries such as electrical machinery and general machinery are above average (Table 2 and Table 3).

Given that innovation (especially process innovation) can be related to improvements in productivity, it would also be interesting to see if innovation is related to both productivity and export-orientation. Table 4 provides a summary of the incidence of innovation from three surveys from 1997 to 2004. In these surveys, innovating firms are those indicating that they have carried out process and/or product innovation based on the Oslo Manual's definition.[5] Data from the surveys suggest that the incidence of innovation is high in a number of export-oriented industries such as:

- Office, Accounting and Computing Machinery
- Electrical Machinery and Apparatus, Radio
- Television and Communication Equipment and Apparatus
- Medical, Precision and Optical Instruments, Watches & Clocks

The above discussions suggest that there could be links between productivity, innovation and trade. This issue can be explored in greater detailed using firm-level data.

[5] In the Oslo manual, a product innovation is the market introduction of a new good or service or a significantly improved good or service with respect to its capabilities, such as quality, user friendliness, software and subsystems. Process innovation is the use of new or significantly improved production processes, distribution methods, or support activity for your goods and services.

Table 4. Incidence of Innovation in Malaysian Manufacturing, 1997-2004

Industry	1997-1999			2000-2001			2002-2004			% Innovating Firms		
	Yes	No	Total	Yes	No	Total	Yes	No	Total	1997-1999	2000-2001	2002-2004
Food Products and Beverages	25	162	187	35	80	115	30	35	65	13.4	30.4	46.2
Tobacco Products	1	2	3	2	2	4	NA	NA	NA	33.3	50	NA
Textiles	6	32	38	8	3	11	8	3	11	15.8	72.7	72.7
Wearing Apparel; Dressing and Dyeing of Fur	2	29	31	29	73	102	6	15	21	6.5	28.4	28.6
Tanning and Dressing of Leather; Luggage, Handbags, and Footwear	1	6	7	2	6	8	8	5	13	14.3	25	61.5
Wood; Products of Wood and Cork Except Furniture	6	112	118	7	37	44	22	18	40	5.1	15.9	55
Paper and Paper Products	7	31	38	6	10	16	9	7	16	18.4	37.5	56.3
Publishing, Printing and Reproduction of Recorded Media	4	27	31	30	28	58	11	16	27	12.9	51.7	40.7
Coke, Refined Petroleum Products and Nuclear Fuel	2	3	5	1	0	1	1	3	4	40	100	25
Chemicals and Chemical Products	9	15	24	14	19	33	16	12	28	37.5	42.4	57.1
Rubber and Plastic Products	41	110	151	20	27	47	38	23	61	27.2	42.6	62.3
Other Non-Metallic Mineral Products	8	43	51	14	22	36	6	13	19	15.7	38.9	31.6
Basic Metals	6	19	25	6	16	22	11	8	19	24	27.3	57.9
Fabricated Metal Products, Except Machinery and Equipment	24	72	96	28	65	93	27	21	48	25	30.1	56.3
Machinery and Equipment N.E.C.	9	26	35	4	38	42	7	8	15	25.7	9.5	46.7
Office, Accounting and Computing Machinery				7	7	14	5	3	8		50	62.5
Electrical Machinery and Apparatus N.E.C	38	71	109	12	6	18	8	6	14	34.9	66.7	57.1
Radio, Television and Communication Equipment and Apparatus				9	2	11	25	8	33		81.8	75.8
Medical, Precision and Optical Instruments, Watches & Clocks	2	4	6	3	1	4	4	2	6	33.3	75	66.7
Motor Vehicles, Trailers and Semi Trailers	13	38	51	9	2	11	5	2	7	25.5	81.8	71.4
Other Transport Equipment				3	7	10	3	3	6		30	50
Furniture; Manufacturing N.E.C.	13	25	38	13	34	47	9	12	21	34.2	27.7	42.9
Recycling	0			1	1	2	2	1	3		50	66.7
	217	**827**	**1044**	**263**	**486**	**749**	**261**	**224**	**485**	**20.8**	**35.1**	**53.8**

Source: MASTIC.

3. Brief Review of the Existing Literature

The firm-level empirical literature on the relationships between productivity, innovation and trade is fairly diverse. This is partly due to the different motivation and data sources used in these studies. Much of the initial literature such as Crepon *et al.* (1998) focused on the determinants of innovation. These include firm size, market share and diversification. The subsequent study by Griffith *et al.* (2006) included additional explanatory variables such as national funding for research, and innovation protection. In these studies, the causality between innovation and productivity appears to be from innovation to productivity. However, while Crepon *et al.*'s finding is supportive of this relationship, the later study by Griffith *et al.* (2006) is less supportive.

A second strand of literature comes from international trade where the focus is on exporting. Within this literature, scholars are interested in the determinants of exporting. Both Greenaway and Kneller (2004) and Wagner (2007) do find that exporters are more productive than non-exporters. The evidence here is supportive of the self-selection story whereby the more productive firms are more likely to self-select into export markets. Furthermore, the act or process of exporting per se does not necessarily improve productivity. This implies that the causality between exporting and productivity is likely to run from productivity gains to exporting. One important additional explanatory variable of exporting that is of relevance here is trade liberalization e.g. Greenaway and Kneller (2007) and Baldwin and Gu (2004).

What about the relationship between exporting, productivity and innovation? In the study by Aw *et al.* (2007), it was found that Taiwanese firms that engage in R&D, and/or workers' training, plus export participation, experience larger productivity increases than firms that only export. In another paper by Almeida and Fernandes (2006), there is evidence that both importers and exporters are more likely to adopt a new technology compared to other firms. However, majority foreign-owned firms are less likely to undertake technological innovation compared to domestic firms. These later studies seem to support the earlier findings on the positive impact of innovation on productivity. However, the evidence on the link between exporting and innovation is sparse and thus requires further research.

To summarize the literature, there seems to be good evidence on the determinants of innovation. There is also enough evidence on the positive impact of productivity on exporting. Given the ambiguous link between innovation and productivity, it is not clear whether innovation has an impact on exporting and vice-versa. These issues are explored empirically using Malaysian firm-level data in the rest of the paper.

4. Methodology and Data

4.1. Methodology

The econometric specifications used in this study are constrained by the data used for the study. The data comprises cross sections from three sets of surveys. This implies that it would not be possible to examine some of the dynamic issues relating to entry-exit and productivity adjustments over time that are undertaken in studies using panel data. Given the data limitations, the focus of this study will be confined to examining empirically various relationships between productivity, trade and innovation.

4.1.1. Productivity Differences between Exporters and Non-Exporters

The literature suggests there are differences in productivity levels between exporters and non-exporters. Productivity differentials between exporters and non-exporters can be tested via stochastic dominance of the productivity distribution for exporters over the productivity distribution for non-exporters. Let F and G be the cumulative distribution functions of productivity (z) for exporters and non-exporters. The first-order stochastic dominance of F relative to G implies that:

$$F(z) - G(z) \geq 0 \quad (1)$$

for all values of z, with strict inequality for some z.

We test this condition using the Kolgomorov-Smirnov test for both definitions of exports. Productivity is measured in terms of value-added per worker or total factor productivity (estimated from residuals of regression on the production function).

Another test that can be used is the Wilcoxon-Mann-Whitney test, which is a non-parametric test that can be used to check if two independent samples are from populations with the same distribution.

4.1.2. Relationship between Exporting and Productivity

Data limitations preclude the testing of the self-selection hypothesis in export participation. Instead, what can be tested is whether productivity levels are related to the propensity to export.

The propensity of firm *i* to export is modelled as:

$$EXPORT_i = x_i \beta_0 + e_i \tag{2}$$

where *EXPORT* is the observed binary export variable, x_i are the explanatory variables, β_0 the coefficient vector and e_i the error term. The explanatory variables x_i include the degree of local ownership, productivity (measured by value-added per worker or total factor productivity) and firm size (in terms of total number of employees).

4.1.3. Relationship between Innovation and Productivity

The firm-level empirical evidence on the relationship between innovation and productivity is sparse and ambiguous (see earlier discussions). However, productivity is closely related to innovation in modern growth theory. The Solow's residual captures contributions to economic growth arising from technological progress. With endogenous growth, additional variables were included to capture spillovers from investment in physical and human capital or differences in the variety and quality of inputs. A micro econometric version or implementation of such models could take the form of an augmented Cobb-Douglas production function that is used to measure productivity:

$$PROD_i = \alpha_1 CAP_i + \alpha_2 HCAP_i + \alpha_3 INNOV_i + \alpha_4 SIZE_i + e_i \tag{3}$$

where $PROD_i$ is labour productivity (natural log of value-added per worker), CAP_i the capital intensity proxied by natural log of fixed asset per worker, $HCAP_i$ the human capital variable proxied by percentage of employees with college/university degrees, $INNOV_i$ is the innovation input and $SIZE_i$ the firm size.

4.1.4. Relationship between Exporting and Innovation

If firms with high productivity self-select to export, whether such productivity levels are a result of innovation is an important question – one that has not been conclusively answered. Alternatively, it is plausible that participation in foreign markets could motivate firms to innovate or firms could get innovative ideas from exporting. The use of cross section data precludes the determination of which of the two hypotheses is likely to hold. Despite such limitations, one could test if any statistical relationships exist between the two variables.

In the first case (productivity → exporting), equation (2) could be modified by replacing the productivity independent variable with an innovation (dummy) variable. In the second case (exporting → productivity), it is difficult to motivate a behavioural equation that is rich enough to capture and distinguish the various possible avenues by which exporting can affect productivity.

4.2. Data

The firm-level data for this study is sourced from three national innovation surveys (NSIs) conducted by the Malaysian Science and Technology Information Centre (MASTIC), Ministry of Science, Technology and Innovation. The reference period and sample size for each of the three data sets are summarized in Table 5.

The available data sets for this study are limited and uneven. The full data set containing innovating as well as non-innovating firms is available for NSI3. The two older data sets (NSI1 and NSI2) available for this study cover only innovating firms.

Table 5. Basic Description of Data Set from National Surveys of Innovation

	Data Set 1 (NSI1)	Data Set 2 (NSI2)	Data Set 3 (NSI3)
Reference Period	1997-1999	2000-2001	2002-2004
Survey Type	2 Stage Survey	1 Stage Survey	2 Stage Survey
Stage 1 Sample Size: All Firms	1044 (NA)	749 (NA)	485
Stage 2 Sample Size: Innovating Firms	399	263	439

Note: NA – Not available for this study.
Source: MASTIC.

In terms of sample representativeness, the coverage is uneven. This can be seen by comparing the NSI3 dataset with aggregated data from the Annual Manufacturing Survey. The 485 firms in the data set constitute only 3.4 % of the sample frame maintained by the Department of Statistics at the time of the NSI survey (see Table 6). Most of the firms which responded to the survey are likely to be larger firms because firms in the sample account for 7.62 % of total employment in the Annual Manufacturing Survey in 2004. The sample representativeness by sub-sectors also shows significant variations, the lowest representation being the furniture sub-sector (around 1%) and the highest being medical, precision and optical instruments (around 12 to 17 %). The results in this paper should be interpreted with this in mind.

Table 6. Statistics on Sample Representativeness of the National Survey of Innovation 2002-2004

	(1) No. of firms in Sample	(2) No. of firms in sample frame	(3) Total employees in sample	(4) Total Employees in Manufacturing Survey	(5) = (1)/(2) (%)	(6) = (3)/(4) (%)
Food products and beverage	65	2,346	6,147	133,402	2.77	4.61
Textiles	11	339	3,207	37,483	3.24	8.56
Wearing Apparel	21	726	3,202	81,152	2.89	3.95
Leather	13	147	915	8,080	8.84	11.32
Wood and cork	40	1,025	14,623	116,329	3.9	12.57
Paper	16	377	3,573	34,821	4.24	10.26
Publishing	27	724	3,870	37,721	3.73	10.26
Coke, refined petroleum	4	47	92	4,353	8.51	2.11
Chemical	28	634	2,849	52,687	4.42	5.41
Rubber, plastic	61	1,509	21,750	174,568	4.04	12.46
Non-metallic minerals	19	728	2,085	56,427	2.61	3.7
Basic metals	19	501	2,909	42,941	3.79	6.77
Fabricated metal	48	1,509	6,063	73,703	3.18	8.23
Machinery, equipment	15	813	609	53,836	1.85	1.13

(Table 6. *Continued*)

	(1) No. of firms in Sample	(2) No. of firms in sample frame	(3) Total employees in sample	(4) Total Employees in Manufacturing Survey	(5) = (1)/(2) (%)	(6) = (3)/(4) (%)
Office, accounting, computing machinery	8	65	2,482	64,293	12.31	3.86
Electrical machinery	14	425	8,288	68,131	3.29	12.16
Radio, TV, communication equipment	33	439	22,523	285,243	7.52	7.9
Medical, precision, optical instrument	6	50	4,407	24,956	12	17.66
Motor vehicle, trailers	7	253	3,789	51,128	2.77	7.41
Other transport	6	183	1,750	29,679	3.28	5.9
Furniture	21	1,340	1,403	101,361	1.57	1.38
Recycling	3	14	318	544	21.43	58.46
Total	485	14,194	116,854	1,532,838	3.42	7.62

Source: Data (1)-(3) from MASTIC, Data (4) from Ramstetter and Sharazat (2009).

Summary statistics for the three data sets are presented in Table 7. Overall, there are significant variations in firm sizes, whether measured in terms of total employees or turnover, across all the three data sets. The mean values of local ownership (%) in the data sets are also consistently high, ranging from 69 % to 84 %. With the exception for the data set from 2000-2001, the average percentage of revenues derived from exports is relatively high from 39-46 %.

Table 7. Summary Statistics of Data

Observations	1997-1999				2000-2001				2002-2004			
	399				263				485			
	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max
Total Employment	207	198	2	979	311	825	1	6500	247	511	1	6000
Total Revenues (RM)	85.3 mil	291 mil	62407	4.36 bil	341 mil	2.2 bil	2400	28.2 bil	68 mil	325 mil	5000	5.7 bil
Local ownership (%)	69	41	0	100	84	34	0	100	75	40	0	100
% Revenue from Exports	46	41	0	100	16	31	0	100	39	40	0	100

Source: Computed by author based on data from MASTIC.

5. Results and Analysis

5.1. Productivity Differences between Exporters and Non-Exporters

The Kolgomorov-Smirnov test for differences in productivity is presented in (Table 8). The first row in the table tests the hypothesis that productivity (measured by value-added per worker) for non-exporters is lower than for exporters. The approximate p-value obtained is 0.002 which is significant. The second row tests the hypothesis that productivity for non-exporters is higher than for exporters. The p-value for this is 0.924 which means this hypothesis is rejected. Results from the combined test, which tests for productivity differences between non-exporters and exporters are reported in the third row. Both the approximate p-value (0.004) and the corrected p-value (0.003) indicate that there are statistically significant differences in productivity between non-exporters and exporters. The results hold for the alternative measure of productivity, namely, TFP. Results from the Wilcoxon-Mann-Whitney test also indicate that there is a statistically significant difference between the two distributions of productivity for exporters and non-exporters (Table 8). Furthermore, exporters have higher ranks (in terms of productivity) than non-exporters.

Table 8. Tests for Productivity Differences between Exporters and Non-Exporters, 2002-2004

Kolgomorov-Smirnov Test			
Labor Productivity	D	P-Value	Corrected P-Value
Non-Exporters	0.1853	0.002	
Exporters	-0.021	0.924	
Combined K-S	0.1853	0.004	0.003
TFP	D	P-Value	Corrected P-Value
Non-Exporters	0.1532	0.046	
Exporters	-0.0539	0.684	
Combined K-S	0.1532	0.093	0.071
Wilcoxon-Mann-Whitney Test			
Exporters	Observations	Rank Sum	Expected
0	138	23818	26979
1	252	52427	49266
Combined	390	76245	76245

Note: H0: Value Added per Employee (non-exporters) = Value Added per Employee (exporters).
Z = -2.970.
Prob > | z | = 0.0030.

Source: Author.

5.2. Relationship between Exporting and Productivity

The probit regressions indicate that the probability of a firm exporting is related to ownership and firm size (proxied by total employees) (Table 9). Firms with foreign ownership are more likely to export. Larger firms are also more likely to export. However, this result holds for the 1997-1999 and 2002-2004 data sets but not for the 2000-2001 data sets. Interestingly, productivity level (measured by value added per employee) does not seem to be related to the probability of exporting.[6] The results are the same if TFP is used as a measure of productivity.

Table 9. Probit Regressions on Relationship between Exporting and Productivity for 1997-1999, 2000-2001 and 2002-2004

	1997-1999	2000-2001	2002-2004	2002-2004	2002-2004
	Innovating Firms	Innovating Firms	Innovating Firms	Innovating & Non-Innovating Firms	Innovating & Non-Innovating Firms
Value Added per Employee		7.54E-09 -1.85E-08	1.90E-10 -4.26E-10	1.41E-08 -2.54E-08	
Percentage Local Ownership	-0.007159*** -0.0024889	-0.0143944*** -0.0030869	-0.0111381*** -0.0038301	-0.0149283*** -0.002776	-0.0131854*** -0.0028222
Firm Size	0.0034949*** -0.0007476	0.0000337 0.0001192	0.0010452*** -0.0004761	0.0020109*** -0.0004391	0.0017921*** (0.0004459)
TFP					5.30E-10 -9.52E-10
Intercept	0.8281483*** -0.2339258	1.146547 -0.287226	1.644838*** -0.3644648	1.365447*** -0.2641005	1.292141*** -0.266401
Observations	322	184	200	350	305
LR Chi2	45.24	27.86	25.69	90.82	66.61
Pseudo R2	0.1385	0.1092	0.146	0.207	0.1792

Note: Dependent variable: value equals one if export > 0, otherwise zero.
Standard errors in parentheses.
*** pí0.01, **pí0.05, *pí0.1.
Source: Author.

Another possible analysis involves the incorporation of variables related to the trade regime. This can be done by using Malaysia's average MFN tariff from WTO's Trade Policy Review for years 2001 and 2005. The results from the regressions are reported in Table 10. In the results obtained, the negative sign for the coefficient suggest that a lower average MFN tariff (perhaps associated with trade liberalization) is related to a higher probability of exporting. However, the variable is statistically significant for

[6] The relationship is not detected even if the exporting and productivity variables are interchanged while maintaining other independent variables the same and applying an OLS regression.

year 2002-2004 for innovating and non-innovating firms. For innovating firms only (2000-2001 and 2002-2004 data sets), the average MFN tariff variable is not statistically significant. These results suggest that tariff levels are not important for exporting by innovating firms. Note that similar results are obtained if TFP is used as a measure of productivity (full regression results are not reported but are available upon request from the author).

Table 10. Probit Regressions on Relationship between Exporting and Trade Liberalization, 2000-2001 and 2002-2004

	2000-2001	2002-2004	2002-2004
	Innovating Firms	Innovating Firms	Innovating & Non-Innovating Firms
Value Added per Employee	-3.16E-07	-3.61E-07	-2.22E-07
	-3.09E-07	-3.72E-07	-3.93E-07
Percentage Local Ownership	-0.0130085***	-0.0048125	-0.0100782***
	-0.0035812	-0.004219	-0.0030282
Firm Size	-0.0001546	0.0020004***	0.0042205***
	-0.0001848	-0.0009792	-0.0008929
Average MFN Tariff (2001, 2005)	-0.0134048	-0.0070779	-0.0361181***
	-0.0101812	-0.0272036	-0.0161877
Intercept	1.433491	1.32776	1.289713
	-0.3649909	-0.4764625	-0.3386313
Observations	127	149	262
LR Chi2	19.13	15.58	78.39
Pseudo R2	0.109	0.1601	0.2631

Note: Dependent variable: value equals one if export > 0, otherwise zero.
Standard errors in parentheses.
*** pí0.01, **pí0.05, *pí0.1.
Source: Author.

5.3. Relationship between Innovation and Productivity

The data limitation for exploring the relation between productivity and innovation is very severe. Only the data set for the 2002-2004 periods contains information on physical and human capital stock. In the OLS regression, both variables are statistically significant (columns 2 and 3 in Table 11). Greater capital intensity and human capital are associated with higher levels of productivity. The signs of the innovation variables suggest that product innovation is associated with higher levels of productivity while the reverse is true for process innovation. However, both variables are not statistically significant.[7] Similar results on the importance of capital intensity and human capital are obtained when TFP is used as a measure of productivity. The same results (column 1) are obtained when productivity is regressed against the two types of innovation using the 2000-2001 data set– note that there is insufficient data (i.e. capital intensity and human capital) to run a well-motivated specification.

Table 11. Productivity and Innovation for 1997-1999, 2000-2001 and 2002-2004

	2000-2001	2002-2004	2002-2004
	Innovating Firms	Innovating Firms	Innovating & Non-Innovating Firms
Capital Intensity		0.0876362***	0.148902***
		-0.0407968	-0.0329454
Human Capital		1.406415***	2.109213***
		-0.6656867	-0.627841
Product Innovation	0.2617075	0.2462003	0.1840611
	-0.4990341	-0.2436427	-0.2276064
Process Innovation	-0.3627744	-0.3020806	-0.3873675
	-0.2901537	-0.31100453	-0.2303578
Intercept	11.67255	9.267929	8.355057
	-0.5601749	-0.7290181	-0.474573
Observations	180	178	315
R2	0.0115	0.069	0.1144
Adjusted R2	0.0003	0.0474	0.1029

Note: Dependent variable: Value Added per Employee.
Standard errors in parentheses.
*** pí0.01, **pí0.05, *pí0.1.
Source: Author.

5.4. Relationship between Exporting and Innovation

Results from the probit regressions with exporting as a dependent variable and with product innovation and process innovation as independent variables are reported in Table 12. The results suggest that process innovation seems to be positively related to exporting propensity (the exception is the 1997-1999 data). Whether innovation per se (whichever type) is related to exporting can be inferred from the use of the full data set from the 2002-2004 period which involves both innovating as well as non-innovating firms. The results there suggest that both types of innovation are positively associated

[7] Given that product and process innovations may take place simultaneously, one alternative specification is to replace the two independent variables with a single innovation variable (for both process and product innovations). The innovation variable specified as such gives a similar result (insignificant).

with the exporting propensity. The other variables such as local ownership and firm size remain statistically significant. Firms with foreign ownership are more likely to export compared to locally owned firms. Similarly, larger firms are more likely to export than smaller firms.

Table 12. Probit Regressions on Relationship between Exporting and Innovation for 1997-1999, 2000-2001 and 2002-2004

	1997-1999	**2000-2001**	**2002-2004**	**2002-2004**
	Innovating Firms	**Innovating Firms**	**Innovating Firms**	**Innovating & Non-Innovating Firms**
Product Innovation	0.6613944*** (0.2239422)	-0.4589041 (0.3369138)	0.3703852 (0.2812146)	0.4778806*** (0.2030802)
Process Innovation	-0.079520202	-0.3433389 (0.1993846)	0.6064402** (0.31195)	0.7571609*** (0.2007789)
Percentage Local Ownership	-0.007124*** (0.0025099)	-0.0137718*** (0.0025879)	-0.011857*** (0.0039508)	-.0164082*** (0.0026275)
Firm Size	0.0036692*** (0.0007638)	0.0001325 (0.0001108)	0.001114*** (0.0004879)	0.0005329*** (0.000207)
Intercept	0.7109743 (0.2433734)	1.428149 (0.4347985)	0.9157908 (0.5189899)	1.206552 (0.2466514)
Observations	321	259	233	427
LR Chi2	53.97	39.38	30.56	144.69
Pseudo R2	0.1655	0.1165	0.155	0.2693

Note: Dependent variable: Value Added per Employee.
Standard errors in parentheses.
*** pí0.01, **pí0.05, *pí0.1.
Source: Author.

6. Conclusions

Policy makers in Malaysia today are concerned about the future of the country's manufactured exports. There is a widespread recognition that the country's manufacturing sector will need to move up the value chain by achieving higher productivity and by innovating. Empirical evidence based on firm-level data can inform policymaking in this area by identifying what the key drivers are, as well as the relationship between exporting, productivity and innovation.

Using firm-level data from three waves of innovation surveys covering the period 1997-2004, this study finds that the link between exporting and productivity is a weak one in Malaysia. Productivity is driven by capital intensity and human capital but this may not necessarily translate into export dynamism. Innovation, whether it is product or process innovation, is likely to be the key driver in exporting. There is some evidence that trade liberalization can promote exporting but such policies may be less relevant to innovating firms. Furthermore, exporters are likely to be larger firms with foreign ownership. This is consistent with the present role of FDI and large MNCs in the country's exporting activities. The main policy implication of the findings from this study is that the policy makers should focus more on enhancing innovation capabilities, rather than productivity, to ensure export dynamism. Trade liberalization may have an impact on promoting exporting, especially amongst non-innovating firms. More attention should also be paid to providing a conducive environment for small domestic firms to innovate and venture into exporting.

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CHAPTER 9

Imports-as-Market Discipline Hypothesis: Evidence from the Thai Manufacturing Sector

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This paper examines the Imports-as-Market Discipline Hypothesis, using the latest industrial census (2006 census) of Thailand. The paper's novel feature is to examine the different possible effects of fragmentation-driven parts and final good imports on the price-cost margin. Our key finding suggests that while imports have the potential to act as a market discipline, the effect on the price-cost margin appears to be different between two categories of imports. It is the importation of parts and components instead of final goods that acts as a market discipline. The higher the proportion of imported parts, the closer the gap between the price and marginal cost, thereby promoting more efficient use of scarce resources. For a small domestic market such as Thailand and other developing countries, it would be difficult for individual plants to reach the industry's economies of scale by relying entirely on the domestic market. For firms whose manufactured goods are exported, it is more likely that they will benefit from economies of scale. The paper provides more empirical evidence of gains from opening up international trade on resource allocation and the need for further liberalization. The finding also highlights gains from participating in global production networks in terms of growth opportunity and resource allocation efficiency.

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1. Issues

How firms change their pricing behavior in response to a change in trade policy remains interesting to the literature in international economics. In general, when faced with intensified international competition, domestic industries which may have reaped oligopoly profits in a protected domestic market, are forced to behave more competitively. This phenomenon is frequently claimed to be especially relevant in developing countries where the protected domestic market often will only support a few firms. This phenomenon is termed in Levinsohn (1993) as the imports-as-market discipline hypothesis. In the imports-as-market discipline hypothesis, firms are always technically efficient. The hypothesis is related to, but still quite different from another firm-level hypothesis in trade liberalization literature that shows how firms enhance their *X*-efficiency as a consequence of the increased competitive pressure induced by trade liberalization. To a certain extent, it is related to an older body of empirical research adopting what is sometimes called the Structure-Conduct-Performance (S-C-P) paradigm.[1]

It seems clear in theory that imposing trade barriers will increase price-marginal cost markup (Helpman & Krugman, 1989). It is the empirical studies, where a positive relationship between price-cost markup and trade barriers might be found.[2] The relationship is related to the issue of resource allocation efficiency and becomes even more important in a period of a rise of protectionism threat amidst the global economic recession. There has been a marked increase in protectionist pressures globally since the second half of 2008 in order to mitigate the adverse effect of global recession on domestic production and employment. Importantly, the imposing of trade barriers would act as additional barriers to only potential foreign entrants, over and above other entry barriers (e.g. scale economies, absolute cost requirement etc.) that are common to

[1] Although the threat of potential entry has been recognized as an important constraint on established firms' monopoly power in studies in industrial organization, foreign competitors have rarely been considered explicitly in analysis (Domowitz *et al.*, 1996; Clarke, 1984; Demsetz, 1973; Min, 1999) have ignored the potential of the influence of foreign trade on domestic market power.

[2] The negative relationship is found in Esposito & Esposito (1971) Pagoulatos & Sorensen (1976); Pugel (1980); Lyons (1981);Geroski (1982); Neuman *et al.* (1984); Chou (1986); De Ghellinck *et al.* (1988); Levinsohn (1993); Katies & Peterson (1994). In the meantime, Urata (1979); Pagoulatos & Sorensen (1981), Nolle (1991); Ståhlhammer (1991, 1992) and Field & Pagoulatos (1994).

both potential domestic and foreign entrants. Hence, it would alter the degree of market contestability. Nonetheless, most of these empirical studies have dated, most of which were in the 1970s and 1980s. Since the 1990s, the role of MNEs and export-oriented ones in particular, have increased significantly since the 1990s.

Against this backdrop, this paper aims to probe the imports-as market discipline hypothesis in Thai manufacturing. Thai manufacturing is suitable for the issue in hand as the sector's nominal protection remains high by regional standards (Jongwanich & Kohpaiboon, 2007). Tariff restructuring received renewed emphasis in the period 2003-2008 with the ultimate target of 3 tariff rates (0, 5 and 10 per cent, respectively, covering raw materials, intermediates, and final goods). Nevertheless, tariff reduction in the new millennium took place marginally. Nonetheless, there are about 20 per cent of tariff lines at the 4-digit level of HS, which are subject to more than 20 per cent tariff rates (Jongwanich & Kohpaiboon, 2007). A cascading tariff structure has been the key characteristic of the tariff structure in Thailand over the past three decades. Hence, variation of the effective rate of protection across industries remains high.

Paper organization is as follows; Section 2 provides an overview of protection in Thailand during the past three decades. In the following section, the analytical framework and empirical model are discussed. Section 4 presents data sets used in this study. Results are in Section 5, followed by a summary and conclusion in the final section.

2. Trade Policy and Patterns of Industry Profitability in Thailand

Historically, there has been a greater reliance on tariffs rather than QRs (Quantitative Restrictions) in Thailand. Over the past two decades, Thailand has made significant progress in trade liberalization. The early emphasis on import-substitution (IS) strategy (1970-87) has given way to a greater emphasis on equalizing incentives between import-competing and export-oriented production. Significant reduction and rationalization of the tariff structure and dismantling most of the non-tariff barriers began from the second half of the 1980s onward. As part of its commitments under the

WTO, a comprehensive plan for tariff reduction and rationalization was proposed in 1990 and implemented between 1995 and 1997. The reform process was temporarily interrupted by the financial crisis during the 1997-99[3] but was renewed afterward as an essential part of overall economic reforms aimed at strengthening efficiency and competitiveness (see Warr 2000; WTO, 1999) with the ultimate target of 3 tariff rates (0, 5 and 10 per cent, respectively, covering raw materials, intermediates, and final goods). Nevertheless, tariff reduction in the new millennium took place marginally and concentrated on around 900 items covering a wide range of manufacturing intermediates such as rubber and articles thereof (HS40), glass and glassware (HS70), knitted fabrics (HS60), other base metals (HS81), woven fabrics (HS58), articles of stone (HS68), man-made staple fiber (HS55), wadding yarns (HS56), cotton (HS52), and miscellaneous vegetable preparations (HS21). The magnitude of tariff reduction is moderate within the range of 0 to 8.9 per cent (Jongwanich & Kohpaiboon, 2007: Table 1).

As a result, the simple average applied tariff rate declined sharply from 40 per cent during 1985-94 to 17 per cent in 1997, and slightly further to below 15 per cent during 2003-07. By regional standards, Thailand remains a high-tariff country. The country's simple average tariff rate continues to exceed levels in Malaysia, the Philippines, Indonesia, and even Mainland China by a wide margin (Table 1).

[3] Tariffs on a number of luxury imports such as perfumes, cosmetics, clothing, leather products, glassware and crystal products, certain shoes and jewelry, and lenses, eyeglasses, cameras, watches, pens and lighters were temporarily raised to increase tax revenue in order to meet the budget surplus of one per cent of gross domestic product (GDP) agreed to with the International Monetary Fund (IMF).

Table 1. Average Tariff of Top 15 Items under Tariff Restructuring in Thailand 2002-2005

HS		Average Tariff Rates				Tariff Difference
		2002	2003	2004	2005	2002–2005
		(1)	(2)	(3)	(4)	(1)–(4)
40	Rubber and articles thereof	23.3	23.3	15.0	8.6	8.3
70	Glass and glassware	18.0	10.1	10.1	10.1	7.9
60	Knitted fabrics	20.0	20.0	12.5	5.0	7.5
81	Other base metals	9.4	3.2	2.5	2.5	7.0
58	Woven fabrics, lace etc.	20.0	20.0	13.2	6.1	6.8
68	Articles of stone	18.3	11.6	11.6	11.6	6.6
55	Man-made staple fibre	15.9	15.9	9.4	4.8	6.5
56	Wadding yarns	17.7	17.7	11.4	6.1	6.3
52	Cotton	15.5	15.5	9.2	4.8	6.3
21	Miscellaneous vegetable preparations	30.3	24.1	24.1	24.1	6.2
54	Man-made filaments	15.0	15.0	8.9	5.0	6.1
13	Laces, gums and other vegetable slabs	16.1	10.0	10.0	10.0	6.1
50	Silk	14.9	14.9	8.9	5.1	6.1
48	Paper and paperboards	17.7	12.2	12.2	6.8	5.5
83	Misc. articles of base metals	19.1	13.6	13.6	13.6	5.5
	Average of all tariff items	14.3	13.3	12.0	11.0	2.3

Source: Compiled from Official Data provided by Ministry of Finance.

A cascading tariff structure has been the key characteristic of the tariff structure in Thailand over the past three decades. At the sectoral level, industries producing intermediate goods (chemicals, fertilizer, metal products and construction material, for example) have relatively low rates of tariff protection. By contrast, final-goods producing sectors (such as food and drinks, pharmaceuticals, garments), with the exception of non-electrical machinery and electrical machinery and equipment, have relatively high rates of protection. Between 1980 and 1999 tariff rates were generally higher for manufacturing, compared with agriculture and other primary product sectors. This is indicated by the fact that the average applied tariff rates (without the various exemptions) for the manufacturing sector during this time period were higher than those for the overall economy. This is consistent with patterns observed in other developing countries and reflects the belief in industrialization as the road to economic independence. After 2003, protection granted to the manufacturing sector is not significantly different from the country's protection average (Table 2).

Table 2. Nominal and Effective Rates of Protection in Thai Manufacturing 1980–2006 (per cent)

	1999	2003	2006
Nominal rate of protection (NRP)			
Processed foods	17.5	8	7.9
Textile products	35.8	7.2	7.1
Leather and Footwear products	53.1	18.3	13.3
Wood products	59.2	17.7	17.7
Paper and pulp	6.7	9.4	2.1
Chemical and petroleum products	25	6.4	4.9
Rubber products	32.9	5.6	4.6
Other non-metal products	16.7	6.5	3.2
Metal products	28.8	16.6	6.6
Machinery	30.1	7.9	7.3
Consumer goods and motor vehicles	37.6	10.4	9.1
Total Manufacturing	26	8.9	6.8
Overall	22.5	9.4	6.2
Effective rate of protection (ERP)			
Processed foods	21.6	9.5	11.8
Textile products	66.2	16.6	16.1
Leather and Footwear products	118.5	31.3	18.8
Wood products	106.8	38.2	38.2
Paper and Pulp	-0.9	25.9	8.3
Chemical and Petroleum products	32.5	4.1	11.4
Rubber products	100.6	56.5	15.4
Other Non-Metal products	39	27.9	9.8
Metal products	84.7	22.4	15.6
Machinery	109.6	2.9	9
Consumer goods and motor vehicles	238.1	46.2	39.7
Total manufacturing	57.3	20.4	15
Overall	73.9	25.3	17.9

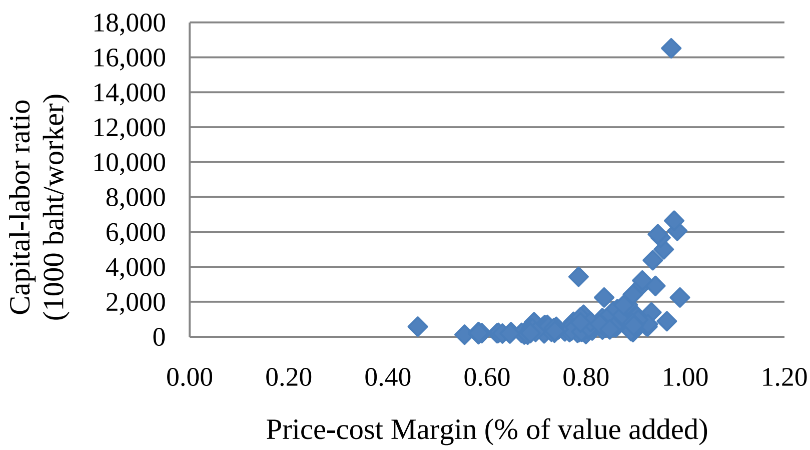
Source: ERP estimates for 1980 are from Akrasanee & Ajanant (1986), those of 1985 from World Bank (1988) and of 2003 are from Jongwanich & Kohpaiboon (2007) and 2006 from the author's calculation.

Generally, nominal protection under the cascading tariff structure does not provide a precise picture of protection in a particular industry.[4] Effective protection is needed as it takes into consideration not only the tariff rate applicable to that sector, but also on tariffs of all other sectors which provide production input (intermediate and capital goods) to that sector. Table 2 illustrates the nominal and effective rate of protection (ERP) estimates for 1999, 2003 and 2006. From 1999 to 2006, ERP estimates exhibited a downward trend in all industries. The simple average of the ERP in the manufacturing sector fell from 34.4 per cent in 1999 to 12.4 per cent and 10.9 per cent in 2003 and 2006, respectively. This is in line with the downward trend in nominal protection discussed above. As a consequence of the cascading tariff structure, ERP estimates for finished goods like agro-processing products, textiles, and leather products are likely to be higher than those for intermediate products (e.g. chemical and petroleum products, machinery, metal products). Measured by the coefficient of variation (CV) of ERP estimates, the degree of ERP dispersion seems to be more or less unchanged. The CV of ERP estimates during the period 1999 and 2006 was in a narrow range between 199-218 per cent. The rank correlation coefficients of ERP estimates, which indicate a change in the industry ranking according to the level of protection, are 38 and 59 per cent during the period 1999–2003 and 2003–06, respectively. Hence, the increasing rank correlation implies that industries which were granted high protection in 1999 are likely to be subject to high protection in the following years. Finally, any interpretation of ERP estimates of consumer goods and motor vehicles in Table 2 requires caution. The figure represents average protection across a wide range of manufacturing products, covering consumer goods, electrical appliances, auto parts and motor vehicles, some of which were recently subject to low tariffs. For example, *ERP* estimates of electrical appliances were around 9-10 per cent (Table 2). Most auto parts were recently subject to tariff rates of less than 10 per cent (Kohpaiboon, 2007).

[4] With uniform tariff rates across all sectors, the nominal and effective tariff rates are equal. For example, there is no need to estimate effective rates of protection for the Chilean economy, because that country has a uniform import duty (8 percent) across all sectors.

As illustrated in Appendix 1, the industry's profitability measured by price-cost margin exhibits a limited degree of variation.[5] It varies in a range between 0.46 and 0.99. Their corresponding coefficient of variation is about 13.1 per cent. The price-cost margin tends to be high in capital intensive industries as shown in Figure 1. Industries such as manufacturers of machinery for food, beverage and tobacco processing (ISIC 2925), manufacturers of malt liquors and malt (ISIC 1553), manufacturers of motor vehicles (ISIC 3410) and manufacturers of refined petroleum products (ISIC 2320) are the top among industries ranked by price-cost margin. In contrast, traditional labor intensive industries such as clothing, footwear and knitted fabrics are those whose price-cost margin is among the lowest. The simple correlation between price-cost margin and capital labor ratio is nearly 50 per cent. Nevertheless, there is no clear relationship between price-cost margin and the import penetration ratio as shown in the scatter plot (Figure 2).

Figure 1. Scattered Plot between Price-cost Margin and Capital-labor Ratio of Thai Manufacturing in 2006.



Note: See detail of variable measurement is fully discussed in the text.
Source: Author's Compilation from the 2006 industrial census.

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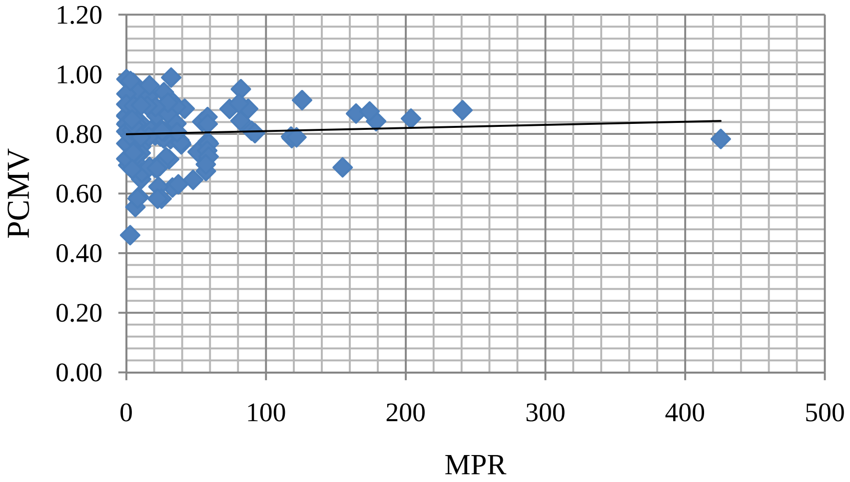
[5] Note that price-cost margin here is defined as the difference between output and cost as a ratio of value added. In some studies, price-cost margin is constructed as a per cent of output. Based on the performance in regression analysis in Section 5 below, the one as a ratio of value added is preferred here. See more detail in Section 5.

Figure 2. Scattered Plot between Price-cost Margin and Import Penetration Ratio of Thai Manufacturing in 2006



Note: See details of variable measurement fully discussed in the text.
Source: Author's Compilation from the 2006 industrial census

3. Analytical Framework

There has been an effort to explain the possibility of a positive relation between imports and domestic market power. For example, Geroski & Jacquemin (1990), Urata (1984) and Haubrich & Lambson (1986) attribute the sound positive relationship due to potential collusion between importers and domestic producers. Interestingly, Lopez & Lopez (1996) proposed an oligopolistic model illustrating that imports could have either a positive or negative effect on the price cost margin. Basically, there is a direct disciplining effect of imports on price cost margins by lowering domestic prices. In addition, the interaction between domestic and foreign firms could make the net effect either positive or negative.

The model is based on firm's profit maximization as follows;

$$\underset{q_i}{Max}\,\pi_i = P(Q,M)q_i - c(q_i) - f_i$$

where q_i =output of firm *I* in the domestic industry including MNE affiliates

$Q = \sum_{i=1}^{N} q_i$ = total domestic output

M = the level of imports

$c(q_i)$ = variable cost of production

f_i = fixed costs

The first order condition for profit maximization for firm *i* is;

$$\frac{\partial \pi_i}{\partial q_i} = q_i \frac{\partial P(Q,M)}{\partial q_i} + P - \frac{\partial c(q_i)}{\partial q_i} = 0$$

$$= q_i \left[\frac{\partial P}{\partial Q}\frac{\partial Q}{\partial q_i} + \frac{\partial P}{\partial M}\frac{\partial M}{\partial Q}\frac{\partial Q}{\partial q_i} \right] + P - MC = 0$$

$$= \frac{Pq_i}{Q}\frac{\partial Q}{\partial q_i}\left[\frac{\partial P}{\partial Q}\frac{Q}{P} + \frac{Q}{P}\frac{\partial P}{\partial M}\frac{\partial M}{\partial Q}\frac{M}{M} \right] + P - MC = 0$$

$$= P\theta_i \left[-\frac{1}{\eta} + \left(\frac{\partial M/M}{\partial Q/Q} \right)\left(\frac{\partial P/P}{\partial M/M} \right) \right] + P - MC = 0 \tag{1}$$

$$= P\theta_i \left[-\frac{1}{\eta} - \frac{\gamma}{\eta_M} \right] + P - \frac{\partial c(q_i)}{\partial q_i} = 0$$

$$\underbrace{\frac{P - MC}{P}}_{Lerner\ Index} = \theta_i \left[\frac{1}{\eta} + \frac{\gamma}{\eta_M} \right]$$

Differentiating Lerner index (i.e. price cost margin) with respect to imports we obtain

$$\frac{\partial LI}{\partial M} = \frac{\partial P}{\partial M} MC + \frac{\partial P}{\partial Q}\frac{\partial Q}{\partial M} MC - P\frac{\partial MC}{\partial Q}\frac{\partial Q}{\partial M} \tag{2}$$

The first term in Equation (2) is the direct effect of imports on the price cost margin. It is expected to be negative. This is referred by Lopez & Lopez (1996) to as the disciplining effect. It is the second and third terms, which make the net effect of imports on Lerner index ambiguous. The second term measures the response of domestic output to changes in imports. This can be either positive or negative, depending on the nature of interaction between domestic and foreign producers. When imports surge, domestic producers might keep their output unchanged. This term would be zero. If the latter increase their output, the second term will be positive. The last element in Equation 2 measures the effect on marginal cost as a consequence of change in total domestic output. As discussed, changes in imports can lead to changes in total domestic output. This could have an effect on the marginal cost, depending on the nature of return to scale of production function. All in all, the model proposed by Lopez & Lopez (1996) points to the ambiguous impact of imports on price cost margins.

The price-cost margin is the ratio of gross profits to output as expressed in Equation 3. Gross profit (or non-wage value added) is computed as the value of output minus inputs, and wages and salaries. Inputs include raw materials and intermediates. Alternatively, PCM can be measured as the ratio of value added (Dowrick, 1990) as in Equation (4). Since there is no strong theoretical suggestion in favor of one measure to the other, both are employed to examine the sensitivity of result to the PCM measures on the regression outcomes.

$$PCMQ = \frac{\text{Output-Input-Wage Compensation}}{\text{Output}} \quad (3)$$

$$PCMV = \frac{\text{Output-Input-Wage Compensation}}{\text{Value Added}} \quad (4)$$

As mentioned earlier, costs in both *PCM* measures are average costs instead of marginal costs. Hence, the general practice in the literature is to control by economies of scale in the profit equation (Neumann *et al.*, 1983). Since direct measures of economies of scale based on engineering data are not available, the widely used proxy, minimum efficient plant scale (MES) adjusted by the cost-disadvantage ratio (*CDR*), is employed (Caves *et al.*, 1975). The formula is in Equation 6. As argued by Davies (1980), both MES and concentration are estimated from the number and size distribution of plants in the industry, and thus are highly correlated with each other. This could create misspecification. Hence, interacting *CDR* with *MES* is needed to mitigate this somehow. The *CDR* ration attempts to proxy the slope of the average cost curve below the minimum efficient scale. In this way, the *MES* provides a floor for the number of efficient establishments only when the cost disadvantage of small plants is appreciable. If there is no cost disadvantage between large and small firms, the *CDR* term will equal one and *EOS* will equal zero.

$$EOS = (1 - CDR)\, MES \quad (5)$$

where $CDR = \dfrac{\left(VA/L\right)^S}{\left(VA/L\right)^L}$

$\left(VA/L\right)^S$ = average value added per labor of the smallest plants accounting for 50 per cent of industry output.

$\left(VA/L\right)^L$ = average value added per labor of the largest plants accounting for 50 per cent of industry output.

In addition, *EOS* itself can influence *PCM* with an ambiguous sign. On the one hand, it would be likely that firms in industries with the higher level of EOS would have more profitability so that the relationship with *PCM* would be positive. On the other hand, the sign could be negative. *EOS* variable, could to a certain extent, be a reflection of the likelihood for firms to reach a scale efficiency as it is the average plant size of the upper tail (the largest plants accounting for 50 per cent). In extreme cases where there is a single and large firm accounting for more than 50 per cent of total output, it is less likely for other firms to reach the same level of output as the large one. Hence, we might find a negative relationship. It would be true for domestic market-oriented industries. By contrast, for export-oriented industries with a larger market size, the effect of *EOS* on export-oriented firms would be positive. To test such a hypothesis, the interaction term between *EOS* and the industry's market orientation is introduced.

With regard to import penetration, three alternative measures are used in this study. The first is the traditional one, imports as a percent of domestic demand, output net of export plus import, expressed in Equation 6. As argued in Athukorala & Hazari (1988), such a formula might be biased in several circumstances. For example, for an industry in which export expansion has outpaced the increase in imports, the denominator dropped sharply, indicating the deterioration of international competitiveness. In fact the opposite has occurred. Another example is when a protected industry experiences export growth collapse, the denominator would increase remarkably and the ratio increased. The standard formula simply understates the loss of competitiveness.

According to Athukorala & Hazari (1988), it would be better to measure import penetration as the import as a ratio of gross output plus import as expressed in Equation 7.

$$TIMP_j = \frac{M_j}{O_j - X_j + M_j} \qquad (6)$$

$$AIMP_j = \frac{M_j}{O_j + M_j} \qquad (7)$$

where M_j = import value by industry *j*

O_j = value of gross output by industry *j*.

X_j = export value of industry *j*

The last alternative is a nominal rate of protection (*NRP*). Industries with high *NRP* are less subject to import threat. Cetaris paribus, firms operating in such industries might be more likely to set their price farther above marginal cost. Note that a measure of *NRP* used in this study is tariff incidence, the ratio between tariff revenue and total imports is at HS 6 digits so that the effect of any tariff exemption schemes are incorporated. The standard concordance is used to match HS and ISIC codes.

The role of imports becomes more complicated in the increasing importance of a global production network —the breakup of the production processes into geographically separated stages.[6] The increasing importance of a global production network would induce more international trade in parts and components so that the nature of imports would be different between finished goods and intermediates. To the best of our knowledge so far, there has not been any studies making such a distinction. To differentiate the impact of intermediate and finished goods imports, β_j is introduced. It is measured by the ratio of parts trade (the sum of imports and exports) to total goods trade. Parts list is a result of a careful disaggregation of trade data based on Revision 3

[6] In the recent literature on international trade an array of alternative terms have been used to describe this phenomenon, including 'international production fragmentation', 'vertical specialization', 'slicing the value chain, and 'outsourcing'.

of the Standard International Trade Classification (SITC, Rev 3) extracted from the United Nations trade data reporting system (UN Comtrade database).[7] It is important to note that the Comtrade database does not provide for the construction of a data series covering the entire range of fragmentation-based trade. The parts list used here is from what was developed in Athukorala & Kohpaiboon (2009) using lists of parts in the Board Economics Classification (BEC) 42 and 53 as a point to departure. Note that parts in BEC 211 are not included as they are primary products which are usually classified as traditional rather than fragmented-intermediates.[8] Additional lists of parts are included based on firm interviews in Kohpaiboon (2009). To convert SITC to ISIC, the standard concordance is used.

As suggested by empirical studies, there are other factors that can have a considerable influence on price-cost margin over and above imports. The first variable is the producer concentration. In this study, the sum of the top four firms' output (instead of sale) share (*CR4*) is used. Its rationale is based on the fact that sellers must be few enough to recognize their mutual interdependence in short-run pricing and long run investment decisions affecting quantity sold in the market. Hence, profit margins tend to be higher in those markets (other things being equal) where concentration is higher.[9] In addition, a small number of firms imply lower costs of forming and monitoring a cartel (Stigler, 1964). Many past studies of industrial organization (i.e. estimating profit function), incorporate the impact of foreign trade in measuring concentration (Kirkpatrick *et al.*, 1984: 79; Bird, 1999). Such practice seems inappropriate in the context of the current study as our prime focus is on the impact of foreign trade on price-cost margin. In addition, as postulated by the theory discussed above, it seems more plausible to distinguish them as two separate explanatory variables.

However, the statistical relationship between concentration and price-cost margin is rather weak and sensitive to the choice of specification, country of interest, period

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[7] For details on the decomposition procedure, see Athukorala (2006). The list of parts and components is available on request.

[8] See further discussion between traditional and fragmentation-based intermediates in Spencer (2005) and Helpman (2006).

[9] There are numerous studies (e.g. Saving, 1970; Cowling & Waterson, 1976; Enbcaoua & Jacquemin, 1980; Clarke & Davies, 1982; Neumann *et al.*, 1983) that have derived profit maximizing expressions relating profits with measures of concentration.

coverage, and estimation technique (Bird, 1999). For example, de Melo and Urata (1986) found a significant association between concentration and profits in their post-trade liberalization equation, but not in their pre-trade liberalization equation. Jacquemin *et al.* (1980) could not find a significant relationship between unadjusted concentration and profits for Belgian manufacturing.

Industry output growth (OG_j) is the second variable incorporated in the model. Generally, actual growth is positively correlated with deviations of actual from expected growth, and hence positively correlated with windfall profits (losses). While we would expect a positive relationship between industry growth and price-cost margin, it can run opposite. The negative relation between profits and growth may exist if growth attracts rapid entry (Caves *et al.*, 1980). In addition, several oligopolistic models show that the impact of growth on profits is different between high and low concentrated industries (Green & Porter, 1984; Rotemberg and Saloner, 1986; Haltiwanger & Harrington, 1991; Stålhammer, 1991) OG_j is measured by the annual growth of gross output between 2000 and 2006 according to the following formula;

$$\ln X_{jt} = \alpha + OG_j t + u_t \quad (8)$$

where X_{jt} =gross output of industry *j* at time t

The third variable is the role of foreign firms. Again, it's theoretically postulated impact on price-cost margin is ambiguous due to the complexities involved in the relationship between FDI and industry performance in developing economies (Caves, 2007). The entry of MNEs increases the degree of competition in host countries suggesting a negative relationship between MNEs and industry profits. On the other hand, MNE affiliates are relatively large and more productive than locally non-affiliated firms. This is especially true in the context of developing countries (Lall, 1978; Ramstetter, 1991). The positive relationship between MNEs and price-cost margin can be expected in several circumstances. For example, their entry could simply raise an industry's weighted average profit rate as there are additional and more productive firms in host countries. With relatively more productivity they can create additional barriers or compound existing barriers, and thereby reduce competitive pressures in domestic industries. Over and above, the relation between price-cost margin and MNEs will be complicated because of the presence of MNEs' transfer pricing practices (Bird, 1999).[10] Foreign firm (FOR) is measured by the output share of foreign firms to total industry.

To estimate the foreign presence, the ratio of sales of foreign firms to total sales (local and foreign) is measured. All plants with foreign shares greater than 10 per cent are considered to be foreign firms for the identification of local firms. In addition, the impact of MNEs on price-cost margin could be different among home countries. In this study we test the hypothesis by making a distinction of foreign firms into three groups, the first world MNE (*FWMNE*), Third World MNEs including Hong Kong, Taiwan, Korea and Singapore (*TWMNE*), and others.

Finally, while it has been generally recognized that import competition could have a significant impact on domestic industry profitability, Caves (1974) argued that firm-specific factors like size, degree of capital intensity, market orientation and ownership may also play a significant role. All in all, to test the import-as-market discipline hypothesis, equation 9 is employed;

$$\begin{aligned} PCM_{ij} &= \alpha_0 + \alpha_1 IMP_j + \alpha_2 \beta_j * IMP_j + \alpha_3 OG_j + \alpha_4 CR_j + \alpha_5 FOR_j + \alpha_6 EOS_j \\ &\quad + \alpha_7 XOR_j * EOS_j + \gamma_1 size_{ij} + \gamma_2 mkt_{ij} + \gamma_3 \left(\frac{K}{L}\right)_{ij} + \gamma_4 for_{ij} + \varepsilon_{ij} \end{aligned} \tag{9}$$

where PCM_{ij} = price-cost margin of establishment *i* in industry *j*; measured by two alternatives as expressed in Equations 3 and 4 above.

Industry-specific Explanatory Variables

IMP_j (+/-) = import penetration ratio of industry *j*: measured by three alternative measures as discussed above

β_j (+)= degree of presence of the global production network

j: measured by a share of part to total imports.

[10] Caves (2007: 225-7) showed that unless tax minimization is curtailed by other constraints such as avoiding tariffs, MNCs have an incentive to use transfer prices to the maximum extent to place profits in the low-tax jurisdictions.

OG_j (+/-) = annual output growth of industry *j* between 2000 and 2006 using the formula in Equation 8

CR_j (+/-) = producer concentration of industry *j*.

EOS_j (-) = economies of scale of industry *j* measured according to Equation 5

XOR_j (-) = the industry *j*'s export orientation

FOR_j (+/-) = Share of foreign firms in industry *j*

Establishment-specific Explanatory Variables

$size_{ij}$ (+) = size of establishment *i of industry j,* proxied by gross output at 4-digit ISIC

mkt_{ij} (-) = market orientation of establishment *i of* industry *j.*

$\left(\frac{K}{L}\right)_{ij}$ (+) = capital-labor ratio of establishment *i of* industry *j.*

for_{ij} (+/-) = foreign ownership of establishment *i* of industry *j*

ε_{ij} = A stochastic error term, representing the other omitted influences.

(The theoretical expected signs in parentheses)

4. Data

Data for the study are compiled from unpublished returns to the Industrial Census 2006, the latest industrial census available, conducted by the National Statistics Office (NSO). A well-known limitation of the cross-sectional data set with each industry representing a single data point is that they make it difficult to control for unobserved industry specific differences. Long-term averages tend to ignore changes that may have occurred over time in the same country. These limitations can be avoided by using the panel data set compiled by pooling cross-industry and time-series data. Particularly, in the nature of technology spillover that involves a time-consuming process, panel data are more appropriate. Unfortunately, given the nature of data availability in this case, this preferred data choice is not possible. So far there are two industrial census sets, i.e. 1996 and 2006, both are establishment-level data. Even though both of them provide establishment identification numbers, the number is not assigned systematically. For a given ID No., an establishment in 1996 is not necessarily the same as that in 2006.

The census covers 73,931 plants, classified according to four-digit industries of International Standard of Industrial Classification (ISIC). The census was cleaned up by firstly checking duplicated samples. As occurred in the 1996 industrial census, there are some duplicated records in the survey return, presumably because plants belonging to the same firm filled the questionnaire using the same records. The procedure that was introduced to deal with this problem was to treat the records that reported the same value of the eight key variables of interest in this study as one record. The eight variables were, registered capital, number of male workers, number of female workers, sales value, and values of (initial and ending periods) capital stocks, value of intermediates and initial stock of raw materials. There are 7,992 such cases so that the final sample dropped to 65,940 plants.[11] In addition, we deleted establishments which had not responded to one or more of the key questions such as sales value, output and which had provided seemingly unrealistic information such as negative output value or the initial capital stock of less than 5,000 baht (less than $200).[12]

The 2006 census contains a large number of micro-enterprises defined as the plants with less than 10 workers. There are 39,152 samples which employ less than 10 workers, out of which 52 per cent are micro enterprises which do not hire paid workers (zero paid workers). The problem of self-employed samples is less severe when considering the samples with more than 10 workers (1,623 samples out of 26,788).

[11] For robustness check, we alter the criteria from 8 to 7 variables (excluding initial raw materials), the number of duplicated samples slightly increase to 8,067 samples. Hence, we strict with our initial criteria to maintain as much samples as possible in our analysis.

[12] If we alter to 10,000 baht the number to be dropped increased to 1,289 samples (another 500 samples dropped).

Hence, our analysis focuses on samples with more than 10 workers net of self-employed firms. 7 industries that are either to serve niches in the domestic market (e.g. processing of nuclear fuel, manufacture of weapons and ammunition), in the service sector (e.g. building and repairing of ships, manufacture of aircraft and spacecraft, and recycling) or explicitly preserved for local enterprises (e.g. manufacture of ovens, furnaces and furnace burners, manufacture of coke oven products) are excluded. All in all, these remaining established plants accounted for 75 percent of Thailand's manufacturing gross output and 62% of manufacturing value added in 2006.

Gross output and its corresponding price deflators are from the National Economics and Social Development Board (NESDB). The annual growth rate is based on gross output at a constant price (1988). Trade data are compiled from the UN Comtrade and the standard concordance between ISIC and HS is used. The nominal rate of protection is freshly calculated in this study based on official data provided by Customs Duty, Ministry of Finance. *CR4* is obtained from Kophaiboon & Ramstetter (2008) in which the concentration is measured at the more aggregate level (e.g. many were measured at 4-digit whereas some at the 3-digit ISIC classification) to guard against possible problems arising from the fact that two reasonably substitutable goods are treated as two different industries according to the conventional industrial classification at a high level of disaggregation. Tables 3 and 4 provide a statistical summary as well as a correlation matrix of all relevant variables in this analysis.

Table 3. Statistics Summary of Variables

Variable	Mean	Std. Dev.	Min	Max	CV
$PCMV_{ij}$	0.43	0.47	-5.61	15.02	107.0
$PCMQ_{ij}$	0.23	0.27	-5.09	3.82	121.1
$\left(\frac{K}{L}\right)_{ij}$	11.73	1.93	4.37	20.32	16.4
$size_{ij}$	15.85	3.63	0.00	26.36	22.9
mkt_{ij}	1.18	0.38	1.00	2.00	32.4
IMP_j	0.18	0.17	0.00	0.62	95.4
$TIMP_j$	0.375	0.286	0.00	0.69	241.3
CR_j	0.46	0.10	0.32	0.69	21.0
for_{ij}	4.96	18.89	0.00	100.00	381.1
β_j	0.10	0.19	0.00	1.00	196.5
OG_j	0.06	0.07	-0.18	0.31	108.9
EOS_j	20.68	1.32	16.08	26.15	6.4
FOR_j	18.90	15.86	0.00	84.76	83.9
NRP_j	0.07	0.05	0.00	0.25	72.2

Source: Author Compilation.

Table 4. Correlation Coefficient Matrix

	$PCMQ_{ij}$	$PCMV_{ij}$	NRP_j	$HAIMP_j$	NRP_j	β_j	$(k/l)_{ij}$	$size_{ij}$	for_{ij}	mkt_{ij}	CR_j	FOR_j	OG_j
$PCMQ_{ij}$	1.0												
$PCMV_{ij}$	0.5	1.0											
$TIMP_j$	0.1	0.1	1.0										
$HAIMP_j$	0.1	0.1	0.4	1.0									
NRP_j	-0.1	-0.1	-0.2	-0.2	1.0								
β_j	0.1	0.1	0.2	0.3	0.1	1.0							
$(k/l)_{ij}$	0.3	0.4	0.2	0.2	-0.2	0.1	1.0						
$size_{ij}$	0.3	0.4	0.2	0.2	-0.1	0.2	0.6	1.0					
for_{ij}	0.0	0.1	0.1	0.2	0.0	0.2	0.2	0.3	1.0				
mkt_{ij}	0.1	0.1	0.1	0.1	0.0	0.2	0.2	0.5	0.4	1.0			
CR_j	0.0	0.0	-0.2	-0.1	0.1	0.2	0.1	0.0	0.0	0.0	1.0		
FOR_j	0.1	0.1	0.2	0.4	-0.1	0.5	0.1	0.2	0.3	0.2	0.0	1.0	
OG_j	0.1	0.1	0.3	0.0	0.0	0.2	0.2	0.1	0.1	0.0	0.0	0.3	1.0
EOS_j	0.0	0.0	0.0	0.1	-0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.4	0.1

Source: Author Compilation.

5. Econometric Procedures and Results

5.1. Econometric Procedures

Initially, the equations are estimated using the ordinary least squares (OLS) method while paying attention to the possible presence of outliers. Due to the nature of cross-sectional data, it is likely that outliers could impact on and mislead the estimated parameters and therefore the careful treatment of outliers is needed. Cook's Distance[13] is used to identify suspected outliers. Results included and excluded Cook's Distance-identified outliers that are different in terms of overall fitness and statistical significance in a few variables (Table 5). In some cases, the sign of estimated coefficients (e.g. export-output ratio in *PCMV*) seems counter-intuitive. Therefore, the preferred choice of our samples is those without outliers identified by Cook's Distance. Table 5 also illustrates results based on two alternative measures of *PCM*. While both results are similar to a great extent, *PCMV* (i.e. value-added denominator) seems to outperform *PCMQ*, based on their performance on overall fits (adjusted R^2). While, regression results are also not sensitive to choices of import penetration ratio measurements, H-A MPR is our preferred measurement in the paper because of data inconsistency between gross output and export, i.e. there are many cases where traditional MPR turns out to be negative.[13] Our following discussion is based on *PCMV* and H-A MPR as the measure of price-cost margin and import penetration ratio, respectively.

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[13] In our estimation, there are 23 industries (out of 125 industries) when the export figure by far exceeds the output one and traditional MPR turns to be negative. To overcome the negative figure, we assume that export equals to output and traditional MPR equals to 100 per cent. The problem becomes less severe when H-A MPR is calculated.

Table 5. Regression Results with and without Outlier Samples

5.1. *PCMQ* (Price-cost as a Per cent of Gross Output)

	Included Outliers		Excluded Outliers		Excluded Outliers	
	H-A MPR		H-A MPR		Traditional MPR	
	Coefficient	*t-stat*	Coefficient	*t-stat*	Coefficient	*t-stat*
$(k/l)_{ij}$	0.027***	*22.41*	0.0309***	*44.42*	0.0308***	*44.29*
$Size_{ij}$	0.022***	*18.45*	0.0109***	*16.86*	0.0107***	*16.64*
mkt_{ij}	-0.033***	*-6.32*	-0.0165***	*-5.05*	-0.0161***	*-4.96*
for_{ij}	-0.001***	*-6.62*	-0.0005***	*-7.92*	-0.0005***	*-8.18*
FOR_j	0.0003***	*2.15*	0.0005***	*5.11*	0.0004***	*4.4*
MPR_j	-0.008***	*-0.48*	-0.0111*	*-1.19*	0.0056	*1.12*
$MPR_j * \beta_j$	-0.011	*-0.38*	-0.0336*	*-1.56*	0.0038	*0.33*
CR_j	0.051***	*2.44*	0.0744***	*5.56*	0.0713***	*5.29*
OG_j	0.247***	*7.22*	0.2613***	*13.07*	0.2521***	*12.03*
EOS_j	-0.006***	*-4.75*	-0.0075***	*-8.36*	-0.0073***	*-8.14*
$EOS_j * XOR_j$	0.001***	*2.07*	0.0012***	*3.95*	0.0008***	*2.77*
Intercept	-0.322***	*-10.52*	-0.1801***	*-9.21*	-0.1796***	*-9.1*
F-stat	130.9	(p=0.00)	317.59	(p=0.00)	316.41	(p=0.00)
Adj-Rsq	0.11		0.2021		0.202	
# obs	24572		23172		23172	

5.2. *PCMV* (Price-cost as a Per cent of Value Added)

	Included Outliers		Excluded Outliers		Excluded Outliers	
	H-A MPR		H-A MPR		Traditional MPR	
	Coefficient	*t-stat*	Coefficient	*t-stat*	Coefficient	*t-stat*
$(k/l)_{ij}$	0.0889***	*35.45*	0.0392***	*35.93*	0.0392***	*35.6*
$Size_{ij}$	-0.0475***	*-13.94*	0.0473***	*47.61*	0.0473***	*47.89*
mkt_{ij}	0.1309***	*15.71*	-0.0531***	*-11.87*	-0.0536***	*-11.93*
for_{ij}	0.0004***	*3.3*	-0.0006***	*-7.66*	-0.0007***	*-7.87*
FOR_j	0.0009***	*4.14*	0.0003*	*1.78*	0.0003**	*2.07*
MPR_j	0.0413**	*1.96*	0.037***	*2.53*	0.0263***	*3.54*
$MPR_j * \beta_j$	0.1429***	*2.97*	-0.103***	*-3.44*	-0.0411**	*-2.56*
CR_j	-0.0797**	*-2.26*	0.132***	*6.83*	0.1323***	*6.72*
OG_j	0.0684*	*1.46*	0.227***	*7.55*	0.1815***	*5.85*
EOS_j	-0.0009	*-0.43*	-0.007***	*-5.17*	-0.0060***	*-4.72*
$EOS_j * XOR_j$	-0.0035***	*-5.03*	0.001**	*2.25*	0.0010**	*2.32*
Intercept	0.0442	*0.87*	-0.72***	*-27.21*	-0.7355***	*-27.42*
F-stat	125.580	(p=0.00)	451.16	(p=0.00)	449.91	(p=0.00)
Adj-Rsq	0.138		0.3052		0.305	
# obs	24696.0		23044		23044	

Notes: t-stat reported is based on robust standard error; ***, **, and * indicate the significant level at 1, 5 and 10 percent, respectively.
Source: Author's estimates.

To ensure the estimates and their corresponding statistics are not affected by a clustered observation, analysis-of-variance (ANOVA) models on *PCM* in each industry is undertaken. The intra-class correlation is 0.01 so that we cannot reject the hypothesis that each observation is completely independent.[14] In addition, the quantile regression estimates are reported as a robustness check against any possible effect of outliers on the estimates. As seen in Table 6, estimated coefficients are virtually insensitive to each subgroup of plants.

[14] ANOVA is conducted for PCM and output levels. The intra class correlation is also low at about less than 0.1.

Table 6. OLS and Quantile Regression-PCM2 = Price-cost as a Percent of Value Added

	25 Percentile		75 Percentile		Median		OLS	
	Coefficient	*t-stat*	Coefficient	*t-stat*	Coefficient	*t-stat*	Coefficient	*t-stat*
$(k/l)_{ij}$	0.0503	*55.6*	0.0436	*59.2*	0.0299	*50.0*	0.0392	*35.9*
$Size_{ij}$	0.0454	*52.6*	0.0391	*58.1*	0.0325	*62.1*	0.0473	*47.6*
mkt_{ij}	-0.0529	*-12.9*	-0.0462	*-13.3*	-0.0406	*-13.9*	-0.0531	*-11.9*
for_{ij}	-0.0006	*-7.4*	-0.0006	*-8.7*	-0.0005	*-8.7*	-0.0006	*-7.7*
FOR_j	0.0004	*3.5*	0.0003	*3.2*	0.0002	*1.9*	0.0003	*1.8*
MPR_j	0.0337	*2.7*	0.0163	*1.7*	-0.0016	*-0.2*	0.0365	*2.5*
$MPR_j * \beta_j$	-0.1370	*-4.8*	-0.0988	*-4.2*	-0.0913	*-4.9*	-0.1034	*-3.4*
CR_j	0.1205	*7.2*	0.0963	*6.9*	0.0854	*7.6*	0.1320	*6.8*
OG_j	0.2633	*10.4*	0.2538	*11.9*	0.1768	*10.0*	0.2266	*7.6*
EOS_j	-0.0076	*-6.3*	-0.0079	*-8.0*	-0.0057	*-7.2*	-0.0066	*-5.2*
$EOS_j * XOR_j$	0.0007	*1.8*	0.0016	*5.2*	0.0021	*8.5*	0.0010	*2.3*
Intercept	-0.8717	*-33.4*	-0.5743	*-27.2*	-0.2525	*-15.2*	-0.7210	*-27.2*
Adj- R^2	0.3234		0.2846		0.2064		0.3052	

Notes: t-stat reported is based on robust standard error; R^2 in the cases of quantile regression is Pseudo R^2; ***, **, and * indicate the significant level at 1,5 and 10 percent, respectively.
Source: Author's estimates.

5.2. OLS Results with Robustness Tests of Variable Measurement

The following discussion in this subsection will be based on OLS estimates. Coefficients corresponding to the firm-specific factors such as capital-labour ratio, size and market orientation reached theoretical expected signs in all specifications. The positive coefficients corresponding to the capital-labour ratio and firm size proxied by output , suggest that more capital intensive and relatively large plants tend to have a price-cost margin. The price-cost margin of export-oriented firms tended to be squeezed as opposed to domestic-oriented ones. On average, the former *PCM* was 5 per cent lower than the latter. To check robustness of the plant's market orientation which is currently the binary dummy (1 = export; 0 otherwise), the actual export-output ratio of plants is used and its corresponding regression outcome is in Table 7's Column 7.2. Basically, the result is not sensitive to choices of the plant's market orientation. The higher the export-output ratio the closer the price-cost margin.

Table 7. OLS Regression with Sensitivity Analysis

	7.1 Baseline		7.2 Firm Export Orientation		7.3 Foreign Ownership		7.4 Nominal Protection		7.5 Multinationals	
	Coefficient	*t-stat*	Coefficient	*t-stat*	Coefficient	*t-stat*	Coefficient	*t-stat*	Coefficient	*t-stat*
$(k/l)_{ij}$	0.039***	*35.9*	0.039***	*35.8*	0.039***	*35.9*	0.039***	*35.8*	0.039***	*35.9*
$Size_{ij}$	0.047***	*47.6*	0.046***	*48.5*	0.048***	*47.6*	0.047***	*47.3*	0.05***	*47.5*
mkt_{ij}	-0.053***	*-11.9*			-0.05***	*-11.5*	-0.052***	*-11.7*	-0.05***	*-11.9*
$mkt1_{ij}$			-0.001***	*-9.9*						
for_{ij}	-0.001***	*-7.7*	-0.001***	*-8.4*			-0.001***	*-8.2*	-0.001***	*-7.7*
$develop_{ij}$					-0.06***	*-7.4*				
$otherfor_{ij}$					-0.001***	*-5.1*				
FOR_j	0.0003**	*1.8*	0.0003**	*2.0*	0.0003*	*1.8*	0.0001	*0.4*		
$FWFOR_j$									0.0002	*1.3*
$TWFOR_j$									0.001*	*1.7*
MPR_j	0.037**	*2.5*	0.03**	*2.1*	0.037***	*2.5*			0.037***	*2.5*
$\beta_j * MPR_j$	-0.103***	*-3.4*	-0.1***	*-3.3*	-0.11***	*-3.5*			-0.11***	*-3.5*
NRP_j							-0.15***	*-3.5*		
$\beta_j * NRP_j$							0.06	*0.6*		
CR_j	0.132***	*6.8*	0.14***	*7.1*	0.13***	*6.9*	0.13***	*6.4*	0.13***	*6.6*
OG_j	0.23***	*7.6*	0.23***	*7.6*	0.23***	*7.6*	0.22***	*7.1*	0.23***	*7.5*

(Table 7. *Continued*)

	7.1 Baseline		7.2 Firm Export Orientation		7.3 Foreign Ownership		7.4 Nominal Protection		7.5 Multinationals	
	Coefficient	*t-stat*	Coefficient	*t-stat*	Coefficient	*t-stat*	Coefficient	*t-stat*	Coefficient	*t-stat*
EOS_j	-0.007***	*-5.2*	-0.01***	*-5.5*	-0.007***	*-5.1*	-0.01***	*-5.4*	-0.01***	*-4.8*
$EOS_j * XOR_j$	0.001**	*2.3*	0.001**	*2.1*	0.001**	*2.3*	0.002***	*4.7*	0.001**	*2.2*
constant	-0.721***	*-27.2*	-0.7463***	*-28.1*	-0.7266***	*-27.4*	-0.69***	*-24.8*	-0.72***	*-27.2*
Adj- R^2	451.16		454.75		432.25		453.13		443.43	
F-stat	0.3052		0.3042		0.3055		0.3053		0.3052	
# obs	23044		23044		23044		23044		23044	

Notes : $mkt1_{ij}$ = actual export-output ratio of plant *i* in industry *j; $develop_{ij}$ = binary dummy (1= foreign from developed country and 0 otherwise);* $otherfor_{ij}$ = binary dummy (1= foreign from non-developed country and 0 otherwise) $FWFOR_j$ = *Presence of MNEs from the first world;* $TWFOR_j$ = *Presence of MNEs from the third world*; NRP_j = nominal rate of protection measured as discussed in the text; t-stat reported is based on robust standard error; ***, **, and * indicate the significant level at 1, 5 and 10 percent, respectively.

Source: Author's estimates.

Another debate on firm-specific variables is related to the plant's ownership (*for*). Currently, the plant's ownership is binary dummy variable, i.e. 1 for plants with foreign equity share exceeding 10 per cent and 0 otherwise. The corresponding coefficient turns out to be negative. Arguably, the nationality of foreign partners does matter to the plant's performance. Direct investment from firms in developed countries might behave differently from multinationals elsewhere. The former might bring more advanced technology so that it would positively affect the plant's performance. It is possible to observe the negative signs due to the transfer pricing practice employed by the former which has a relatively large network and long established in cross-border investment as opposed to the latter. To do so, the alternative binary dummy variable (*developed*) is introduced. That is, if plants are owned by firms in developed countries, *developed* is equal to one. Foreign firms from other countries are measured by *otherfor* whereas the locally owned firm remained the controlled group in this experiment. As presented in Column 7.3 of Table 7, the coefficients associated to *develop* and *otherfor* are both negative, consistent with the estimation outcome in Column 7.1. The former's estimated coefficient is much larger than that associated with the latter. All other things being equal, the found and relatively large coefficient in the former is transfer pricing practice used in multinational enterprises from the first world.

Coefficients corresponding to industry-specific factors such as output growth, and concentration tend to be in line with theory postulation. Since 'producer' concentration is used in this study, the positive relationship between concentration and *PCMV* reflect the effect of all forms of entry barriers at the industry level that might exist. The positive estimate associated with output growth suggests that while rapid output expansion could induce more firms to join, the negative sign corresponding to OG_j suggests that it would take time for firms to enter and catch up the emerged business opportunity.

In regard to imports as a market discipline hypothesis, the relationship between PCM and import penetration is not linear as hypothesized earlier. It is conditioned by the nature of imported goods. The coefficient corresponding to the import penetration ratio turns out to be positive whereas that related to the proportion of imported parts (β_j) proves to be negative, both of which are statistically significant at 1 per cent. For final goods, i.e. goods that are not really tailored made for any specific use[15], there is a positive relation between *PCMV* and *IMP*. This reflects economic ideology in tariff policy making in Thailand. The main theme in tariff policy making in Thailand is that tariffs of goods in which there are none or few local producers and are upstream industries, are likely to be low or even zero. In some cases, they are eligible for tariff exemption schemes to promote production efficiency of downstream industries. Hence, their corresponding import penetration tends to be high. Such goods are likely to be under the non-competitive environment. Hence, their price-cost margin would be higher than other goods. In addition, as mentioned earlier there are few domestic producers, these producers are unlikely to increase output in response to import increases.

In contrast, imports of parts and components are the reflection of the extent to which a given industry participates in the global production sharing. Under the global production network, each country specializes in different slices (different tasks) of the production process determined by their relative cost advantage and other relevant economic fundamentals. This is done to enhance the competitiveness of products at the end of the value chain. Hence, imports of parts and components tend to have a relatively stronger discipline effect on the price-cost margin. The greater the degree of reliance on imported parts, the more the intense global competition passes through. Hence, the price-cost margin would be lower as opposed to final good imports. In order to illustrate result robustness, import penetration is replaced by a nominal rate of protection. Only the coefficient corresponds to *NRP* which is statistically significant at the one per cent level. The interaction term with beta is not significant at an acceptable level (i.e. 10 per cent) although their signs are in line with the result based on *IMP*.

Another interesting finding is the role of *EOS* in profitability function. The coefficient corresponding to *EOS* is negative and statistically significant at the one per cent level. This seems to contradict the general expectation of a positive relationship

[15] For example, general machines such as stamping machines, forklift, cranes, are final goods whereas specific ICs and/or semi-conductors jointly designed between Solicica and Panasonic (Japan) are parts and components.

between *EOS* and PCM.[16] Interestingly, the interaction term between *EOS* and *XOR* turns out to be positive and significant at the one per cent level. For the entire domestic oriented industry (*XOR*=0), the negative coefficient associated with *EOS* implies the difficulty for individual plants in a given industry to reach economies of scale. Hence, the price-cost margin of plants in that industry would be smaller. Interestingly, when some portion of output is for export, the likelihood of a given plant to reach economies of scale becomes larger (Table 7). To elaborate on this hypothesis, total samples are separated into two subgroups. Equation 9 is re-estimated without mkt_{ij} and the interaction term between *EOS* and *XOR*. The corresponding regression results are reported in Table 8 (Column 8.1). Generally, they support the above hypothesis. That is, in a subgroup of non-exporting firms, the coefficient corresponding to *EOS* variable turns out to be negative and statistically significant at one per cent. By contrast, *EOS* in a subgroup of exporting firms is positive and different from zero significantly. In addition, other variables become more intuitive. The obvious one is the annual growth of domestic output variable which is statistically significant only in the non-exporting firm subgroup only. Other variables seem to be consistent with our discussion so far and those related to the market discipline hypothesis.

5.3. Simultaneity Problem

Lack of bias in and consistent OLS estimates rest on the assumption that the explanatory variables are uncorrelated with the stochastic disturbance terms. This assumption becomes invalid for any individual equation in a system of equations whenever at least one of the explanatory variables of that equation is jointly-determined and making the use of OLS inappropriate. In our case, it is arguable that *MPR* and *CR4* can be affected by *PCM*. In this circumstance, the alternative estimators devised to be used in this situation fall into two main categories: system methods and single-equation methods. The system methods, of which three-stage least squares (3SLS) and full-information maximum likelihood (FIML) are best known, are superior to the single-

[16] When industries exhibit relatively high level of EOS, firms would operate in less competitive environment and experience wider price-cost margin.

equation methods in terms of efficiency of the estimates. 2SLS and 3SLS estimates are equivalent asymptotically (Wooldridge 2002: pp.199).

Table 8. Regression Analysis with Alternative Estimations

8.1. Sub-group 1: Domestic-oriented Plants

	OLS		2SLS		3SLS	
	Coefficient	*t-stat*	Coefficient	*t-stat*	Coefficient	*t-stat*
$(k/l)_{ij}$	0.039***	*31.77*	0.039***	*32.31*	0.04***	*32.81*
$Size_{ij}$	0.051***	*45.59*	0.051***	*45.03*	0.05***	*45.31*
for_{ij}	-0.001***	*-6.6*	-0.001***	*-4.95*	-0.0009***	*-5.01*
FOR_j	0.0004***	*2.67*	0.0002	*1.11*	0.0002*	*1.24*
MPR_j	0.04***	*2.64*	0.082***	*3.06*	0.07***	*3.07*
$MPR_j * \beta_j$	-0.097**	*-2.4*	-0.101**	*-2.13*	-0.09*	*-1.86*
CR_j	0.123***	*5.65*	0.130***	*5.58*	0.028***	*0.85*
OG_j	0.225***	*6.55*	0.251***	*6.62*	0.22***	*6*
EOS_j	-0.007***	*-4.86*	-0.007***	*-4.19*	-0.0054***	*-3.22*
Intercept	-0.81***	*-26.3*	-0.81***	*-23.4*	0.33***	*105.4*
Adj- R^2	0.3092		0.3080		0.0379	
#obs	18778		18778		18778	

8.2. Sub-group 2: Export-oriented Plants

	Coefficient	*t-stat*	Coefficient	*t-stat*	Coefficient	*t-stat*
$(k/l)_{ij}$	0.028***	*11.99*	0.03***	*10.54*	0.028***	*10.72*
$Size_{ij}$	0.028***	*11.59*	0.03***	*13.7*	0.028***	*13.76*
for_{ij}	-0.0002**	*-2.23*	-0.0003***	*-2.41*	-0.0002**	*-2.38*
FOR_j	-0.0003*	*-1.3*	-0.0003*	*-1.4*	-0.0004*	*-1.46*
MPR_j	0.1***	*5.62*	0.11***	*3.02*	0.13***	*4.09*
$MPR_j * \beta_j$	-0.09***	*-2.07*	-0.07*	*-1.34*	-0.09*	*-1.63*
CR_j	0.06*	*1.4*	0.06*	*1.38*	0.07*	*1.17*
OG_j	0.06*	*1.03*	0.05	*0.86*	0.06	*1*
EOS_j	0.006**	*2.19*	0.006**	*2.04*	0.006*	*1.8*
Intercept	-0.54***	*-9.47*	-0.54***	*-8.6*	-0.53***	*-8.5*
Adj- R^2	0.1303		0.1257		0.1298	
#obs	4266		4266		4266	

Notes: 2SLS = Two-stage Least Square Estimation; export-output ratio is used as an instrument for import penetration ratio as their simple correlation exceeds 50 per cent and producer concentration industry *j*'s instrument variable is its corresponding conglomerate share defined as share of local entrepreneurs which own more than one firm (with different company's name); 3 SLS = Three-stage Least Square Estimation; The other two equations are defined as follows;

$$CR_j = \alpha_0 + \alpha_1 \left(k/l\right)_{ij} + \alpha_2 CONG_j + \alpha_3 FOR_j + \alpha_3 OI_j + \varepsilon_{ij}$$

$$MPR_j = \beta_0 + \beta_1 XOR_j + \beta_2 NRP_j + \gamma_{ij}$$

For OLS, *t*-stat reported is based on robust standard error; ***, **, and * indicate the significant level at 1, 5 and 10 percent, respectively; for 3SLS t-stat is Z-value.

Source: Author's estimates.

To guard against the possible effect of the simultaneity problem, Equation 9 without mkt_{ij} and the interaction term between *EOS* and *XOR* is estimated by 2SLS and 3SLS. Results are reported in Table 8. Note that in general, the results are in line with OLS estimates discussed above. The effect of imports on price-cost margin is conditioned by types of imports. Parts and components imports have greater disciplining effect as opposed to final goods imports. *EOS* seems to have a positive effect for the export-oriented firms. For domestic-oriented firms, *EOS* is a reflection of difficulties for an individual plant to reach the minimum efficiency scale.

6. Conclusions and Policy Inferences

This paper examines the imports-as-market discipline hypothesis, using Thai manufacturing as a case study. The latest industrial census (2006 census) is employed. The paper's novel feature is to incorporate and examine the possible effect of product fragmentation phenomenon on the relationship between imports and the price-cost margin. The key finding is that the relationship between imports and the price-cost margin is not unique. For final goods imports, a positive relationship between the price-cost margin and imports was found. The higher the proportion of imported parts, the closer the gap between price and marginal cost. This also implies higher efficiency in resource allocation. In addition, for a small domestic market such as Thailand, it would be difficult for individual plants to reach the industry's economies of scale. Export-oriented firms are in a better position to benefit economies of scale.

The key policy inference is the relative importance of international trade acting as a market discipline. Even though not all kinds of imported goods would have a net discipline effect, participating in the global production network as well as outward market orientation could play a key role to promote efficient use of scarce resources. In addition, even in industries where economies of scale matter, an outward market orientation would increase the likelihood for firms/plants to benefit from it. Nonetheless, the analysis in this paper can be drawn from the cross-sectional analysis. It is under a rather restrictive assumption of long-run steady-state equilibrium. In fact, the effect of trade liberalization on mark-up might show up only in the short term. In the long term, entry/exit of firms or other endogenous response of firms might make the relationship between trade liberalization and mark-up disappear. This would be the paper's shortcoming and points for another research effort in the future where more appropriate data sets are available.

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Appendix 1. Data Appendix

ISIC	Description	Import Penetration Ratio (%)	Nominal Protection	Price-cost Margin a ratio of Value Added)	Capital-labor ratio (1000 baht/worker)
1511	Production, processing and preserving of meat and meat products	10.6	21.3	0.76	306.5
1512	Processing and preserving of fish and fish products	118.4	32.8	0.79	266.4
1513	Processing and preserving of fruit and vegetables	39.4	69.0	0.76	367.2
1514	Manufacture of vegetable and animal oils and fats	34.6	7.5	0.90	1243.6
1520	Manufacture of dairy products	13.8	4.7	0.92	637.9
1531	Manufacture of grain mill products	7.0	61.1	0.91	1013.2
1532	Manufacture of starches and starch products	3.7	4.8	0.90	1211.8
1533	Manufacture of prepared animal feeds	13.4	10.0	0.93	1393.6
1541	Manufacture of bakery products	38.0	36.3	0.78	446.7
1542	Manufacture of sugar	0.1	6.6	0.86	1582.0
1543	Manufacture of cocoa, chocolate and sugar confectionery	31.7	18.3	0.78	224.0
1544	Manufacture of macaroni, noodles, couscous and similar farinaceous products	4.3	39.1	0.77	265.3
1549	Manufacture of other food products n.e.c.	240.7	54.4	0.88	824.8
1551	Distilling, rectifying and blending of spirits; ethyl alcohol production from fermented materials	5.1	1.0	0.96	5004.5
1552	Manufacture of wines	9.9	4.0	0.84	518.8
1553	Manufacture of malt liquors and malt	0.2	0.5	0.98	6067.2
1554	Manufacture of soft drinks; production of mineral waters	0.5	31.6	0.84	2249.2

(Appendix 1. *Continued*)

ISIC	Description	Import Penetration Ratio (%)	Nominal Protection	Price-cost Margin a ratio of Value Added)	Capital-labor ratio (1000 baht/worker)
1600	Manufacture of tobacco products	3.4	1.8	0.92	581.6
1711	Preparation and spinning of textile fibers; weaving of textiles	203.8	97.1	0.85	731.7
1712	Finishing of textiles	0.0	0.0	0.77	618.0
1721	Manufacture of made-up textile articles, except apparel	33.1	22.9	0.62	201.1
1722	Manufacture of carpets and rugs	5.6	13.9	0.80	158.6
1723	Manufacture of cordage, rope, twine and netting	10.3	2.4	0.74	228.2
1729	Manufacture of other textiles n.e.c.	58.2	7.3	0.77	853.2
1730	Manufacture of knitted and crocheted fabrics and articles	23.1	7.5	0.62	219.5
1810	Manufacture of wearing apparel, except fur apparel	37.3	300.0	0.63	181.6
1820	Dressing and dyeing of fur; manufacture of articles of fur	3.4	0.5	0.71	571.9
1911	Tanning and dressing of leather	20.7	1.1	0.69	551.0
1912	Manufacture of luggage, handbags and the like, saddlery and harness	6.5	18.4	0.55	116.9
1920	Manufacture of footwear	25.3	70.0	0.58	143.7
2010	Sawmilling and planing of wood	117.9	10.4	0.79	368.1
2021	Manufacture of veneer sheets; manufacture of plywood, laminboard, particle board and other panels and boards	20.7	4.0	0.79	1256.8
2022	Manufacture of builders' carpentry and joinery	24.4	6.1	0.79	387.3
2023	Manufacture of wooden containers	30.7	17.7	0.72	192.1

(**Appendix 1. *Continued***)

ISIC	Description	Import Penetration Ratio (%)	Nominal Protection	Price-cost Margin a ratio of Value Added)	Capital-labor ratio (1000 baht/worker)
2029	Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials	57.0	120.4	0.68	125.9
2101	Manufacture of pulp, paper and paperboard	31.7	4.2	0.91	2986.6
2021	Manufacture of veneer sheets; manufacture of plywood, laminboard, particle board and other panels and boards	20.7	4.0	0.79	1256.8
2022	Manufacture of builders' carpentry and joinery	24.4	6.1	0.79	387.3
2023	Manufacture of wooden containers	30.7	17.7	0.72	192.1
2029	Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials	57.0	120.4	0.68	125.9
2101	Manufacture of pulp, paper and paperboard	31.7	4.2	0.91	2986.6
2102	Manufacture of corrugated paper and paperboard and of containers of paper and paperboard	21.6	7.6	0.86	1337.0
2109	Manufacture of other articles of paper and paperboard	41.8	4.5	0.88	1213.8
2211	Publishing of books, brochures, musical books and other publications	10.7	2.1	0.65	263.4
2212	Publishing of newspapers, journals and periodicals	1.4	1.4	0.69	832.8
2213	Publishing of recorded media	2.8	0.4	0.46	576.3
2219	Other publishing	17.6	0.8	0.81	358.5
2221	Printing	51.1	28.6	0.74	570.8
2222	Service activities related to printing	10.4	2.7	0.69	479.3
2230	Reproduction of recorded media	0.0	0.3	0.72	672.0
2320	Manufacture of refined petroleum products	5.0	0.1	0.97	16526.7

(**Appendix 1. *Continued***)

ISIC	Description	Import Penetration Ratio (%)	Nominal Protection	Price-cost Margin a ratio of Value Added)	Capital-labor ratio (1000 baht/worker)
2411	Manufacture of basic chemicals, except fertilizers and nitrogen compounds	82.0	2.8	0.95	5675.7
2412	Manufacture of fertilizers and nitrogen compounds	164.5	5.0	0.87	927.2
2413	Manufacture of plastics in primary forms and of synthetic rubber	26.9	2.5	0.94	2912.0
2421	Manufacture of pesticides and other agro-chemical products	26.8	2.0	0.78	3436.7
2422	Manufacture of paints, varnishes and similar coatings, printing ink and mastics	81.8	8.0	0.84	716.2
2423	Manufacture of pharmaceuticals, medicinal chemicals and botanical products	59.1	4.3	0.77	498.3
2424	Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations	87.2	11.6	0.88	865.3
2429	Manufacture of other chemical products n.e.c.	73.9	3.3	0.88	1829.8
2430	Manufacture of man-made fibers	7.5	1.2	0.94	5870.2
2511	Manufacture of rubber tires and tubes; retreading and rebuilding of rubber tires	6.2	4.8	0.85	1447.0
2519	Manufacture of other rubber products	35.6	31.0	0.89	568.9
2520	Manufacture of plastic products	425.5	27.0	0.78	646.4
2610	Manufacture of glass and glass products	27.1	7.4	0.89	2424.5
2691	Manufacture of non-structural non-refractory ceramic ware	39.0	27.3	0.77	344.8
2692	Manufacture of refractory ceramic products	27.3	4.0	0.81	477.2
2693	Manufacture of structural non-refractory clay and ceramic products	15.9	22.0	0.92	715.1
2694	Manufacture of cement, lime and plaster	0.1	0.8	0.93	4380.2
2695	Manufacture of articles of concrete, cement and plaster	7.5	54.6	0.83	1068.7

(**Appendix 1.** ***Continued***)

ISIC	Description	Import Penetration Ratio (%)	Nominal Protection	Price-cost Margin a ratio of Value Added)	Capital-labor ratio (1000 baht/worker)
2696	Cutting, shaping and finishing of stone	35.6	9.6	0.84	789.6
2699	Manufacture of other non-metallic mineral products n.e.c.	30.1	1.1	0.87	1038.7
2710	Manufacture of basic iron and steel	125.8	5.1	0.91	3221.6
2720	Manufacture of basic precious and non-ferrous metals	80.7	1.5	0.90	1188.3
2731	Casting of iron and steel	0.0	0.0	0.86	535.0
2732	Casting of non-ferrous metals	0.0	1.1	0.83	411.7
2811	Manufacture of structural metal products	89.7	48.8	0.81	594.5
2812	Manufacture of tanks, reservoirs and containers of metal	35.9	3.1	0.83	648.1
2813	Manufacture of steam generators, except central heating hot water boilers	11.3	1.2	0.67	219.1
2891	Forging, pressing, stamping and roll-forming of metal; powder metallurgy	0.0	0.0	0.81	554.5
2892	Treatment and coating of metals; general mechanical engineering on a fee or contract basis	0.0	0.0	0.90	782.6
2893	Manufacture of cutlery, hand tools and general hardware	92.1	13.9	0.80	435.8
2899	Manufacture of other fabricated metal products n.e.c.	178.8	15.5	0.84	765.9
2911	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines	2.9	0.5	0.79	298.5
2912	Manufacture of pumps, compressors, taps and valves	29.9	3.8	0.90	971.7
2913	Manufacture of bearings, gears, gearing and driving elements	16.2	5.3	0.79	285.3
2915	Manufacture of lifting and handling equipment	28.5	7.4	0.72	678.3
2919	Manufacture of other general purpose machinery	54.4	20.5	0.84	1053.2

(**Appendix 1. Continued)**

ISIC	Description	Import Penetration Ratio (%)	Nominal Protection	Price-cost Margin a ratio of Value Added)	Capital-labor ratio (1000 baht/worker)
2921	Manufacture of agricultural and forestry machinery	57.9	15.5	0.74	422.6
2922	Manufacture of machine-tools	58.2	4.7	0.86	573.2
2923	Manufacture of machinery for metallurgy	4.0	0.4	0.81	689.0
2924	Manufacture of machinery for mining, quarrying and construction	25.4	8.1	0.81	580.8
2925	Manufacture of machinery for food, beverage and tobacco processing	32.1	3.3	0.99	2246.7
2926	Manufacture of machinery for textile, apparel and leather production	16.7	0.8	0.69	479.4
2929	Manufacture of other special purpose machinery	59.0	3.6	0.72	572.5
2930	Manufacture of domestic appliances n.e.c.	5.2	4.4	0.86	556.1
3000	Manufacture of office, accounting and computing machinery	10.4	1.3	0.79	1130.0
3110	Manufacture of electric motors, generators and transformers	36.4	7.2	0.81	497.9
3120	Manufacture of electricity distribution and control apparatus	58.3	11.6	0.83	635.4
3130	Manufacture of insulated wire and cable	25.7	4.6	0.81	847.5
3140	Manufacture of accumulators, primary cells and primary batteries	5.3	2.8	0.83	726.7
3150	Manufacture of electric lamps and lighting equipment	21.0	5.1	0.89	464.1
3190	Manufacture of other electrical equipment n.e.c.	23.8	5.5	0.69	477.4
3210	Manufacture of electronic valves and tubes and other electronic components	121.9	5.1	0.79	808.6
3220	Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy	15.2	0.4	0.89	267.8
3230	Manufacture of television and radio receivers, sound or video recording or reproducing apparatus, and associated goods	16.6	0.8	0.96	890.9

(Appendix 1. *Continued*)

ISIC	Description	Import Penetration Ratio (%)	Nominal Protection	Price-cost Margin a ratio of Value Added)	Capital-labor ratio (1000 baht/worker)
3311	Manufacture of medical and surgical equipment and orthopedic appliances	22.4	2.0	0.58	271.4
3312	Manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes, except industrial process control equipment	7.7	0.3	0.73	281.9
3313	Manufacture of industrial process control equipment	6.2	0.4	0.89	323.3
3320	Manufacture of optical instruments and photographic equipment	5.4	1.9	0.89	782.7
3330	Manufacture of watches and clocks	5.4	0.5	0.73	494.2
3410	Manufacture of motor vehicles	3.1	8.7	0.98	6646.9
3420	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers	4.1	10.7	0.85	423.2
3430	Manufacture of parts and accessories for motor vehicles and their engines	174.2	53.0	0.88	1808.3
3591	Manufacture of motorcycles	10.6	28.7	0.90	632.5
3592	Manufacture of bicycles and invalid carriages	5.1	5.5	0.74	315.3
3599	Manufacture of other transport equipment n.e.c.	4.3	2.2	0.68	121.1
3610	Manufacture of furniture	57.0	29.4	0.70	277.4
3691	Manufacture of jewellery and related articles	47.8	23.5	0.65	182.7
3692	Manufacture of musical instruments	8.9	1.8	0.59	205.3
3693	Manufacture of sports goods	8.1	8.3	0.58	216.0
3694	Manufacture of games and toys	21.9	10.9	0.68	278.7
3699	Other manufacturing n.e.c.	154.9	42.5	0.69	206.9

Source: Author’s Compilation from the 2006 industrial census.

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CHAPTER 10

Globalization and Firm Demand for Skilled Labor in China's Manufacturing Sector

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In this paper, we use large-scale firm-level census data to examine how trade and FDI affect firm demand for skilled labor in China's manufacturing sector. Our estimation results suggest that exporters tend to employ more unskilled workers than non-exporters. This is true for both Chinese exporters in the ordinary trade regime and foreign-invested exporting firms in the processing trade regime. Although this finding is consistent with the Heckscher–Ohlin model, it contradicts the predictions of the recent international trade literature on heterogeneous firms. We also find that FDI is associated with a higher share of skilled labor in total employment, which supports the Feenstra-Hanson theory of outsourcing. Our results are robust to alternative definitions of variables and econometric methods.

1. Introduction

One of the most important questions in the study of globalization is how trade and FDI liberalization affects demand for skilled labor. This issue is related to the question of globalization and wage inequality. Conventional wisdom predicts favorable effects of trade liberalization on unskilled labor. According to the Heckscher–Ohlin model, trade liberalization will increase demand for unskilled labor in developing countries because developing countries are relatively rich in unskilled labor and will specialize in the production of goods that are unskilled-labor-intensive. The Stolper-Samuelson theorem, which is based on the Heckscher–Ohlin model, predicts that trade will increase the wages of unskilled workers and reduce wage inequality between skilled and unskilled workers. However, there is overwhelming empirical evidence in developing countries that unskilled workers are generally not better off relative to workers with higher skill levels.

Motivated by this observation, Feenstra and Hanson (1996, 1999) propose an alternative explanation. Their theory is based on outsourcing, or the international fragmentation of production, where production processes are sliced thinner and thinner into many stages and the resulting production fragments are carried out in different locations. According to Feenstra and Hanson, those production activities that are shifted to developing countries are unskill-intensive in developed countries but are in fact skill-intensive in developing countries.

In a growing body of literature on heterogeneous firms in international trade, exporters are considered to be superior to non-exporters in many respects, including the skill intensity of their workers. For example, according to the theoretical models of Yeaple (2005) and Costatini and Melitz (2007), in equilibrium, exporters are more productive and choose to employ more skilled workers than non-exporters.

China is an important laboratory for investigations of the relationship between globalization and demand for skilled labor. In the past three decades, China has been transformed from one of the most isolated countries in the world into one of its largest trading nations. China edged past Germany in 2009 to become the world's largest exporter.[1] At the same time, there has been substantial increase in the proportion of skilled labor to total employment since reforms began to occur in the late 1970s. Table 1 shows the increase in skill level among Chinese industrial firms in the three most recent census years.

Table 1. Share in Total Employment by Education Group (%)

	1985	1995	2004
College and above	2.9	5.7	11.3
Senior high school	23.6	34.1	32.9
Junior high school and below	73.5	60.2	55.8

Source: 1985, 1995 and 2004 censuses.

To test these hypotheses, we estimate a firm-level equation using 2004 census data, which covers the universe of manufacturing firms in China. In the dataset, firms report employment by education level. We have two measures for skilled labor: the share of workers with senior high school degrees and above in total employment and the proportion of workers with college-level education and above in total employment.

In the econometric model, we use the share of skilled labor as our dependent variable. We include exports, FDI and the interaction between them as the independent variables. Capital, technology, scale and industry and provincial fixed effects are also included as control variables.

Our empirical results suggest that FDI is associated with a higher share of skilled labor. We also find that exporters tend to employ more unskilled workers than do non-exporters. This is true for both Chinese exporters in the ordinary trade regime and foreign-invested exporting firms in the processing trade regime. The empirical results are robust to alternative definitions of variables and alternative econometric models. First, we examine a more detailed classification of ownership by dividing domestic and foreign forms of ownership into five categories. Second, we experiment with alternative definitions of export and FDI variables. Instead of employing dummy variables, we use continuous variables of export intensity and foreign equity share to measure firm export orientation and foreign presence. Third, we split the sample into

[1] Associated Press: China becomes biggest exporter, edging out Germany, January 10, 2010.

data from the coastal region and from the interior region and run separate regressions with these two subsamples. Fourth, we use Tobit regression as an alternative econometric method. Our baseline regression results hold given all of these robustness checks.

The evidence that exporters employ more unskilled labor supports the Heckscher–Ohlin model. Our findings are consistent with Ma and Zhang (2008), who find that Chinese exporters are more labor intensive than non-exporters. Exporting firms are those that most effectively exploit the comparative advantages of labor cost in China. However, our findings contradict the “stylized facts’ of recent theoretical and empirical literature on heterogeneous firms. The findings related to FDI support the Feenstra-Hanson theory of outsourcing. Those activities that have shifted from developed countries to China are indeed more skill-intensive than the average skill level of existing production activities in China.

Although wage inequality is related to both demand and supply factors, our empirical results have important implications for public policy. China has evolved from one of the most egalitarian countries before reform into one of the most unequal countries in the world. According to our findings, exporting can help reduce the wage gap between the skilled labor and the unskilled labor, while FDI appears to increase such inequality.

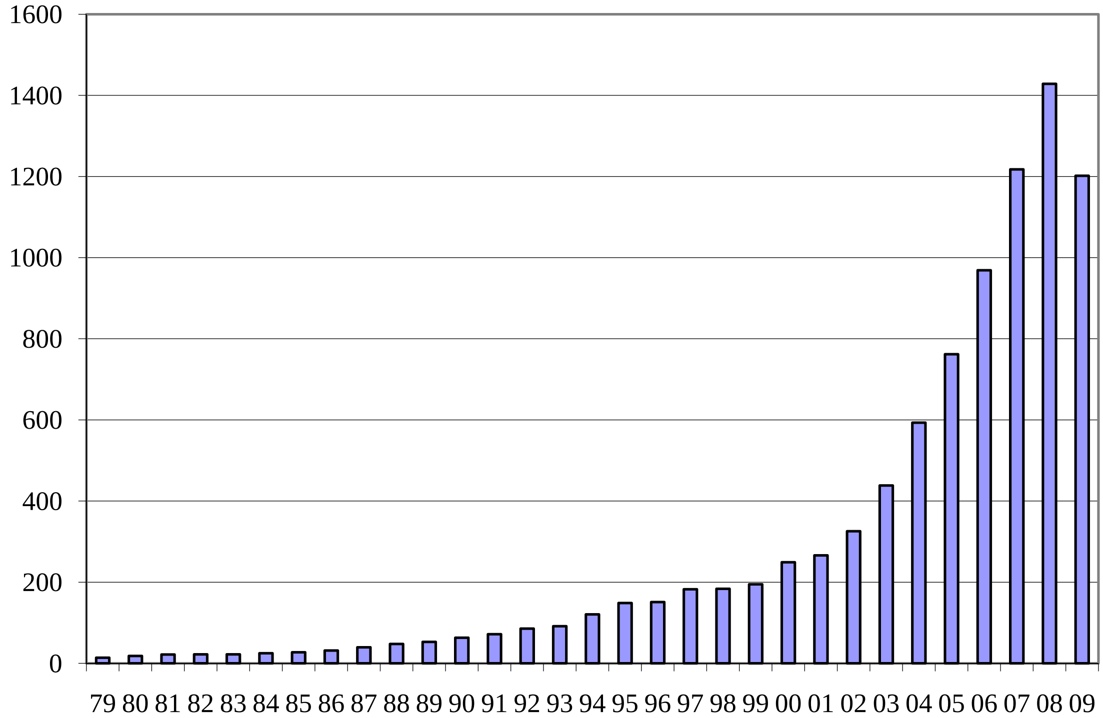
The rest of the paper is organized as follows. The next section presents the background for this study. Section 3 discusses the literature and hypotheses. Section 4 describes the data and the estimation strategy. The regression results are reported in Section 5. Finally, we discuss our conclusions and policy implications in Section 6.

2. Background: Trade and FDI in China

In the 1970s, China was one of the most isolated countries in the world. Since the early 1980s, the Chinese government has been actively promoting foreign trade. The reforms had several key features, including granting trading rights to manufacturing firms, the reduction and eventual elimination of the mandatory plan, and the reform of the foreign exchange regime (Lardy, 2001, p. 46). These trade reforms, combined with other export promotion policies such as rebates on value-added taxes on exports and the duty drawback system, have helped to transform China into a major trading power. Stimulated by China's entry into the WTO, the annual growth rate for Chinese exports between 2001 and 2009 was as high as 20 percent. In the reform era, China's exports grew from $14 billion in 1979 to $1202 billion in 2009 (Figure 1), while over the same period, the ratio of exports to GDP rose from 0.06 to 0.31.

Figure 1. China's Exports (1979-2009)

(Unit: Billions of U.S. Dollars)



Sources: 1979-2008: China Statistical Yearbook, 1988, 1995, 2009;
2009: Statistical Communiqué of the People's Republic of China on 2009 National Economic and Social Development.

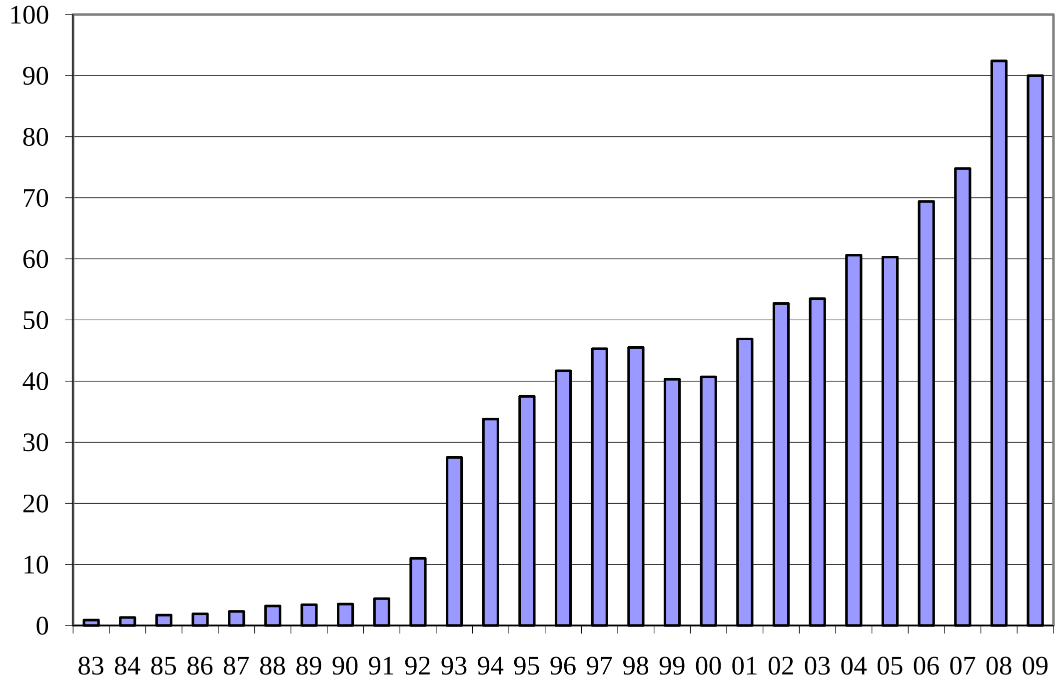
China's exports structure has changed dramatically over the past three decades. In the 1980s, China's leading exports were crude oil, refined petroleum products and apparel. In the early and mid-1990s, labor-intensive goods dominated Chinese exports. Since the late 1990s, China has emerged as a major producer and exporter of electronic and information technology products such as consumer electronics, office equipment and computers, and communications equipment. China has become the world's new manufacturing workshop for technology-oriented products.

Similarly, in the reform era, China has aggressively pursued policies that encourage FDI inflow. It is not surprising that China developed its first law governing foreign investment in 1979, while the first law relevant to domestic firms was not enacted until 1988.[2] Figure 2 shows that the amount of China's FDI inflow has increased dramatically, shifting from less than $1 billion in 1983 to $90 billion in 2009. China's accumulative FDI reached $900 billion by the end of 2009.[3] Foreign-invested firms accounted for about 10 percent of total investment in fixed assets and 31 percent of total industrial output in 2008.[4] Nearly 70 percent of FDI in China was poured into the manufacturing sector. This is mainly due to the competitive edge that China's relatively low production cost for manufacturing affords. One of the main goals of China's FDI policies is to promote technology transfer to China, especially from multinational companies. Since the mid-1990s, China has been encouraging FDI to flow into technology-oriented industries such as electronic information, bioengineering, new materials, and aviation and aerospace. Local R&D centers have also been established.[5]

[2] Source: Table 11.1, Clarke *et al.* (2008).
[3] Source: Author's calculation based on information from the *China Statistical Yearbook*.
[4] Source: *China Statistical Yearbook* 2009.
[5] See Long (2005) for a recent review of China's FDI policy.

Figure 2. FDI Inflow into China (1983-2009)

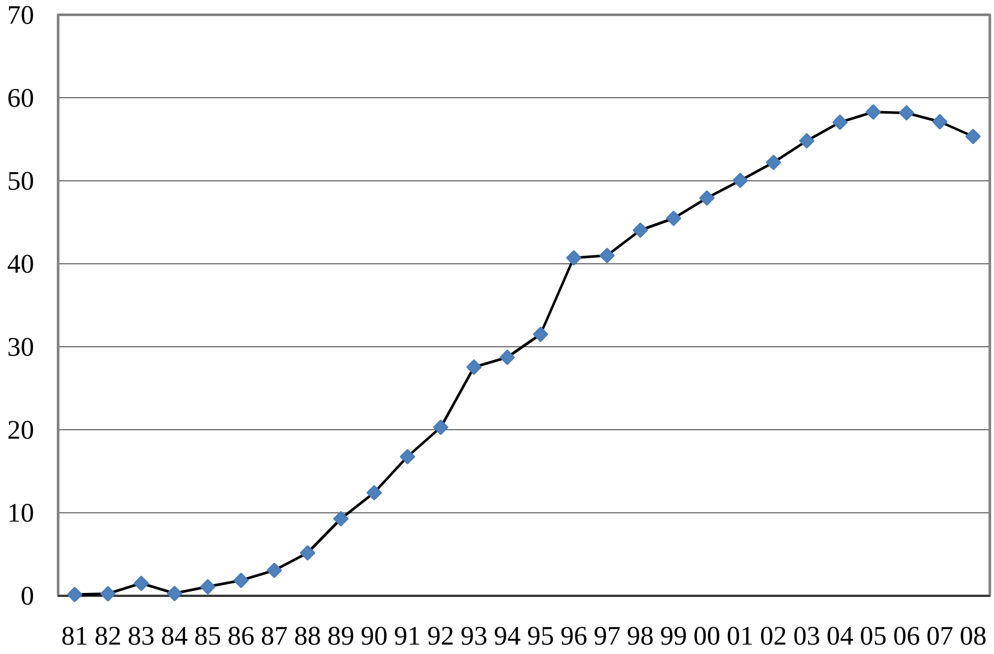
(Unit: Billions of U.S. Dollars)



Sources: 1983-2008: China Statistical Yearbook, 1988, 1995, 2009;
2009: Statistical Communiqué of the People's Republic of China on 2009 National Economic and Social Development.

China's exports and FDI are closely related. With the increasing fragmentation of production, multinationals have used China as a major assembly center. A large part of China's overall success in foreign trade can be attributed to the strong export orientation of foreign-invested firms. Foreign parts and components are brought in, assembled or processed using relatively low-cost Chinese labor, and then exported to international markets. The contribution of foreign-invested firms to total exports jumped from only 0.2 percent in 1981 to 55 percent in 2008 (Figure 3). In the electronics and telecommunications industry, for example, foreign-invested firms accounted for 95 percent of Chinese exports. China is able to export huge quantities of high-tech products only because it imports most of the high value-added and technology-intensive parts and components. China only specializes in the assembly of these goods, which constitutes the labor-intensive stage of the vertical value chain. Moreover, most exports of electronic and information products are produced not by Chinese-owned firms but instead by foreign firms that are using China as an export platform.

Figure 3. Percentage of Foreign-Invested Firms in China's Exports (1981-2008)



Source: Author's calculations based on China Statistical Yearbook, 1988, 1995, 2009.

As a result of FDI, China's foreign trade is often described as dual regimes. The ordinary trade regime, which is characterized by Chinese-owned firms, purchases intermediate inputs from domestic suppliers and exports labor-intensive goods such as garments and shoes. On the other hand, the processing trade regime, which is characterized by foreign-invested firms, purchases intermediate inputs from overseas and exports capital-intensive or technology-intensive goods such as machinery and electronics. In this paper, we utilize this unique dual regimes feature of Chinese foreign trade to test our hypotheses regarding trade and FDI.

3. Related Literature and Hypotheses

The Heckscher–Ohlin model of international trade probably provides the most direct link between trade openness and the demand for skilled labor. Although the theoretical and empirical drawbacks of the model are widely acknowledged at this time, this model has dominated the thinking about the distributional effects of globalization for a long time. (Goldberg and Pavcnik, 2007). The Heckscher–Ohlin model predicts that countries that are relatively rich in unskilled labor will specialize in the production of goods that are unskilled-labor intensive, leading to increased demand for unskilled labor.

The Stolper–Samuelson theorem, a companion theorem of Heckscher–Ohlin model, deals with distributional effects by linking changes in product prices to changes in factor returns. An increase in the price of unskilled-labor-intensive products that is induced by trade liberalization should increase the return to unskilled labor, the factor that is most intensively used in the production of these products. In contrast, the expected decrease in the price of skilled-labor-intensive imported products should lead to a decline in wages for skilled labor. Based on the Stolper–Samuelson theorem, one would expect trade liberalization in developing countries to favor unskilled workers.

There has been abundant evidence in developing countries that contradicts the theorized Stolper–Samuelson effects. Empirical studies on developing countries such as Argentina, Brazil, Mexico, Chile, Colombia and India have consistently found increasing inequality for those countries with greater exposure to globalization.

The Heckscher–Ohlin model mainly deals with industry-level variables. At the firm level, it is possible that in developing countries, exporters are less skill-intensive than non-exporters to fully exploit their comparative advantage. However, this is not always true in a theoretical sense. As Bernard and Jensen (1997) point out, large variation in factor intensity exists among firms even within narrowly defined industries. Bernard *et al.* (2007) study the firm dynamics within comparative advantage industries and comparative disadvantage industries under trade liberalization. They find that the improvements in aggregate productivity following trade liberalization can even reverse the real-wage losses of scarce factors.

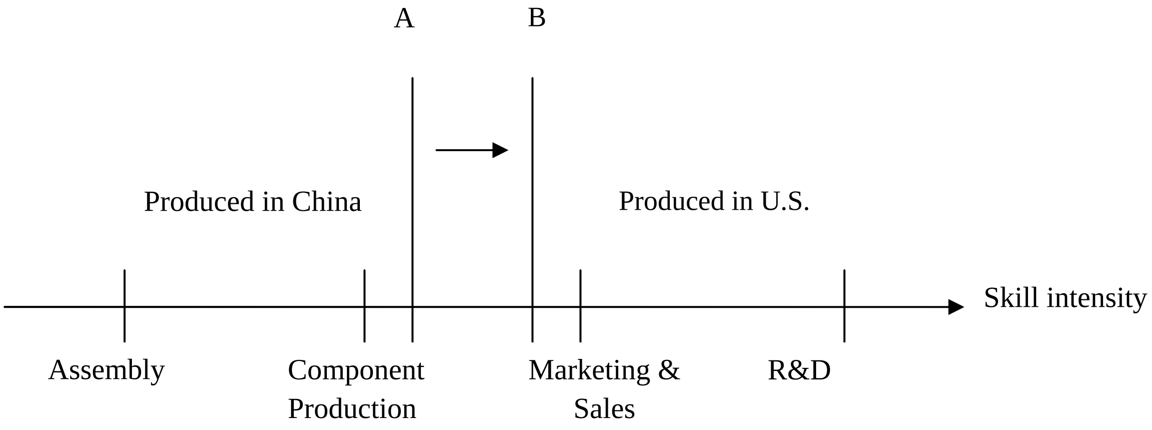
In fact, recent literature on heterogeneous firms in international trade (e.g., Melitz, 2003) can be extended to link exporter status with higher skill share because exporters need to overcome the fixed costs of accessing international markets. Theoretical and empirical studies at the firm level have always found that exporting firms are larger, use more advanced technologies, employ more skilled workers, pay higher wages, and appear to be more productive than firms that do not export. In fact, exporters are more skill-intensive is considered one of the most robust findings in Tybout's (2003) survey article. Recent work on innovation and exports provides theoretical guidance to understand this issue. For example, in Yeaple's (2005) model, firms endogenously choose technology and workers' skill. In equilibrium, exporters choose higher skilled workers than do non-exporters. Costantini and Melitz (2007) construct a theoretical model in which decisions regarding export market participation and innovation are modeled jointly. In their theory, innovation by exporters generates extra demand for skilled labor. In an empirical study, Bustos (2005) finds that exporters in Argentina use more skilled labor than non-exporters.

In another strand of literature, Feenstra and Hanson (1996, 1997, 1999) propose a theory of trade in intermediate goods and outsourcing. In their model, the final good is assembled from a continuum of intermediate inputs indexed by $z \in [0,1]$, which includes all activities from design and production to final delivery to the consumer. Inputs vary in terms of the relative amounts of skilled and unskilled labor used in production. These activities are listed based on skilled/unskilled ratios in increasing order. For example, the least skill-intensive activity is assembly, and the most skill-intensive activity is R&D. Feenstra and Hanson show that the south will produce the range of goods $[0, z^*)$ and that the north will produce $(z^*,1]$. When capital flows from the north to the south, the equilibrium value of z^* increases. As a result, outsourcing increases the demand for skilled labor in both the north and the south.

To understand the Feenstra-Hanson effects, let us consider the "value chain" of a multinational firm from the Unites States, which includes all of the activities involved in the production of a good, from R&D to assembly to marketing and after-sales service. In Figure 4, we arrange these activities in increasing order based on the ratio of skilled to unskilled labor used in each activity. In this example, assembly uses the least amount of skilled labor relative to unskilled labor, followed by component production. We assume the marketing and sales and R&D require a higher level of skilled labor. Under globalization, a firm would outsource to China those activities that used the most unskilled labor. Therefore, activities to the left of line A would be relocated to China, while activities to the right of line A would be performed in the United States. Suppose that this multinational firm wishes to outsource more activities to China due to reduced trade costs or increasing production costs at home. The firm will choose those activities that are just to the right line A. The new borderline between the activities performed in China and the U.S. is now line B.

The activities between A and B are less skill-intensive than the activities still conducted in the U.S. This means that on average, the range of activities now done in the U.S. is more skill-intensive than before the shift. As a result, the relative demand for skilled labor in U.S. should increase. The activities that are newly outsourced to China (those between A and B) are more skill-intensive than the activities that already took place in China (those to the left of A). Therefore, the relative demand for skilled labor in China should also increase.

Figure 4. Outsourcing on the Value-Chain



Note: This figure is modified from figure 4 of Feenstra (2007).

The effects of outsourcing have been examined empirically for a number of developed economies, including, for example, Feenstra and Hanson (1999) for the U.S., Falk and Koebel (2001) for Germany; Strauss-Kahn (2003) for France, Hijzen *et al.* (2005) for the UK, and Hsieh and Woo (2005) for Hong Kong. Most of these studies find that outsourcing is an important source of increasing demand for skilled labor in developed countries.

There have been very few similar studies of developing countries. Feenstra and Hanson (1997) test their theory using Mexican data. They linked the increase in relative wages for skilled labor to the FDI inflow in Mexico and find that FDI can explain a large portion of the increase in the skilled labor share in total wages. Much of the FDI was the results of outsourcing by U.S. multinationals. To the best of our knowledge, there has been virtually no empirical work on the relationship between globalization and firm skill structure in China.

It is worth mentioning that in the literature, in addition to the Feenstra-Hanson theory, there are other theories of the relation between trade and skill structure. These studies include “defensive innovations” (Wood, 1995), product life cycle (Zhu, 2005), and quality upgrades to products for export (Verhoogen, 2008).

In this paper, we take advantage of the dual regime of Chinese exports to empirically test these major theories in international trade. The ordinary trade exports produced by Chinese firms are directly related to the Heckscher–Ohlin model, while processing trade exports produced by foreign-invested firms will allow us to test the Feenstra-Hanson theory.

4. Data and Empirical Strategy

4.1. The Data

The main dataset used in this study is the 2004 Economic Census Database. China conducted its first economic census in 2004; it covers the universe of Chinese industrial firms and service firms in that year. Our firm-level dataset includes all manufacturing industries. In the data, firms report detailed information including firm IDs, ownership, output, value added, exports, four-digit industry codes, six-digit geographic codes, employment, and capital stock. After deleting those observations with missing variables, we have a total sample of about 1.18 million manufacturing firms.

Most important for this study are the variables related to human capital: the number of employees by education level. Unfortunately, the database does not provide a wage information breakdown by education level. Because of this data limitation, we can only study skill structure based on employment share, not based on wage share. In the data, we have two measures of skilled labor: (1) senior high school and above, which accounts for about 39 percent of total manufacturing employment; and (2) college and above, with about 9 percent of total employment.

Table 2 reports summary statistics for the key variables in the 2004 census. Appendix Tables 1 and 2 present the share of skilled labor by province and two-digit industry in 2004. To our surprise, the skill share of the coastal region on average is actually lower than that of the interior region. We believe that this is strong indication of the Heckscher–Ohlin effect.

Table 2. Summary Statistics of 2004 Census

Variable	Obs	Mean	Std. Dev.	Min	Max
Employment (person)	1,187,267	68.99	355.03	1.0	113781
Capital Stock	1,187,264	7357.72	178216.00	0.0	103000000
Output	1,187,267	16308.55	270184.00	1.0	73000000
Export	1,187,267	3456.23	123592.60	0.0	69400000
Number of Computers	1,187,267	9.32	1687.99	0.0	874206
Share of Senior High School and above in Total Employment	1,187,267	0.39	0.31	0.0	1
Share of College and above in Total Employment	1,187,267	0.09	0.17	0.0	1
ln(K/Y)	1,167,218	-1.18	1.44	-11.6	15
ln(Y)	1,187,267	7.60	1.77	0.0	18
ln(wage rate)	1.186,045	2.08	0.64	-6.0	10
FDI Dummy	1,187,267	0.08	0.27	0.0	1
Exporter Dummy	1,187,267	0.11	0.31	0.0	1
ln(computer intensity)	1,187,267	-6.48	0.70	-6.9	12
Export intensity	1,187,267	0.07	0.24	0.0	1
Foreign Equity Share	1,179,206	0.06	0.24	0.0	1

Note: The unit of all values is 1,000 Yuan.

4.2. Econometric Model

Following Berman *et al.* (1994), we estimate the following firm-level equation:

$$S_i = \alpha + \beta_1 \ln\left(\frac{K_i}{Y_i}\right) + \beta_2 \ln(Y_i) + \beta_3 \ln(\text{computer intensity})_i + \beta_4 Exporter_i$$
$$+ \beta_5 FDI_i + \beta_6 Exporter * FDI + \sum_j \theta_j Industry_j + \sum_k \gamma_k Province_k + \varepsilon_i\,, \qquad (1)$$

where

- S_i : the share of skilled labor in total employment for firm *i*.
- $\ln\left(\frac{K_i}{Y_i}\right)$: the logarithm of capital intensity, which captures the capital-skill complementarity.
- $\ln(Y_i)$: the logarithm of output, included to control for scale effects.
- *FDI*: a dummy for foreign-invested firms.
- ln(computer intensity): defined as $\ln\left(\frac{\text{number of computers}}{Y_i}+0.001\right)$. We include computer intensity as a proxy for firm technology.
- $Exporter * FDI$: an interaction term for the FDI dummy and exporter dummy.
- $Industry_j$: a full set of three-digit industry dummies.
- $Province_k$: a full set of provincial dummies.

5. Regression Results

5.1. Baseline Regression

Table 3 reports the estimation results for Equation (1) with 2004 firm-level data. The dependent variable in the first three columns is the share of workers with senior high school-level education and above in total employment. Because we include the exporter dummy, FDI dummy and the interaction term between them in the regression, the benchmark category is domestic non-exporters. The first column shows that the average skill share of domestic non-exporters is 0.378, while the share of skilled labor of domestic exporters is on average 0.016 lower than that of domestic non-exporters. Foreign-invested non-exporters tend to have a much higher skill share, 0.556, but the average skill share of foreign-invested exporters is only 0.455. All of the variables are statistically significant at the 1 percent level. Throughout the paper, we report the standard errors corrected for 2-digit industry/province clustering. In the second column, we add the capital intensity (ln(*K*/*Y*)), scale effect (ln*Y*) and technology proxy (ln(computer intensity)). Compared with that in the first column, the coefficient of the FDI dummy in the second column is decreased by nearly half. To the extent that the capital and technology introduced by FDI are skill-biased, including these controls in the regression may underestimate the effect of FDI. The regression results indicate that capital intensity, the scale factor and computer intensity are all associated with a higher skill share. Given that both trade and FDI vary enormously across industries and regions, we include in column 3 a full set of industry and provincial dummies. Now the R-squared increases substantially from that of the second column, but the estimates are similar.

Table 3. Skill Share Regression (Baseline)

	Dependent Variable: Share of Senior High School and above			Dependent Variable: Share of College and above		
	1	2	3	4	5	6
Exporter Dummy	-0.016**	-0.059***	-0.013***	0.001	-0.023***	-0.002**
	(0.007)	(0.001)	(0.003)	(0.003)	(0.003)	(0.001)
FDI Dummy	0.178***	0.091***	0.097***	0.125***	0.074***	0.073***
	(0.008)	(0.002)	(0.005)	(0.006)	(0.005)	(0.004)
Exporter*FDI	-0.101***	-0.063***	-0.079***	-0.086***	-0.064***	-0.065***
	(0.009)	(0.002)	(0.006)	(0.001)	(0.005)	(0.004)
ln(K/Y)		0.011***	0.007***		0.0013*	-0.001*
		(0.001)	(0.001)		(0.001)	(0.001)
lnY		0.029***	0.023***		0.015***	0.012***
		(0.001)	(0.001)		(0.001)	(0.000)
ln(Computer Intensity)		0.118***	0.086***		0.081***	0.062***
		(0.004)	(0.002)		(0.003)	(0.002)
Constant	0.378***	0.946***	0.797***	0.082***	0.497***	0.445***
	(0.007)	(0.024)	(0.019)	(0.003)	(0.021)	(0.019)
Industry Dummies	No	No	Yes	No	No	Yes
Provincial Dummies	No	No	Yes	No	No	Yes
No. of observations	1187267	1187267	1167218	1187267	1187267	1167218
R-squared	0.0124	0.0812	0.1792	0.0205	0.1229	0.2320

Notes: The benchmark category is domestic non-exporters. Numbers in parentheses are standard errors corrected for 2-digit industry/province clustering. *, **, and *** represent statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

In the last three columns, we use college education rather than senior high school-level education as a measure of skilled labor. The estimated coefficients of the exporter dummy, the FDI dummy and the interaction term are generally lower than in the first three columns. For example, the estimate of the FDI dummy decreases from 0.101 in column 3 to 0.076 in column 6. This is expected because the overall share of workers with college-level education is much smaller than the share of workers with senior high school-level education.

Our estimates are not only statistically significant but also quantitatively significant. For example, a one-standard-deviation increases in the FDI dummy increases college skill share by 0.31×0.076 = 2.4%.

5.2. Examining the Different Categories of Ownership

The dichotomy between domestic firms and foreign-invested firms may be overly simplistic because there is a large degree of variation within each category. Chinese statistics identify two types of foreign-invested firms: those with investments from Hong Kong, Macao and Taiwan (HMT) and those with investments from countries in other regions (mostly the OECD countries). HMT investment in China accounted for about 40 percent of China's overall FDI in 2004. The investors from these regions have cultural, linguistic and geographic advantages over OECD firms. The advantages of OECD firms over HMT firms lie in their more advanced technology, global production chains and internationally recognized brand names.

Within domestic ownership categories, state-owned enterprises (SOEs) used to be the "commanding heights" before reform. After several rounds of privatization, large state enterprises still play an important role in today's Chinese economy. According to a study by Jefferson *et al.* (2008), SOEs are the least efficient firms in China in terms of productivity. However, government policy has continued to favor the SOEs by providing bank credits and subsidized resources. Before the higher education reform of the late 1990s, each college graduate in China was guaranteed a government-assigned job through a centralized placement system. Under such a system, the SOEs usually absorb a majority of college graduates.

To examine how ownership and export status affect demand for skilled labor, we classify all firms into one of the following 5×2 categories: state exporters and non-exporters, collective exporters and non-exporters, private exporters and non-exporters, HMT FDI exporters and non-exporters, and OECD FDI exporters and non-exporters. Table 4 shows the regression results with private non-exporters as the missing category (benchmark). Columns 3 and 6 are our preferred specifications. Consistent with the baseline regression results, for every ownership category, exporters have a lower skill share than non-exporters. For both exporters and non-exporters, OECD-invested firms appear to have the highest skill share, followed by SOEs, HMT invested firms, and finally, collective and private firms.

Table 4. Skill Share Regression (Ownership)

	Dependent Variable: Share of Senior High School and above			Dependent Variable: Share of College and above		
	1	2	3	4	5	6
HMT FDI Exporter	0.042***	-0.039***	-0.012	0.022***	-0.024***	-0.005
	(0.012)	(0.010)	(0.009)	(0.006)	(0.006)	(0.005)
HMT FDI Non-Exporter	0.166***	0.092***	0.095***	0.098***	0.056***	0.056***
	(0.009)	(0.008)	(0.006)	(0.006)	(0.005)	(0.004)
OECD FDI Exporter	0.134***	0.058***	0.070***	0.083***	0.042***	0.041***
	(0.012)	(0.010)	(0.008)	(0.006)	(0.006)	(0.005)
OECD FDI Non-Exporter FDI	0.241***	0.160***	0.142***	0.177***	0.129***	0.111***
	(0.009)	(0.007)	(0.006)	(0.008)	(0.006)	(0.005)
State-Owned Exporter	0.135***	0.067***	0.061***	0.074***	0.041***	0.032***
	(0.009)	(0.007)	(0.004)	(0.005)	(0.004)	(0.002)
State-Owned Non-Exporter	0.189***	0.145***	0.098***	0.102***	0.077***	0.051***
	(0.006)	(0.004)	(0.003)	(0.003)	(0.002)	(0.002)
Collective-Owned Exporter	-0.020***	-0.056***	-0.028***	-0.011***	-0.031***	-0.017***
	(0.007)	(0.006)	(0.005)	(0.003)	(0.003)	(0.003)
Collective-Owned Non-Exporter	0.028***	0.028***	0.010***	0.006***	0.008***	-0.006***
	(0.005)	(0.004)	(0.003)	(0.002)	(0.002)	(0.001)
Private Exporter	-0.023***	-0.052***	-0.006**	-0.001	-0.018***	0.002
	(0.007)	(0.006)	(0.003)	(0.003)	(0.003)	(0.001)
ln(K/Y)		0.006***	0.004***		-0.001	-0.002***
		(0.001)	(0.001)		(0.001)	(0.001)
lnY		0.021***	0.018***		0.010***	0.010***
		(0.001)	(0.001)		(0.000)	(0.000)
ln(Computer Intensity)		0.111***	0.081***		0.076***	0.064***
		(0.004)	(0.002)		(0.003)	(0.002)
Constant	0.357***	0.928***	0.782***	0.070***	0.487***	0.438***
	(0.007)	(0.022)	(0.020)	(0.003)	(0.021)	(0.019)
Industry Dummies	No	No	Yes	No	No	Yes
Provincial Dummies	No	No	Yes	No	No	Yes
No. of observations	1187267	1187267	1167218	1187267	1187267	1167218
R-squared	0.0452	0.0998	0.1877	0.0559	0.1437	0.2177

Notes: The benchmark category is private non-exporters. Numbers in parentheses are standard errors corrected for 2-digit industry/province clustering. *, **, and *** represent statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

5.3. Using Alternative Definitions of Export and FDI Variable

In this subsection, to conduct a robustness check, we use alternative definitions of export and FDI variables. Rather than using an exporter dummy variable, we create an export intensity variable defined as the export to sales ratio. As a continuous variable, export intensity allows us to exploit richer information on the export orientation of firms. Similarly, we create a new variable of foreign equity share to replace the FDI dummy. Wholly foreign-owned firms may have stronger incentives to bring the latest technology to China than will joint ventures. Foreign equity share can be a better measure of foreign presence than the FDI dummy.

Table 5 reports the regression results with alternative definitions of export and FDI variables. The results are qualitatively the same. Compared with the baseline results in Table 3, the negative effects of the export variable are stronger for both measures of skilled labor in Table 5.

Table 5. Skill Share Regression (Export Intensity and Foreign Equity Share)

	Dependent Variable: Share of Senior High School and above			Dependent Variable: Share of College and above		
	1	2	3	4	5	6
Export Intensity	-0.057***	-0.097***	-0.029***	-0.019***	-0.044***	-0.010***
	(0.009)	(0.007)	(0.005)	(0.004)	(0.003)	(0.002)
Foreign Equity Share	0.203***	0.101***	0.109***	0.139***	0.076***	0.080***
	(0.012)	(0.009)	(0.005)	(0.009)	(0.005)	(0.006)
Export Intensity*Foreign Equity Share	-0.135***	-0.091***	-0.130***	-0.116***	-0.079***	-0.099***
	(0.011)	(0.009)	(0.006)	(0.008)	(0.005)	(0.006)
ln(K/Y)		0.010***	0.008***		0.0013*	-0.001
		(0.001)	(0.001)		(0.001)	(0.001)
lnY		0.028***	0.023***		0.015***	0.013***
		(0.001)	(0.001)		(0.001)	(0.000)
ln(Computer Intensity)		0.119***	0.086***		0.081***	0.063***
		(0.004)	(0.002)		(0.003)	(0.002)
Constant	0.380***	0.953***	0.798***	0.084***	0.502***	0.447***
	(0.003)	(0.024)	(0.018)	(0.003)	(0.022)	(0.019)
Industry Dummies	No	No	Yes	No	No	Yes
Provincial Dummies	No	No	Yes	No	No	Yes
No. of observations	1179206	1160713	1160713	1179206	1160713	1160713
R-squared	0.0131	0.0838	0.1811	0.0201	0.1257	0.2334

Notes: Export intensity is defined as ratio of export to sales. Foreign equity share is defined as the share of total equity held by foreign firms or foreign investors. Numbers in parentheses are standard errors corrected for 2-digit industry/province clustering. *, **, and *** represent statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

5.4. Examining the Coastal Region and the Interior Region

The geographic distribution of trade and FDI in China has been highly uneven. Due to their convenient location, better infrastructure and superior business environment, the coastal regions have been the main source of exports and main recipients of FDI. In 2004, our sample year, the coastal provinces accounted for 89 percent of total exports and received 88 percent of the total FDI in China. Because both trade and FDI are highly concentrated in the coastal region, it will be useful to examine if our earlier results hold for the interior region.

To compare the interior region with the coastal region, we split the sample and run the same regression separately for interior firms only and coastal firms only.[6] We report the estimation results in Table 6. The firms in coastal and interior regions show a similar pattern. The only exception is Column 4, where the negative coefficient of the exporter dummy is no longer statistically significant.

Table 6. Skill Share Regression (Coastal vs. Interior Region)

	Dependent Variable: Share of Senior High School and above		Dependent Variable: Share of College and above	
	Coastal Region Only	Interior Region Only	Coastal Region Only	Interior Region Only
Exporter Dummy	-0.011***	-0.016***	-0.002	-0.001
	(0.003)	(0.006)	(0.001)	(0.003)
FDI Dummy	0.101***	0.979***	0.074***	0.082***
	(0.006)	(0.005)	(0.004)	(0.004)
Exporter*FDI	-0.079***	-0.043***	-0.064***	-0.046***
	(0.005)	(0.008)	(0.004)	(0.006)
ln(K/Y)	0.003**	0.016***	-0.002***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
lnY	0.021***	0.025***	0.012***	0.011***
	(0.001)	(0.001)	(0.000)	(0.000)
ln(Computer Intensity)	0.082***	0.094***	0.058***	0.076***
	(0.002)	(0.002)	(0.002)	(0.002)
Constant	0.801***	0.777***	0.434***	0.474***
	(0.022)	(0.020)	(0.022)	(0.016)
Industry Dummies	Yes0.2260	Yes	Yes	Yes
Provincial Dummies	Yes	Yes	Yes	Yes
No. of observations	816826	350392	816826	350392
R-squared	0.1589	0.2339	0.2012	0.2659

Notes: We run the regression with two subsamples: coastal region and interior region. The benchmark category is domestic non-exporters. Numbers in parentheses are standard errors

[6] The coastal region includes Beijing, Fujian, Guangdong, Hainan, Hebei, Jiangsu, Liaoning, Shandong, Shanghai, Tianjin and Zhejiang; the interior region includes all other provinces.

corrected for 2-digit industry/province clustering. *, **, and *** represent statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

5.5. Alternative Econometric Model: Tobit Regression

Given that the skill share is defined as bounded between 0 and 1, it may not be appropriate to use this censored variable as a dependent variable. We re-estimate Equation (1) using Tobit regression. The estimation results are presented in Table 7. Again, the export variable and FDI variable exhibit opposite signs and are statistically significant at the 1 percent level. The coefficient of the interaction term is also negative.

Table 7. Skill Share Tobit Regression

	Dependent Variable: Share of Senior High School and above			Dependent Variable: Share of College and above		
	1	2	3	4	5	6
Exporter Dummy	-0.004***	-0.064***	-0.014***	-0.003***	-0.052***	-0.015***
	(0.002)	(0.002)	0.000	(0.001)	(0.001)	(0.001)
FDI Dummy	0.222***	0.107***	0.118***	0.239***	0.107***	0.111***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
Exporter*FDI	-0.131***	-0.082***	-0.106***	-0.155***	-0.092***	-0.989***
	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)
ln(K/Y)		0.014***	0.009***		0.012***	0.008***
		0.000	0.000		0.000	0.000
lnY		0.039***	0.032***		0.055***	0.048***
		0.000	0.000		(0.000)	(0.000)
ln(Computer Intensity)		0.154***	0.112***		0.160***	0.123***
		(0.001)	(0.001)		(0.000)	(0.000)
Constant	0.364***	1.087***	0.895***	0.296***	0.591***	0.425***
	(0.000)	(0.002)	(0.004)	0.000	(0.002)	(0.004)
Industry Dummies	No	No	Yes	No	No	Yes
Provincial Dummies	No	No	Yes	No	No	Yes
No. of observations	1187267	1187267	1167218	1187267	1187267	1167218
Pseudo R-squared	0.0101	0.0729	0.1593	0.0423	0.2321	0.3751

Notes: The benchmark category is domestic non-exporters. Numbers in parentheses are standard errors. *, **, and *** represent statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Alternatively, we have also used the logistic transformation of skill share as the dependent variable:

$$\text{LOGIT Skill Share} = \ln\left(\frac{\text{Skill Share}}{1-\text{Skill Share}}\right).$$

The results are similar and are available upon request. Our baseline regression results are quite robust to the use of these alternative econometric methods.

6. Conclusions and Policy Implications

This study uses large-scale firm-level census data to examine how trade and FDI affect the demand for skilled labor in China's manufacturing firms. We use two measures of skilled labor: senior high school-level education and college-level education. For both measures, we find that exporters tend to employ more unskilled workers than do non-exporters. The results hold for both Chinese exporters in the ordinary trade regime and foreign-invested exporting firms in the processing trade regime. Although these findings are consistent with the Heckscher–Ohlin model, they are somewhat surprising given the predictions of a large body of literature on trade and heterogeneous firms. We also find that FDI is associated with a higher share of skilled labor in total employment. We interpret this finding as evidence in support of Feenstra and Hanson's outsourcing theory. Our results are qualitatively the same for several robustness checks.

The estimation results revealed in this paper do not provide a direct answer to the inequality question because the equilibrium return to skill is determined by both demand and supply factors. However, the demand factors have strong effects on wages. In Table 8, we run a firm-level wage regression in which we regress the logarithms of wage rates on the share of college education and the share of senior high school education. Table 8 reports the estimation results with the full sample and the subsamples for the coastal region and interior region. We find that those firms with a higher share of skilled labor do pay higher wages.[7] Such effects are stronger for the coastal sample than for the interior sample.

[7] Column 2 of Table 8 implies about 12.7 percent and 3.3 percent returns to an additional year of schooling for college education and senior high school education, respectively. Recent studies find about 10 percent returns to a year of schooling in China's urban area (for example, Zhang and Zhao, 2007).

Table 8. Wage Regression

Dependent Variable: In(wage rate)

	Full Sample		Coastal Region Only		Interior Region Only	
	1	2	3	4	5	6
Share of College	0.650***	0.506***	0.665***	0.523***	0.648***	0.458***
Education	(0.003)	(0.018)	(0.004)	(0.025)	(0.006)	(0.015)
Share of Senior	0.109***	0.097***	0.104***	0.091***	0.179***	0.100***
High School	(0.002)	(0.007)	(0.003)	(0.007)	(0.004)	(0.013)
	2.008***	2.363***	2.087***	2.255***	1.802***	2.074***
Constant	(0.001)	(0.003)	(0.004)	(0.055)	(0.002)	(0.031)
Industry Dummies	No	Yes	No	Yes	No	Yes
Provincial Dummies	No	Yes	No	Yes	No	Yes
No. of observations	1187267	1187267	1187267	1187267	1187267	1187267
R-squared	0.0336	0.1572	0.0361	0.1406	0.0388	0.1008

Notes: Numbers in parentheses are standard errors corrected for 2-digit industry/province clustering. *, **, and *** represent statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Our empirical results should be very useful for policy-makers. If a more equal distribution of income between skilled labor and unskilled labor is desired, then according to our findings, government policies that promote exports (and particularly ordinary trade exports) can be strongly justified. Policy-makers should also be aware of the opposite effects of foreign direct investment.

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Appendix Table 1. Percentage of Skilled Labor in Total Employment by Province (2004)

Province	2004 (Senior High School and above)	2004 (College and above)
National Average	47.5	13.0
Beijing	58.6	22.0
Tianjin	52.2	13.4
Hebei	40.7	8.9
Shanxi	46.5	11.7
Inner Mongolia	57.1	14.5
Liaoning	45.0	16.1
Jilin	59.5	16.8
Heilongjiang	57.7	17.0
Shanghai	41.0	12.8
Jiangsu	43.0	9.4
Zhejiang	31.7	6.7
Anhui	41.4	10.5
Fujian	35.7	7.8
Jiangxi	43.1	9.6
Shandong	44.8	10.3
Henan	44.9	10.0
Hubei	54.4	15.3
Hunan	48.5	12.3
Guangdong	41.5	8.9
Guangxi	45.0	10.4
Hainan	56.0	16.5
Chongqing	51.8	14.2
Sichuan	48.2	14.4
Guizhou	47.6	15.3
Yunnan	40.3	11.1
Tibet	30.1	9.4
Shaanxi	59.0	17.3
Gansu	52.6	14.4
Qinghai	51.2	13.1
Ningxia	46.9	12.7
Xinjiang	57.1	19.2

Source: 2004 Census Database.

Appendix Table 2. Percentage of Skilled Labor in Total Employment by Industry (2004)

Industry	2004 (Senior High School and above)	2004 (College and above)
Processing of Food from Agricultural Products	42.5	9.7
Mfg. of Foods	46.3	12.5
Mfg. of Beverages	52.4	14.4
Mfg. of Tobacco	62.6	23.0
Mfg. of Apparel, Footwear, and Caps	34.1	5.3
Mfg. of Textile Wearing Apparel, Footwear and Caps	30.3	4.9
Mfg. of Leather, Fur, Feather and Related Products	27.8	4.1
Processing of Timber, Mfg. of Wood, etc. Products	32.5	5.6
Mfg. of Furniture	35.1	6.8
Mfg. of Paper and Paper Products	41.0	8.2
Printing, Reproduction of Recording Media	49.1	10.9
Mfg. of Articles for Culture, Education and Sport	29.6	5.4
Processing of Petroleum and Nuclear Fuel and Coking	59.3	18.6
Mfg. of Raw Chemical Mat'ls and Chem. Products	51.8	15.0
Mfg. of Medicines	69.4	27.2
Mfg. of Chemical Fibers	51.6	12.7
Mfg. of Rubber	41.5	8.3
Mfg. of Plastics	39.3	8.2
Mfg. of Non-metallic Mineral Products	32.7	5.8
Smelting and Pressing of Ferrous Metals	54.0	15.3
Smelting and Pressing of Non-ferrous Metals	50.1	14.6
Mfg. of Metal Products	40.2	9.1
Mfg. of General Purpose Machinery	47.5	12.7
Mfg. of Special Purpose Machinery	56.3	17.5
Mfg. of Transport Equipment	57.2	17.2
Mfg. of Electrical Machinery and Equipment	49.9	14.0
Mfg. of Comm. Equip., Computers, and Electronic Equip.	59.8	18.1
Mfg. of Instruments and Mach. for Culture and Office Work	56.7	20.0
Mfg. of Artwork and Other Manufacturing	33.1	6.1

Source: 2004 Census Database.

CHAPTER 11

The Source of Production, Employment and Productivity in Indonesia

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Interest in the impact of globalizing corporate activities and deepening economic integration on the performance of local firms has developed over the last decade. The interest has led to a new and rapidly expanding body of literature on the subject. Our paper attempts to observe the source of output, employment, and productivity over three periods, namely, 1) the pre-crisis period (1990-1996), 2) the crisis and recovery period (1996-2000), and 3) the post-crisis period (2000-2006). We find that high output during the pre-crisis period was driven significantly from the existing firms. The trend, however, reversed in the 1996-2000 period where the source of manufacturing output was from new-entrants. In the context of employment, we witness that the exporting firms consistently provide more jobs than the non-exporting firms. Interestingly, prior to crisis, Non-FDI firms create much more job compare to that of FDI firms. The situation was reversed post crisis with FDI firms created more job than Non-FDI. Concerning labor productivity, we observe a significant drop in Non-FDI firms. In contrast the contribution of FDI in manufacturing productivity is consistently increasing throughout the periods. The finding also reinforces the significant role of FDI in improving labor productivity over periods. The story is similar to exporting-non exporting firms, where labor productivity of exporting firms also improves throughout period.

1. Introduction

Interest surrounding the impact of globalizing corporate activities and deepening economic integration on the performance of local firms has developed over the last decade. The interest has led to a new and rapidly expanding body of literature on the subject. As a result, the literature has generated new insights on why some firms export abroad and others do not, why some firms fail to survive under intense pressure from globalization, whilst others do, and why some choose to invest abroad rather than export. Another strand of literature seeks to answer the question of whether the presence of MNE (Multi National Enterprises) and exporting activities have a positive impact on domestic firms. In short, the new literature sheds light on the key drivers of globalization and the impact of the phenomenon on local firms' performance.

In addition to this literature, another branch of study also explores the impact of firm behavior on the whole economy. Three channels can be observed as the main sources of economic growth, namely, production, employment, and productivity. In Indonesia some studies have been conducted on the decomposition of labor growth according to components of GDP (Gross Domestic Product) growth (Aswicahyono and Kartika 2009) and productivity of the national economy by using the Total Factor Productivity approach (Aswicahyono 2000). However, a question remains on whether the sources of the Indonesian labor enlargement in 1975 – 2000 are from labor productivity, domestic demand, export expansion, or import substitution.

This question is still highly relevant as Indonesia has experienced unemployment since the 1997/1998 economic crisis. While the economy grew moderately between 2000 and 2004, unemployment rates were still high and the formal sector was stagnant. It is expected that by decomposing the sources of production growth, employment and productivity, we may come up with a better understanding of how trade policies and globalization affect these variables. Therefore, this study attempts to learn from the country's experience what factors in the economy drive employment. Thus, the period observed is 1975 to 2006 as the country went through a boom and bust period as well as major policy development during that period. Our analysis will be divided into three periods before and after the 1998 economic crisis; 1)1990-1996 (pre-crisis period), 2) 1996-2000 (crisis & recovery period), and 3) 2000-2006 (post crisis period).

2. Literature Review

In regard to a review study of empirical research on the impact of globalization on firm activities, Hayakawa, Kimura and Machikita's study offers excellent references to such studies. Hayakawa *et al.* (Hayakawa *et al.,* 2009) summarize empirical research as aiming to understand the relationship between globalization and the behavior of firms. Moreover, the study, discusses the use of micro data in observing firm behavior in reaction to policy measures on globalization. It reviews topics regarding firm behaviors in response to globalization, ranging from the selection of investing and exporting derived theoretically from the Melitz model; selection of outward investment country destinations; entry mode choice; selection of dead or surviving firms; selection of the number of varieties; products and resource changes; roles of outward and inward FDI; agglomeration and changes in the source of employment, production and productivity (i.e. decomposition). Apart from several studies and methodologies investigating firm-level behaviors in response to globalization, the decomposition methodology (production, employment and productivity) is a methodology assessing the impact of changes at firm level on the national economy. The approach might seem simple compared to other methods utilizing plant-level datasets though it reasonably captures the dynamic changes of firms as it also relies heavily on micro level data (e.g. exit and entry plants).

There are three issues concerning decomposition that are discussed in this paper. First is the impact of firm dynamics on employment creation (decomposition of employment). Second is the variation of output changes due to the behavior of firms throughout the period (decomposition of output). Lastly is the change of labor productivity because of firm dynamics (decomposition of productivity).

A well-known study of employment decomposition is Davis, Haltiwanger, and Schuh's research on job creation and destruction in US manufacturing (Davis *et al.,* 1996). The study investigates forces that impinge on the distribution of labor demand across industries, including the dynamics of output markets, firm and industry restructuring, and competition, both at a domestic and foreign level. As plan-level data becomes increasingly available, there is a growing body of studies investigating the trend of job creation and destruction (for example Davis and Haltiwanger 1990, 2001, Basker 2005, Ibsen and Westergaard-Nielsen 2004,Bentivogli and Pagano 1999, Klein, Schuh and Triest 2002).

Ibsen and Nielsen (2004) observed that job destruction and job creation could be caused by 1) the effect of economic policies, 2) the degree of in and outsourcing of firms and 3) the firm's ability to create new ideas that can be transformed into jobs. Moreover, job destruction and job creation are also the result of corporate strategies (e.g. maximizing the potential economic outcome). Moreover, the dynamics of job creation and destruction are most likely related to labor laws, firm-specific strategies, and the role of the educational system. Though the unemployment rate may give an apparent picture of the employment situation at an aggregate level, job creation and destruction indicators offer more indicative measures on the plant-level situation. In other words, the indicators are central in measuring how well the economy functions and how it adjusts to some forces, such as technological changes, managerial skills, and international outsourcing, etc.

By definition, job destruction is related to a process where the person is separated from the workplace and then, he or she will look for another job, retire, continue to study, etc. Meanwhile, in the case of job creation, the internal departments of a company will look for a candidate to fill a job function. They might hire someone who is already unemployed or who already has a job in a company and is interested in a move to another company. Therefore, job destruction and job creation are systematically related to the size of the workplace, average educational level, region, and industry growth.

On the decomposition of production, a strand of literature surrounding this area benefits from a novel plant-level dataset. In the context of the developed countries, where longitudinal firm level data are available, there are many studies focusing on reallocation as a source of industry output because of firm entry or exit or the dynamic pattern of composition of output across firms. For the United States, Bernard and

Jensen's studies are well-known areas of research focusing on the decomposition of US production growth (2004, 2007). A further study by Bernard, Redding and Scott focuses on the frequency and determinants of product switching in the US manufacturing sector. They found that product switching alters firm behavior in reallocating resources or inputs in order to gain the most efficient usage.

Furthermore, labor productivity decomposition at firm-level can be traced to several studies (in the United States for Baily, Bartelsman and Haltiwanger 1994; Baldwin 1995; Haltiwanger 1997; and Bartelsman and Doms 2000; in the case of Israel Griliches and Regev 1995; in the case of Taiwan Aw, Chen and Roberts 2001; Australia; Bland and Will 2001). Many experts have reached the conclusion that firm performance varies greatly, even among firms which share similar characteristics.

A study by Aw, Chen and Roberts finds that the high growth of output in Taiwan's manufacturing sector has been associated with the high rates of firm entries and exits. Using panel data, they found that new entrant firms have lower productivity though their performance is still heterogeneous. Furthermore, exiting firms have been shown to be less productive than continuing or surviving firms. Moreover, they also noted that the productivity differential between new entrants and exiting firms plays a key role as the source of productivity growth in manufacturing and it accounted for one-half of industrial improvement (Aw, Chen and Roberts 2001). Unlike Aw, Chen and Roberts' findings, Griliches and Regev found that the growth of productivity largely comes from productivity growth within firms rather than from new-entrant, exiting firms or differential growth of firms from earlier periods.

Bland and Will specifically observe labor productivity within a sample of Australian manufacturing. While hypothesis suggests that the change in labor productivity is forced by the movement of resources from less to more productive firms, the study finds no clear association between resource movement (reflected by changes in employment shares) and labor productivity for continuing or surviving firms. Furthermore, they find that there is no unique situation in which labor productivity specifically increases in more-productive firms or, the opposite, labor productivity decreases in less-productive firms. The study finds that increases in labor productivity take place at the less-productive firms and also the more-productive firms during the base period. However, decreases in labor productivity also occur in the less and more productive firms.

In the context of Indonesia, Aswicahyono and Kartika observe a change in the source of employment growth throughout several periods. Aswicahyono and Kartika find that a pre-crisis (1975-1995) rapid improvement in labor productivity reduced labor requirements considerably. A reduction in (potential) employment opportunities was due to productivity improvements, However it is more than compensated by the rapid creation of employment opportunities due to the rapid growth of output. On average, during 1975-1995, output growth stimulated employment at nearly twice the reduction rate of employment due to labor productivity improvements.

Their study also suggests that a slowdown in labor productivity improvements during 1980-1985 coincided with the late import substitution period of 1980-1985. It can be concluded in general that prior to the crisis, through rapid investment growth, Indonesia was able to marshal massive employment creation and improve the well being of workers through productivity improvement.

Table 1. Source of Employment Growth in 1990-1995 by Sector

	dL	Qda	adQ	dD	dE	dIS	dIO
1 - Agriculture	2,033,965	(12,305,524)	14,339,489	21,730,284	3,978,875	(6,360,472)	(5,009,198)
2 - Mining	183,044	(116,588)	299,632	425,571	100,246	(114,931)	(111,254)
3 - Manufacturing	3,125,276	(3,278,829)	6,404,105	6,387,779	1,620,089	(2,234,519)	630,755
4 - Construction	896,037	(1,079,261)	1,975,298	1,888,247	21,280	(23,803)	89,574
5 - Wholesale & retail trade	3,502,454	(4,886,024)	8,388,478	7,342,485	1,423,586	(663,364)	285,771
6 - Transport & communication	1,205,761	(472,427)	1,678,188	1,127,076	554,911	(630,778)	626,980
7 - Other Activities	2,046,800	(7,048,546)	9,095,346	7,283,033	780,674	(998,075)	2,029,715
	12,993,337	(29,187,200)	42,180,537	46,184,474	8,479,661	(11,025,941)	(1,457,656)
1 - Agriculture	100	605	(705)	(1,068)	(196)	313	246
2 - Mining	100	(64)	164	232	55	(63)	(61)
3 - Manufacturing	100	(105)	205	204	52	(71)	20
4 - Construction	100	(120)	220	211	2	(3)	10
5 - Wholesale & retail trade	100	(140)	240	210	41	(19)	8
6 - Transport & communication	100	(39)	139	93	46	(52)	52
7 - Other Activities	100	(344)	444	356	38	(49)	99
	100	(225)	325	355	65	(85)	(11)

Table 2. Source of Employment Growth in 1995-2000 by Sector

	dL	Qda	adQ	dD	dE	dIS	dIO
1 - Agriculture	(68,446)	1,189,275	(1,257,721)	(2,080,469)	7,614,228	(2,804,603)	(3,986,877)
2 - Mining	33,636	(4,732)	38,368	(195,514)	177,631	(87,764)	144,015
3 - Manufacturing	153,218	(1,221,026)	1,374,244	(1,518,712)	3,495,152	(700,490)	98,293
4 - Construction	415,175	1,297,050	(881,875)	(868,016)	37,211	(24,136)	(26,934)
5 - Wholesale & retail trade	3,685,833	3,424,758	261,075	(3,880,655)	1,529,352	(713,500)	3,325,878
6 - Transport & communication	1,097,073	507,626	589,447	164,304	666,117	(530,190)	289,217
7 - Other Activities	733,245	2,252,447	(1,519,202)	(2,102,835)	759,265	(756,634)	581,002
	6,049,734	7,445,398	(1,395,664)	(10,481,897)	14,278,954	(5,617,316)	424,595
1 - Agriculture	(100)	1,738	(1,838)	(3,040)	11,124	(4,098)	(5,825)
2 - Mining	100	(14)	114	(581)	528	(261)	428
3 - Manufacturing	100	(797)	897	(991)	2,281	(457)	64
4 - Construction	100	312	(212)	(209)	9	(6)	(6)
5 - Wholesale & retail trade	100	93	7	(105)	41	(19)	90
6 - Transport & communication	100	46	54	15	61	(48)	26
7 - Other Activities	100	307	(207)	(287)	104	(103)	79
	100	123	(23)	(173)	236	(93)	7

Source: Aswicayono and Kartika 2009.
Note dL: The change in employment Qda is the output multiplied by the change in labour requirement per unit of output; adQ is the labour requirement per unit output multiplied by the change in output; dD is the change in demand; dE is the change in export; dIS is the change in import substitution and dIO is the change in input-output.

Moreover, employment induced by domestic demand was the main source of employment prior to the crisis. The effects of a large market and increased purchasing power, due to rapid economic growth produced this result. Third, employment created by exporting during the export boom period 1985-1995 more than doubled that of the import substitution period (1975-1985). Improvement in productivity was also better during the export boom period.

The pattern has been different since the 1998 economic crisis. First, the source of employment growth was mainly declining productivity, while output expansion contributed negatively to employment creation. Therefore, the economy ended up with fewer jobs and lower productivity. Manufacturing and mining are the exception but were responsible for a lower level of employment creation (Table 2). Second, domestic demand expansion was no longer the main source of employment, replaced by export induced employment (Aswicahyono and Kartika 2009).

The paper finds that the impact of greater productivity on employment is ambiguous. An increase in productivity allows firms to absorb fewer workers, which, in turn, decreases the level of employment. However, an increase in productivity will lead to an expansion in firm productivity, that is, by using the same resources; the output produced will be larger than before. Higher output will enable firms to expand production and use more resources, including labor. In this channel, a higher level of productivity leads to more absorption in employment. Recent research supports the latter view.

In regard to the decomposition of productivity, large empirical studies focus on total factor productivity (TFP) growth. One study was done by Sjoholm (1997). Using detailed micro data from Indonesian manufacturing industries for the years 1980 and 1991, he calculated each firm's value added growth, labor growth, a proxy for capital growth (which is investment per output) export share of output, and share of imports in intermediate inputs. He then regressed the growth of value added on the remaining variables.[1] His study suggests that participation in international trade, especially through exporting, does have a positive impact on firms' TFP growth.

In the same vein Aswicahyono's study also undertakes research on the sources of TFP growth (Aswicahyono 2000). His study finds that the growth of demand, whether from export expansion or import substitution, leads to a positive result for TFP growth. The strong positive sign of the growth of demand, regardless of the source of growth, indicates the importance of economies of scale. Since economies of scale are one of the components of TFP growth, we may see a positive association between the growth of demand and TFP growth (Verdoorn's Law). Moreover, he also finds that there is no significant advantage for an import substitution strategy relative to an export expansion strategy. His study concludes that an export expansion strategy is more conducive to TFP growth than an import strategy.

[1] It should be noted here that even though the dependent variable is value added growth, the inclusion of labour and capital growth as the independent variables make it equivalent to the productivity studies.

Interestingly, according to his study, competition does create a positive environment for TFP growth. In addition, ownership has no effect on TFP growth. He finds that government and foreign ownership variables give an insignificant result. Yet he cautiously argues that it is uncertain whether the insignificant result is due to the fact that ownership has no effect on TFP growth, or to the inaccuracy of the measurement of ownership.

Two previous studies on productivity are based on aggregate data and hence depict aggregate industry dynamics. More recent papers provide firm level analysis and provide a more detailed firm level dynamic. Earlier studies on firm dynamics show considerable evidence of firms 'graduating' to larger size groups. (Aswicahyono *et al.*, 2008). The analysis was made possible by the fact that each firm in the annual survey is identified by a consistent designated code that enables it to be traced over time. The results of the study dispel the common populist view at the time that the declining share of small firms is a sign that these firms were being pushed out in the process of the rapid industrialization. Instead, the declining share of small firms can be interpreted positively that they were vacating the smaller size groups and graduating to larger groupings.

Aswicahyono *et al.* (2008) repeat the exercise until the year 2005. They find that there is little change in the size share based on current size, with the share of small firms rising slightly pre-crisis, then falling somewhat, while the largest firms were most affected by the economic crisis. However, based on size in the initial year, the small firm's shares rose quite quickly up until the crisis, but then began to decline from 2001. Based on this finding they conclude that the crisis and its immediate aftermath have changed the characteristics of firm mobility.

Table 3. Current and Initial Size

Current Size (% VA)				Initial Size (% VA)			
	Small L=20-99	Medium L=100-499	Large L=500-		Small L=20-99	Medium L=100-499	Large L=500-
1990	7	27	66	1990	7	27	66
1991	6	28	66	1991	7	28	65
1992	7	28	64	1992	10	31	59
1993	7	23	70	1993	10	31	58
1994	7	23	70	1994	11	29	60
1995	7	22	71	1995	13	29	59
1996	7	21	73	1996	12	31	57
1997	8	27	65	1997	14	38	48
1998	8	24	68	1998	14	32	54
1999	7	25	68	1999	12	33	54
2000	7	24	68	2000	13	31	56
2001	9	24	68	2001	15	31	54
2002	7	24	69	2002	13	31	56
2003	6	23	70	2003	13	31	56
2004	6	25	69	2004	13	32	55
2005	5	25	70	2005	12	33	55

Source: Statistik Industri (SI), various years.

Until the crisis, smaller firms continued to display the dynamism evident in the pre-crisis period. However, after the crisis, the pace of graduation slowed, and the small firms' share in both series based on current and on initial size, declined. There are three possibilities why the behavior changed: (i) it could simply reflect a longer term process of industrial consolidation. (ii) It could indicate that smaller firms experienced greater adjustment difficulties or (iii) the increased competitive pressures that resulted as firms fought to survive. The paper hypothesized that the slowing down of the pace of graduation might be because the barriers for smaller firms increasing their scale have risen since the crisis, particularly in gaining access to finance. The argument is that banks have more difficulty differentiating between 'good' and 'bad' loan applicants after the crisis and, as a result, banks are more likely to adopt more stringent lending policies which favor those who were able to provide more collateral and/or an established credit history. (Stiglitz and Weiss, 1981)

The Aswicahyono *et al.* (2008) paper calculates the transition matrices and gives further evidence that the speed of firm mobility slowed after the crisis. During 1992-1996, 90.6% of the firms that were small at the beginning of the period had still not shown any signs of growth at the end of the period. For the remaining balance of the small companies, 8.8% and 0.6% had graduated to the medium and large groups respectively. During 2001-2004, a larger proportion (96.1%) remains small and a smaller percentage has graduated to the medium (3.7%) and the large group (0.1%). A clear result over the two sub-periods is that there is less mobility: more small firms remained small after the crisis as compared to before it. A similar conclusion holds for the medium sized firms.

Table 4.a. Distribution of Plants (% Total Plants), 1992 and 1996

		1996		
		S=20-99	M=100-499	L=500+
1992	S=20-99	90.6	8.8	0.6
	M=100-499	13.1	75.4	11.5
	L=500+	1.9	13.1	85.1

Table 4.b. Distribution of Plants (% Total Plants), 2001 and 2004

		2004		
		S=20-99	M=100-499	L=500+
2001	S=20-99	96.1	3.7	0.1
	M=100-499	10.9	84.3	4.8
	L=500+	0.9	11.8	87.3

Source: Statistik Industri (SI), 1992, 1996, 2001, and 2004.

3. Data and Methodology

3.1. Indonesian Manufacturing Data

The data for the Indonesian manufacturing industries are documented by the Indonesian Central Bureau of Statistics (Badan Pusat Statistik, BPS). With some modification to suit Indonesian conditions, BPS uses the International Standard

Industrial Classification (ISIC) for all economic activities. The Indonesian Census of Manufacturing is part of a decennial Economic Census, while the Survey of Large and Medium Scale Manufacturing is conducted annually in intercensal years, aimed (not always successfully) at the complete coverage of all establishments with 20 or more workers. Depending on the year, there are up to 160 variables including firm identification, sector classification, type of ownership, exports, and input and output variables. The aggregate data at the five- digit ISIC level are available in a published summary form in Statistik Industri (SI), while the firm level data can be obtained from BPS in electronic form.

The census and survey data attempt to cover all establishments with twenty or more workers. In 1985 BPS changed field procedures and improved them further in 1988 and 1990. Before 1985, field procedures were deficient in identifying new establishments and merely replaced establishments that ceased operation so that the number of firms between 1975 and 1985 remained more or less constant. The new field procedures were conducted through a door-to-door enumeration. As a result, the number of establishments showed a sharp increase in 1985, 1988 and 1990. Realizing the majority of establishments had started before they were included in the annual survey, BPS decided to correct this under-coverage by 'back casting' the history of establishments that were discovered after entry. The variables that were back casted are output, value added and total number of workers.

The biggest impact of the back cast was on the number of establishments, with employment less affected, and nominal value added .even less. This pattern occurs because most of the under-enumerated back cast establishments were smaller in terms of employment and value added per worker. In terms of trends, the growth in the number of establishments and employment in the back cast series was far smoother than in the SI data. However, the value added trend remained more or less the same.

The discussion of the data sources above draws attention to the fact that there are two data sources - the SI data and the back cast series. The SI data are superior in terms of the variables they covered but showed apparent under-coverage. On the other hand, the back cast data cover all firms in the manufacturing sector but only report four variables, output, intermediate input, value added and number of workers. The under-coverage in the SI data suggests any analysis that uses this sample, pre and post 1985, may be misleading. This is especially relevant to an examination of the effects of the trade reform during the 1980s. Hence, with these data flaws, it will be more difficult to test whether changes in the 1980s are due to trade reform or to the altered sample size of the industry database.

Another complication of using Indonesian manufacturing industry data is the changes in the ISIC code. From 1975-1990 there were 119 industries (ISIC rev1), from 1991-1999. There were 286 industries (ISIC rev2). In 2000, BPS changed the classification into ISIC rev 3 with around 300 industries.

3.2. Methodology

This section extends the analysis of firm-level dynamics by examining several additional aspects: the patterns of firm-level entries and exits, and the rates of expansion and contraction for 'surviving' firms. We will undertake this analysis by tracking the history of each firm enumerated in the survey. An earlier study by Narjoko (2006) examined these patterns in the pre-crisis and crisis periods. This analysis extends the examination through to 2006, by which time manufacturing output had returned to pre-crisis levels and was growing moderately. We will employ three periods of analysis. First is the period of trade liberalization in the pre 1997/98 crisis period (1990-1996), second is the post rapid growth and crisis period (1996-2000) and third is the post-crisis period (2000-2006).

Our study, moreover, disaggregates the analysis into two key features indicating globalization. First, we analyze the decomposition based on the firm's ownership (foreign or domestic ownership). The second feature is output markets (i.e. export or domestic). By disaggregating firms by these features, we can try to understand whether there are significant differences in the source of employment, output and productivity between firms with low-exposure to globalization, illustrated by domestic ownership and domestic market oriented, and high-exposure firms, namely, foreign firms and export-oriented ones. Another important novel point of this analysis is how these variables (employment, output and productivity) in these two types of firms differ across the periods.

The analysis is expected to shed light on the main sources of production, employment and productivity. In regard to the source of production, the benchmark of our estimation strategy is the Bernard *et al.,* methodology which decomposes the sources of US economic growth (Bertnard *et al.,* 2006). Regarding the source of employment, our estimation strategy employs a job decomposition framework. Furthermore, on productivity we will employ Foster *et al.* (2001). The detailed estimation can be described as follows:

The Decomposition of Output

Bernard *et al.,* classifies firms into three categories. 1) firms producing products at time *t* and *t-5* (called "incumbents"), 2) surviving firms which have no production at time *t-5* yet produce at time t (called "adders"), 3) firms which exist only at time *t* ("new entrants"). Subscript *p* refers to the output index, B_{tp}, A_{tp} and N_{tp} are sets of incumbents, adders, and new entrant firms respectively.

$$Y_{tp} = \sum_{j \in B_{tp}} Y_{tpj} + \sum_{j \in A_{tp}} Y_{tpj} + \sum_{j \in N_{tp}} Y_{tpj} \qquad (1)$$

On the other hand, any output reduction can be decomposed into the three categories of firms 1) the incumbents which decrease their production, 2) surviving firms producing at time *t* but not at *t+5* (called "droppers") and 3) firms exiting from the industry at time *t* and *t+5*. The estimation can be described as follows:

$$Y_{tp} = \sum_{j \in C_{tp}} Y_{tpj} + \sum_{j \in D_{tp}} Y_{tpj} + \sum_{j \in X_{tp}} Y_{tpj} \qquad (2)$$

C_{tp}, D_{tp} and X_{tp} refer to the sets of incumbents, droppers and exiting firms respectively.

The Decomposition of Employment

The estimation of employment decomposition can be described as follows:

$$\Delta L = \sum_{e \in N} L_t^e + \sum_{e \in C} (L_t^e - L_{t-5}^e) - \sum_{e \in X} L_{t-5}^e \qquad (3)$$

The equation above describes the net change of employment derived from three terms. The first term captures job creation from new-entrant firms. The second illustrates the changes of employment size within surviving firms. The last term exhibits job creation due to exiting firms.

As equation 3 does not provide details about job reallocation within continuing firms, the equation can be decomposed into a further equation as follows:

$$\Delta L = \left[\sum_{e\in N} L_t^e - \sum_{e\in X} L_{t-5}^e\right]_1 + \sum_{e\in C}\left[\frac{L_{t-5}^e}{Q_{t-5}^i}\cdot\left(Q_t^e - Q_{t-5}^e\right)\right]_2 + \sum_{e\in C}\left[Q_{t-5}^e\cdot\left(\frac{L_t^e}{Q_t^e} - \frac{L_{t-5}^e}{Q_{t-5}^e}\right)\right]_3 + \sum_{e\in C}\left[\left(\frac{L_t^e}{Q_t^e} - \frac{L_{t-5}^e}{Q_{t-5}^e}\right)\cdot\left(Q_t^e - Q_{t-5}^e\right)\right]_4 \quad (4)$$

Equation 4 exhibits several key points. First, as labor demand would depend on the state of output (i.e. increases in labor demand are due to output expansion), it is important to put output-based weight on the employment level at each plant. Bracket 2, 3, and 4 represent the relative labor demand weighted by output level on each continuing/surviving plant. The first bracket shows the change of employment due to entry-exit firms. The second bracket describes the relative labor change due to the change in output at the continuing firms. In other words, it illustrates the change of employment in regard to output expansion or contraction. The third bracket suggests an own-effect of labor demand The last bracket is the cross-term effect of labor demand.

The Decomposition of Productivity

We follow Foster *et al.*,'s approach (as quoted from Hayakawa *et al.*, 2009).

$$\Delta A_{it} = \underbrace{\left[\sum_{e\in C} s_{et-1}\Delta A_{et} + \sum_{e\in C}\left(A_{et-1} - A_{it-1}\right)\Delta s_{et} + \sum_{e\in C}\Delta s_{et}\Delta A_{et}\right]}_{Continuing\ \ firms} + \underbrace{\left[\sum_{e\in N} s_{et}\left(A_{et} - A_{it-1}\right)\right]}_{Entry\ \ firms} - \underbrace{\left[\sum_{e\in X} s_{et-1}\left(A_{et-1} - A_{it-1}\right)\right]}_{Exiting\ \ firms}, \quad (5)$$

A_{it} refers to productivity (labor productivity) in industry *i* at time *t*. e is plant index. *S* is share of a plant in the industry in terms of output/inputs. *C, N, X* are continuing plants, entry plants and exiting plant respectively.

Similar to equation 4, equation 5 impinges on several important points. First, as noted by Hayakawa, Kimura and Machikita, there is a need to impose output-based weight on labor productivity as we aggregate each firm's productivity. Another issue is the importance of distinguishing between the reallocation effect and own effect in productivity growth. The reallocation effect represents the productivity growth affected by the expansion of more productive plants relative to less-productive firms. The own effect tells us about the productivity growth at each firm. The own effect is captured by the first term of the first bracket. The reallocation effect is exhibited by the second term and the last term of the first bracket, that is the cross-term. The second and third brackets describe the productivity differential between the new-entrant and exiting firms.

4. Result

4.1. Entry and Exit

This section further discusses the response of firms to such change utilizing a micro dataset. We analyze dynamics at the firm level by utilizing the entry and exit rate of firms and output decomposition. Moreover, we look into three major periods: 1) Pre-crisis period (1990-1996), 2) crisis and recovery period (1996-2000), and 3) post-crisis period (2000-2006). We also separate our analysis into two major categories: 1 ownership (foreign or non foreign ownership) and 2 market orientation (export or domestic).

In regard to firm entry and exit, we found that the entry of new firms was far higher than the exit of firms in the pre-crisis period. Moreover, high entry firms largely came from wood and wood products, chemical products, non-metallic mineral products, and fabricated metal products (ISIC 33, 35, 36, and 38) in which their number was almost double that of the exit firms of the respective sectors. The trend was reversed in the crisis-recovery period (1996-2000), where exiting firms exceeded new entrants. Exiting firms surpassing new entrants occurred in nearly all of the sectors. Yet they were most significant in non-metallic mineral products. Surprisingly, though the number of entry firms that produced wood and wood products declined significantly. The number of, exiting firms also declined slightly during 1996-2000. In other words, we did not see a dramatic change in firm-level dynamics in the industry. After the crisis (2000-2006), we observed that new entrant firms reached higher levels than that of the pre-crisis period and firms were more dynamic than they were before the crisis. The main driver was largely the food and beverages, textiles and paper products industries (ISIC 31, 32 and 34).

Table 5. The Number of Firms

Manuf.	**Incumbent**	**New-Entrant**	**Exiting**	**Total**
1990-1996	9,707	12,814	6,466	16,055
1996-2000	16,496	4,875	6,025	15,346
2000-2006	12,416	15,503	8,954	18,965
Export	**Incumbent**	**New-Entrant**	**Exiting**	**Total**
1990-1996	1,827	2,459	629	3,657
1996-2000	2,641	890	728	2,803
2000-2006	2,459	2,463	1,301	3,621
Non-Export	**Incumbent**	**New-Entrant**	**Exiting**	**Total**
1990-1996	7,880	10,355	5,837	12,398
1996-2000	13,855	3,985	5,297	12,543
2000-2006	9,957	13,040	7,653	15,344
FDI	**Incumbent**	**New-Entrant**	**Exiting**	**Total**
1990-1996	469	669	1,982	(844)
1996-2000	1,113	535	154	1,494
2000-2006	1,068	846	585	1,329
Non-FDI	**Incumbent**	**New-Entrant**	**Exiting**	**Total**
1990-1996	9,238	12,145	4,484	16,899
1996-2000	15,383	4,340	5,871	13,852
2000-2006	11,348	14,657	8,369	17,636

Source: Authors' calculation.

Concerning entry and exit by ownership, we found data that puzzled us. Before the crisis, the number of exiting firms owned by foreign companies was higher than the new-entrants. There were a significant number of firms that exited in food and beverages, wood products and paper products. However, the level of new firms entering overtook the level of exiting firms during the period of the crisis and afterwards. On the other hand, there was no significantly different pattern of firm dynamics in the domestic firms.

Regarding the output market orientation, we saw that the number of new entrant firms with export markets was higher than exiting firms during all of the period. The number declined during the crisis but the level of new entrants returned to pre-crisis level. The story is somewhat different to non-export firms, which followed the general pattern of manufacturing dynamism. Interestingly the level of new entrant firms was slightly higher in the post-crisis period than that of in the pre-crisis period.

4.2. Decomposition of Output

As we decomposed the sources of output, we observed that high output during the pre-crisis period was driven significantly by the existing firms. The wood, chemical, basic metal and fabricated metal products industries (ISIC 33, 35, 37 and 38) were the leading sectors that boosted manufacturing output in 1990-1996. Yet the trend reversed in the 1996-2000 period where the source of manufacturing output growth was new entrants. The wood and basic metal industries were sectors which contributed considerably to the growth in manufacturing output. As the economy recovered, the output of existing firms increased significantly yet the level was still lower than that of in the pre-crisis level.

Table 6. Decomposition of Output

Manuf.	Incumbent	New-Entrant	Exiting	Total
1990-1996	26,763	12,688	2,472	36,979
1996-2000	1,892	7,025	3,739	5,178
2000-2006	18,802	15,589	17,856	16,534

Export	Incumbent	New-Entrant	Exiting	Total
1990-1996	18,480	7,962	557	25,886
1996-2000	2,067	3,674	2,113	3,628
2000-2006	11,961	6,918	6,268	12,611

Non-Export	Incumbent	New-Entrant	Exiting	Total
1990-1996	8,283	4,725	1,914	11,093
1996-2000	(175)	3,351	1,626	1,550
2000-2006	6,840	8,671	11,589	3,923

FDI	Incumbent	New-Entrant	Exiting	Total
1990-1996	7,024	4,547	1,954	9,616
1996-2000	5,479	4,343	1,262	8,561
2000-2006	8,148	6,334	8,192	6,290

Non-FDI	Incumbent	New-Entrant	Exiting	Total
1990-1996	19,739	8,141	518	27,362
1996-2000	(3,587)	2,682	2,477	(3,382)
2000-2006	10,653	9,254	9,664	10,244

Source: Authors' calculation.

Moreover, the pattern of each classification does not show a significant difference to the manufacturing pattern in general, yet, some are worth mentioning. In the post-crisis period, the source of output growth in non-export firms was mainly new-entrant firms. The level of output growth from the new-entrants in the post-crisis-period (2000-2006) was almost double that in the pre-crisis period (1990-1996). At the same time, the output of the existing firms did not return to the pre-crisis period level and it was even lower than that of the new-entrants. It seems to suggest that output in the post-crisis period was mostly driven by the use of new resources rather than the reallocation of resources within the firms. Another interesting figure is that the output level of foreign firms was slightly higher than that of in the pre-crisis period-while the general manufacturing output level in the post-crisis period did return to the pre-crisis level.

4.3. Decomposition of Labor

Table 7 shows the pattern of employment creation during the pre -crisis, crisis, and post-crisis period. First, in general we observe similarities in the pattern: employment creation came mainly from net-entry and continuing firms, while a change in the labor coefficient and the interaction term contribute negatively to employment creation. This is a positive indicator of economic development, in which a new labor force is employed by new entry and the expansion of existing firms. Productivity improvements, on the other hand, reduce labor requirements per unit of output and hence contribute negatively to employment creation. However, even though increased productivity reduces labor requirements, increased productivity also reduces the cost of production. This in turn may induce a larger scale of production, which in turn creates job opportunities. The worrying sign is that during the post crisis period, the ability of the manufacturing sector, especially the contribution of continuing firms, to absorb labor has been reduced considerably,

Table 7. Decomposition of Labor

Manuf.	Net Entry	Continuing	Change in Labor Coeff	Interaction Term	Total
1990-1996	90,951	3,468,421	(749,220)	(2,181,453)	628,699
1996-2000	41,249	404,920	(12,123)	(325,490)	108,557
2000-2006	224,939	1,243,324	(498,235)	(697,057)	272,972
FDI	**Net Entry**	**Continuing**	**Change in Labor Coeff**	**Interaction Term**	**Total**
1990-1996	(40,063)	610,735	(96,064)	(403,547)	71,062
1996-2000	82,186	220,257	(97,973)	(59,911)	144,559
2000-2006	74,847	251,473	(62,132)	(115,707)	148,480
Non-FDI	**Net Entry**	**Continuing**	**Change in Labor Coeff**	**Interaction Term**	**Total**
1990-1996	131,014	2,857,685	(653,156)	(1,777,906)	557,637
1996-2000	(40,937)	184,663	85,851	(265,579)	(36,002)
2000-2006	150,092	991,851	(436,102)	(581,349)	124,492
Export	**Net Entry**	**Continuing**	**Change in Labor Coeff**	**Interaction Term**	**Total**
1990-1996	654,394	1,566,336	(446,897)	(762,360)	1,011,473
1996-2000	26,970	98,223	155,032	(102,447)	177,778
2000-2006	116,965	549,003	(143,781)	(357,349)	164,838
Non-Export	**Net Entry**	**Continuing**	**Change in Labor Coeff**	**Interaction Term**	**Total**
1990-1996	290,759	1,207,409	(250,081)	(776,659)	471,428
1996-2000	14,279	440,780	(299,883)	(224,397)	(69,221)
2000-2006	107,974	521,088	(294,127)	(226,802)	108,134

Source: Authors' calculation.

As expected, the exporting firms consistently provide more jobs than the non-exporting firms. Interestingly, prior to the crisis, non-FDI firms created many more jobs compared to of FDI firms. The situation was reversed post crisis with FDI firms creating more jobs than non-FDI. Another salient feature is that both FDI and exporting firms can withstand a crisis better than the non-FDI, non-exporting firms.

4.4. Decomposition of Labor Productivity

Table 8 shows the pattern of labor productivity change during the pre- crisis, crisis, and post-crisis periods. Again, we observe a sharp drop in productivity gains post-crisis compared to the pre crisis period. However, the sharp drop mostly occurs in non-FDI. In contrast, the contribution of FDI to manufacturing productivity is consistently increasing throughout the periods. Another salient feature is that during the crisis FDI firms show an improvement in productivity. In contrast, the non-FDI firms experience large productivity losses.

Table 8. Decomposition of Labor Productivity

Manuf.	**Incumbent**	**New-Entrant**	**Exiting**	**Total**
1990-1996	21,948	37,287	11,007	48,228
1996-2000	(8,669)	6,762	10,044	(11,951)
2000-2006	6,401	13,779	10,945	9,235

FDI	**Incumbent**	**New-Entrant**	**Exiting**	**Total**
1990-1996	715	7,070	9,943	(2,158)
1996-2000	4,900	12,583	6,031	11,452
2000-2006	3,656	10,248	10,363	3,540

Non-FDI	**Incumbent**	**New-Entrant**	**Exiting**	**Total**
1990-1996	24,045	33,670	(117)	57,832
1996-2000	(12,906)	(3,367)	4,594	(20,866)
2000-2006	3,418	8,372	4,962	6,828

Export	**Incumbent**	**New-Entrant**	**Exiting**	**Total**
1990-1996	24,613	35,842	9,971	50,483
1996-2000	1,134	6,559	12,240	(4,547)
2000-2006	6,605	11,481	8,415	9,671

Non-Export	**Incumbent**	**New-Entrant**	**Exiting**	**Total**
1990-1996	2,756	7,545	4,058	6,243
1996-2000	(5,977)	2,741	820	(4,056)
2000-2006	1,865	3,962	3,152	2,675

Source: Authors' calculation.

Exporting and non-exporting firms exhibit similar patterns. Both show large positive productivity gains prior to the crisis, but experience a loss of productivity during the crisis, and regain productivity, with a smaller magnitude post-crisis. However, during the crisis, in the case of exporting firms, it was bankruptcy that contributed negatively to aggregate labor productivity. In contrast, in the case of non-exporting firms, the decline of the productivity of incumbent firms was the major source of lost productivity.

5. Why Employment Grew Slowly

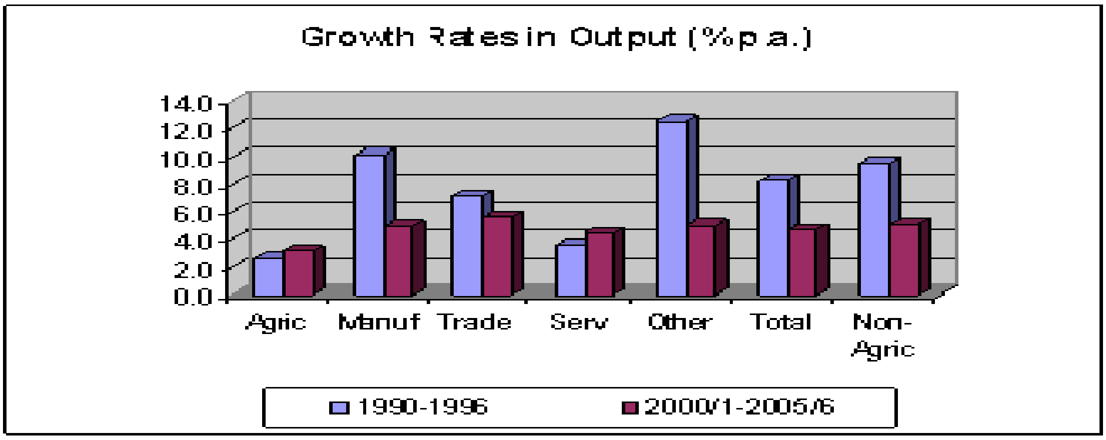
This subsection attempts to answer the question of why employment performance did not improve significantly amid strong economic growth during the recovery period. With regard to this, we identify at two domestic issues explaining low employment growth: 1) slow output growth in traditional labor-intensive industries, and 2) Stringent labor policies.

5.1. Slow Output Growth in Traditional Labor-intensive Industries

Why was the unemployment rate stubbornly high even though the economy still grew steadily? Some observers link the problem to the decelerating trend in the output growth of traditionally labor-intensive sectors, particularly the manufacturing sector (Manning 2008). This relationship, namely, the relationship between employment and output essentially relies on microeconomic theory suggesting that demand for the labor of profit maximizing firms will be at the point where the value of marginal productivity of labor is equal to the real wage rate. This shows that, assuming technology is constant, in the short-run; changes in employment are mainly due to changes in output. In this context, slow output growth of manufacturing would lower its rate in creating employment opportunities.

Figure 1 illustrates the general trend of output growth by sectors. It shows that the output growth of the agricultural and service sectors in the post-crisis period was higher than the pre-crisis period. However, the output growth of the manufacturing and trade sectors was not back to the pre-crisis levels yet. Some studies suggest that the economic crisis has changed the compositional contribution of sectors to GDP. Indeed, Aswicahyono *et al.* (2008) argue that there is a major shift in the composition of GDP, where industry is no longer the leading sector it was.

Figure 1. Growth Rates in Output



Source: Manning (2008).

Even though the trends within manufacturing vary from one industry to another due to the economic crisis, some sectors nevertheless are worth noticing, especially labor-intensive industries. During the crisis, many sub-sectors in manufacturing experienced a significant contraction (see **Table 9**). Textiles, clothes and leather industries (TCL) which are responsible for creating large employment opportunities declined by -3.4 % during the crisis. The wood and wood products industry suffered a significant loss by shrinking by -14% during the same period. Some signs of recovery occurred in the 2000-2002 period however, their growth has been slow in recent years.

Table 9. Output Growth and Shares of Manufacturing

Growth		**1994-96**	**1997-99**	**2000-02**	**2003-06**
31	Food, Beverages, and tobacco	17.5	5.6	1.6	3.5
32	**Textile, clothes and leather Ind.**	**8.7**	**-3.4**	**4.9**	**3.2**
33	**Wood and wood products**	**4.0**	**-14.0**	**2.7**	**-0.6**
34	**Paper and paper products**	**11.4**	**2.2**	**1.0**	**5.1**
35	Chemical and chemical products	10.7	-0.8	4.1	8.2
36	Non metallic mineral products	16.9	-7.0	10.4	5.2
37	Basic metal industries	11.1	-9.2	3.6	-2.4
38	Fab. metal, machine, and eq.	7.3	-21.2	26.3	11.6
39	Other manuf. Ind.	10.3	-10.2	4.8	9.2
Non-oil and Gas Manufacturing		**10.5**	**-6.3**	**7.4**	**6.2**

Growth		1993	1999	2002	2006
31	Food, Beverages, and tobacco	20.7	36.5	30.9	27.9
32	**Textile, clothes and leather Ind.**	**13.4**	**14.2**	**13.2**	**11.8**
33	**Wood and wood products**	**9.8**	**6.4**	**5.6**	**4.3**
34	**Paper and paper products**	**4.8**	**6.6**	**5.5**	**5.2**
35	Chemical and chemical products	11.2	13.5	12.3	13.3
36	Non metallic mineral products	2.9	3.2	3.5	3.4
37	Basic metal industries	3.0	2.7	2.4	1.7
38	Fab. metal, machine, and eq.	33.3	16.1	25.9	31.5
39	Other manuf. Ind.	1.0	0.8	0.8	0.8
Non-oil and Gas Manufacturing		**100.0**	**100.0**	**100.0**	**100.0**

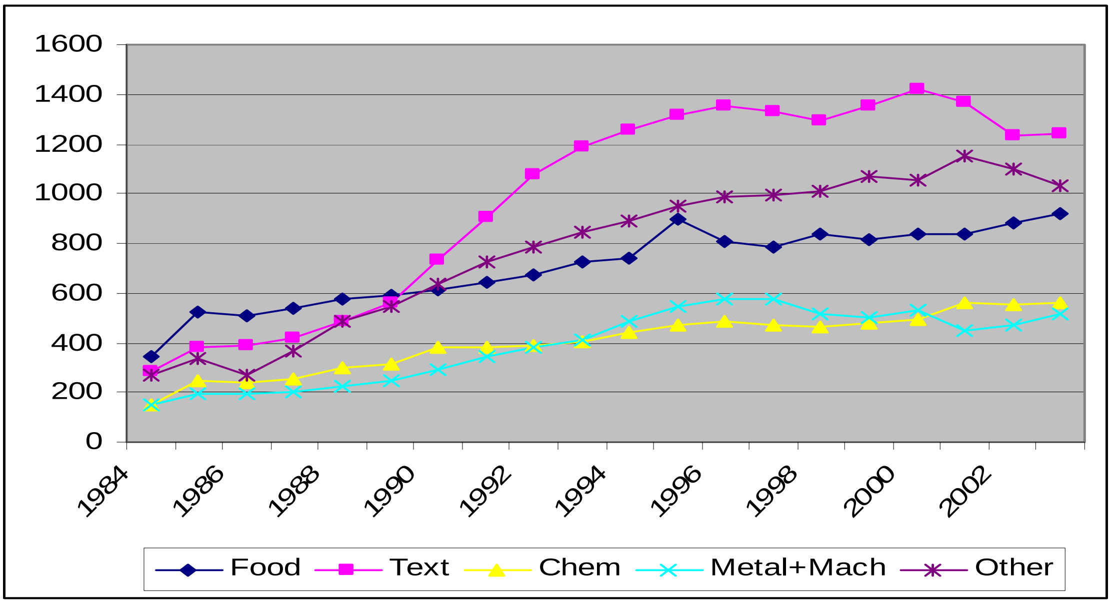
Source: Aswicahyono *et al.* (2008).

In addition, comparing trends between the pre-crisis and the post-crisis periods (2000-2006), the output growth of food, TCL, and wood sectors had not returned to the pre-crisis level. By 2003-2006, textiles, cloth and leather industries (TCL) grew slower (3.2%) than during the pre-crisis period (8.7% in the 1994-1996). Food, beverages and tobacco industries also experienced a similar slowdown in growth. Before the crisis, the sector grew at a strong pace, 17.5% between 1994 and 1996. During 2003-2006, it grew slower than the pre-crisis level, 3.5%. Meanwhile, the wood and wood products sector continued to lag by growing negatively, -0.3% between 2003 and 2006. The shortage of input supply was the main factor behind a decline in the growth of the wood sector. Furthermore, the chemicals sector grew quite steadily between 2003 and 2006 and was likely to continue to progress to the pre-crisis levels.

A recent troubling finding suggests that these sectors are no longer export growth engines (Aswicahyono *et al.*, 2008). Some recent surveys also suggest that non-tradable sectors, employing few workers, grew dramatically, whilst meanwhile the tradable sectors grew at a modest pace (Kong and Ramayandi 2008). These findings strongly support the argument of compositional shifting in GDP which is likely to have a serious effect on employment, particularly in the formal sector.

Figure 2, moreover, confirms that the sluggish output growths in textiles and food industries were followed by slow employment growth in these sectors. Manning notes that before the crisis, these sectors (textiles, chemicals and food products sectors) created about one-third of the jobs in manufacturing. Therefore, the poor performance of these sectors would significantly affect the overall employment growth in the manufacturing sector.

Figure 5. Employment in Major Sectors of Large & Medium Manufacturing 1984-2003



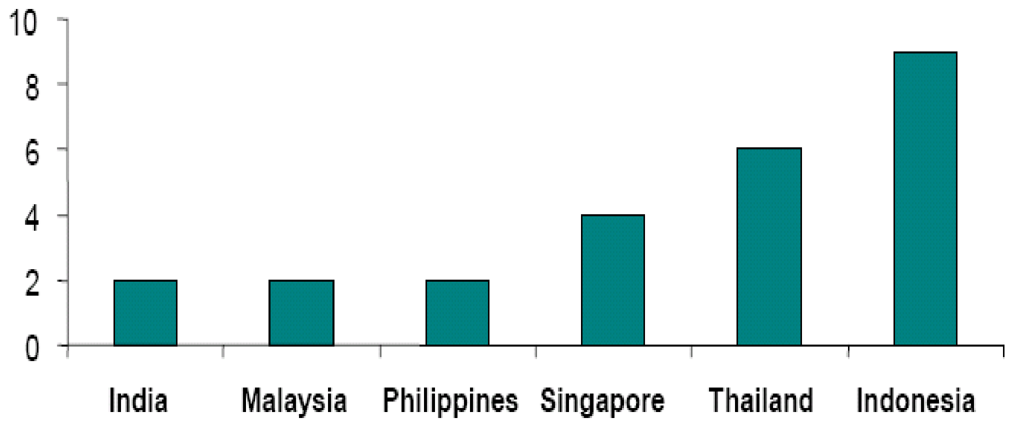
Source: Manning 2008.

5.2. Stringent Labor Policy: Manpower Law No 13/2003

Many studies also point out that the slower formal sector growth was connected to Manpower Law No 13/2003. Manning and Roesad (2007) excellently summarize the articles of manpower law No 13/2003 which are hurdles for employment growth in the formal sector, particularly articles about severance pay, sub-contracting and fixed-term contracts. Though sub-contracting and fixed-term contracts are the key controversial points of the Law, this article mainly will discuss severance pay and emphasize its impact on the growth of employment, particularly in the formal sector.

Some points, moreover, are worth noting regarding severance costs. First, in the regional context, increases in severance payments occurred in the period when they fell in many countries. These increases would have a backwash effect on the growth of employment particularly in the formal sector, considering the economy was not in a favorable condition as compared to other countries. Figure 8 shows clearly that severance pay for the dismissal of a worker with four years of experience due to economic reasons is quite high in Indonesia.

Figure 6. Severance Pay in Number of Monthly Wages for a Worker with 4-years Experience at a Firm and Dismissed for Economic Reasons



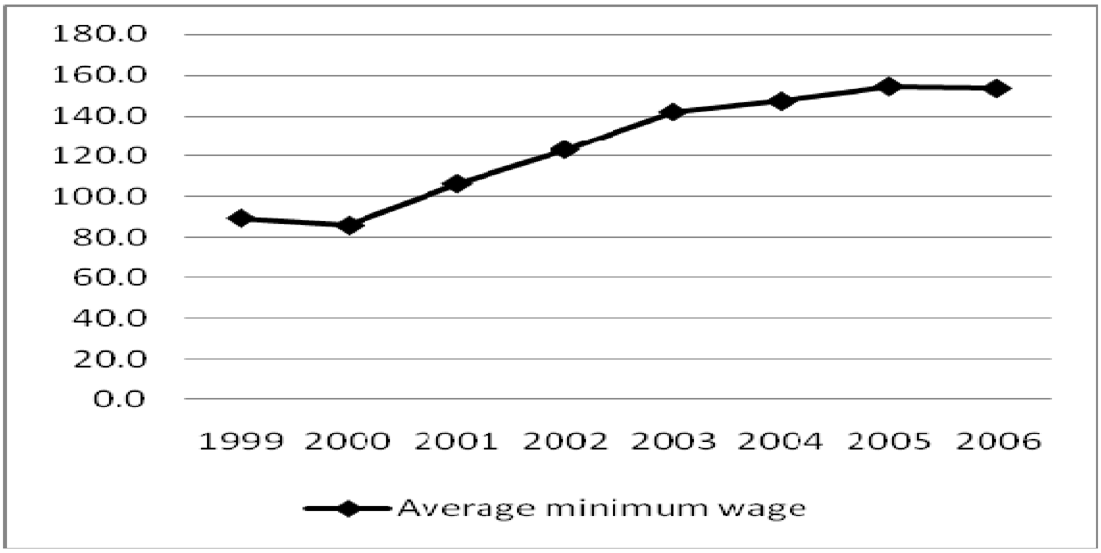
Source: GIAT-UNPAD 2004, quoted from Kelly Bird (2005).

Second, severance costs in real terms have increased dramatically, particularly in the period 2000-2003, and were mainly due to a dramatic increase in the minimum wage and at a time when the manufacturing sector was on the way to recovery (Manning and Roesad 2007). **Figure 7** shows that there is a sharp increase in the real minimum wage in the period 2000-2003. This sharp increase dramatically maintained the level of severance costs. Manning and Roesad show that during 2000-2003 severance costs skyrocketed by 170%. A rapid increase occurred in the Bandung area where severance costs rose by 250% and the main contribution of increases in severance costs was the real minimum wage.

Even so, this rapid increase does not necessarily occur in reality, first and foremost because of low compliance rates which are common in developing countries. Furthermore, some studies show a strong positive relationship between the minimum wage rates and non-compliance rates across developing countries. Bird shows that as the minimum wage rate relative to median wage rate rises, the number of wage workers earning below the minimum wage rate is increases (Bird 2005). He concludes that, comparing across developing countries, higher minimum wage rates are usually followed by a higher number of non-compliant firms.

Therefore, if the compliance rates are low, for example because of a weak enforcement mechanism, one may argue that the law would not lead to an improvement in welfare for those covered by the law (formal sectors) or there may even be a deterioration in welfare for those outside the formal sectors. Indeed, the Law may be irrelevant in regard to implying any welfare changes (Manning and Roesad 2007). In addition, since the coverage provided by the law is quite low, its impact on employment may be pretty small. However, the potential effect due to a stringent labor regime would contribute to the slower growth of employment in the formal sector.

Figure 9. Average Real Minimum Wage



Source: Depnakertrans.

Table 10. Rise in Real Severance Costs and Contribution of Increases in Severance Rates and Minimum Wage Rates, by Firm Location 2000-03

	Increase in real Minimum Wage	% of increase in severance costs due to rise in			
		Severance pay rate	Real minimum wage	Total	Increase in real severance costs 2000-03
Indonesia (Average)	47.5	49	51	100	170
Jakarta	65.2	41	59	100	203
Bandung	90.8	33	67	100	250
Surabaya	83.6	35	65	100	237

Source: Maning and Roesad (2007).

6. How Globalization Affects Indonesian Manufacturing: A Case Study of the Textile Industry

The textile industry has been an important sector, as it provides a large number of employment opportunities. However, it experiences strong pressure from international markets. Atje *et al.* (2008) reports that the Indonesian textile industry has faced a new international competitive environment. Some reasons for this are; the end of the WTO Agreement on Textiles and Clothing (ATC), the rapid growth in export of Chinese goods to the world, trade liberalization of the textiles, clothing and footwear (TCF) market in ASEAN, and the creation of preferential trade areas (PTAs).

Though the ATC ended in 2005; implying a freer market of textile trading Hassler (2004) argues that it might not be the case as some developed countries sill imposed various non-tariff barriers. Japan, for example, introduced a high import duty and Australia imposed a quota on garment importers. In Western Europe, some countries such as Sweden and Germany require eco-labeling standards for their imported goods (Hyvarinen 1997, cited in Hassler 2004). All of these trade measures definitely impede the competitiveness of developing countries' products.

Hassler furthermore notes that an implication of the end of ATC may be a lower demand for clothing suppliers (Hassler 2004). Atje *et al.* (2008) argue that it may impact Indonesia in at least two ways. First, large importing economies may import goods from geographically closer countries since the delivery cost in terms of nominal cost and time is lower than other exporting countries. It encourages North American and Western Europe neighboring countries such as Latin American and African countries, and is detrimental to the Asian countries. The second implication is that buyers would prefer to import from producers who are able to provide products and services related to all stages of production (Minor and Feeney 2006). The services which importers might require include designing, sample making, material and accessory sourcing, financing, and making up. This new type of demand from large importers would create new opportunities for Indonesia and other Asian countries in the region.

Another globalization effect is the role of China in the global market. The growing export market for Chinese goods has a considerable impact on emerging economies, including Indonesia. However, it seems that in the long run, China may upgrade its technological ladder, moving away from the labor-intensive manufacturing industries. In addition, using the Finger-Kreinin export similarity index, Athukorala suggests that goods from Indonesia, and other ASEAN countries, have low similarity to Chinese products in 2003. Nevertheless, it is noted that among the ASEAN countries, Indonesian products are the closest in similarity to Chinese products. This may imply that the effect of China's huge export expansion on Indonesian exports might be less harsh than expected although it could not be regarded as being negligible (Atje *et al.*, 2008).

In the context of liberalization in ASEAN and the creation of PTAs, the regional initiatives of the ASEAN Economic Community (AEC) might assist its member countries to prop up their competitive advantage in the textile industry. One of the AEC priority sectors is textiles and garments which is in line to be fully liberalized in the region by 2010. During the post-quota era, ASEAN was able to integrate its supply chain in order to serve large markets such as the US and the EU with a full range of services and products in textiles and product of textiles (TPT). All ASEAN countries are clothing manufacturers except Singapore and, to some extent, Malaysia (Minor and Feeney 2006). However, the opportunity lies in the fact that countries have different cost competitive advantages. Some are competitive in making up; others in yarn producing, fabric dying and finishing, and others are in logistics, design, and marketing. Therefore, a regional integrated supply chain would enable industries in the region to compete with other cheap-labor countries and thus strengthen its position in the international market.

Nevertheless, a few shortcomings of the ASEAN production network are; the low levels of intra-industry trade in the region, substantial exemptions from tariff elimination for some newcomers in the Association, and various goods and services' standards applied by member states. Minor and Feeney (2006) report that intra-industry trade in the ASEAN region is only around 10% of all ASEAN imports of yarn and fabric. Moreover, the member countries have agreed to eliminate tariffs by 2010 with a few exceptions, whereas the Philippines, Cambodia, and Vietnam have significant tariff lines excluded from the agreement. Another shortcoming is that there are diverse standards of products ranging from low standards adopted by the least developed countries to high standards adopted by the most developed countries in the region. This could potentially hamper the free flow of goods and services in the region.

Therefore, initiatives should be taken to speed up the integration of the ASEAN production network in order to enhance the competitiveness of the region's industries in the global market. The initiatives are; promoting the elimination of tariffs, trade facilitation, customs improvement, and partnerships between ASEAN producers. An example of a partnership is suggested by Minor and Feeney (2006) which takes a form of geographic hubs between Malaysia, Singapore, and Thailand.

7. Conclusion and Policy Recommendation

Our study attempts to observe the sources of output, employment, and productivity over three periods, namely, 1) the pre-crisis period (1990-1996), 2) the crisis and recovery period (1996-2000), and 3) the post-crisis period (2000-2006). In order to capture the impact of globalization on Indonesia's manufacturing industry, our analysis is also classified by ownership (foreign investment and domestic), and market orientation (export or non export). Based on the decomposition method, we find that there are significant changes in the pattern of output, employment and labor productivity.

In regard to output, we find that high output during the pre-crisis period was driven significantly by the existing firms. Firms in the wood, chemical, basic metal and fabricated metal products industries (ISIC 33, 35, 37 and 38) were the leading sectors that boosted manufacturing output in 1990-1996. The trend, however, reversed in the 1996-2000 period where the source of manufacturing output came from new entrants. Moreover, there are no significant differences in terms of ownership and market orientation.

Concerning employment, we see that exporting firms consistently provide more jobs than the non-exporting firms. Interestingly, prior to the crisis, non-FDI firms created many more jobs compared with FDI firms. The situation was reversed post crisis with FDI firms creating more jobs than non-FDI. Another salient feature is that both FDI and exporting firms were able to withstand the crisis better than the non-FDI, non exporting firms.

In the context of labor productivity, we observe a significant drop in non-FDI firms. In contrast, the contribution of FDI in manufacturing productivity is consistently increasing throughout the periods. The finding also reinforces the significant role of FDI in improving labor productivity over periods. The story is similar to exporting versus on exporting firms, where the labor productivity of exporting firms also improves throughout the period. Finally, we suggest several policy measures:

In order to encourage manufacturing output growth, the government needs to:

- Maintain macro-economic stability and coordination in the macroeconomic policy mix (fiscal & monetary policy). Macroeconomic stability, especially the interest rate and exchange rate, is necessary to support a better investment climate
- Increase investment in infrastructure support, especially in the improvement of energy resources and the improvement of the port management system in order to strengthen competitiveness.
- Create a business friendly environment through regulatory and bureaucratic reforms. In the decentralization context, this policy should be pursued by increasing coordination among government agencies horizontally and vertically as well as by controlling and abolishing unnecessary regulations, taxes and levies that have harmed economic activities.
- Provide market access information and trade facilitation as well as seeking new market destinations to increase exports. This can be pursued by intensifying and improving the effectiveness of joint government and industry approaches to market promotion, such as joint public-private participation in trade fairs, trade delegations, etc.
- Consider further involvement in preferential trade agreements with its export partners in order to avoid losses in its competitiveness with other countries since it is not involved in any preferential trade arrangement. However, persistent

support for multilateral trade agreements that facilitate global tariff reduction through the WTO framework should also be intensified.

Concerning labor issues, the government is expected to

- Reform labor-related regulations aimed at creating a more flexible labor market. The top priority of the reform should be severance payment regulations increasing by almost double in the period of recovery. Firms need to subcontract and outsource labor using permanent workers which will offer flexibility for adjusting input costs and coping with any shock in demand. This is particularly important in the labor-intensive industries.
- However, the government cannot simply impose a fully coherent reform, because this might be self-defeating. In a new democratic environment with strong labor unions, it is necessary that all stakeholders concerned (i.e. the government, employers and workers) should have an active part in the process.

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CHAPTER 12

Structural Adjustment and International Migration: Firm Survey Analysis of the Thai Clothing Industry

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This paper probes the structural adjustment process using evidence from the Thai clothing industry, with a view to informing the policy debate about international migration. The analysis is based on in-depth interviewing with 50 clothing firms in Thailand during November 2009-February 2010. The key finding is that not all firms opt to hire unskilled foreign workers (henceforth foreign workers). There are systematic differences in firm characteristics between firms who hire foreign workers and those who do not. The latter are relatively large in size (both employment and sales), perform better, and actively undertake upgrading activities. The former are struggling to maintain their profit margin, are relatively small, and do not adequately invest in upgrading activities. Interestingly, hiring foreign workers is not firms' first response but is a reflection of the fact that they have not yet been successful in undertaking functional upgrading. While there are many kinds of upgrading (service, product and functional), our finding points to the relative importance of functional upgrading for long-term and more sustainable development. Firms which were late in undertaking functional upgrading are likely to hire foreign workers during their structural adjustment process. Allowing unskilled foreign workers on a temporary basis would be a win-win-win solution for labor importing and exporting countries, as well as for the migrants themselves. Nevertheless, a condition for firms hiring unskilled foreign workers must be related to preventing any retarding effect on upgrading effort. Three policy inferences can be made from this paper. First, potential exists for mutual benefit for countries in the region, and there is room for international organization to materialize such potential. Secondly, it seems risky for labor-importing countries to impose one-size-fit-all policy measures in managing flows of unskilled foreign workers. Sector-specific types of policies are preferable. Finally, it is functional upgrading that plays the pivotal role in a sustainable development process.

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1. Issues

Liberalizing international trade, accelerating technological change and shifting societal concerns are important drivers of structural change, both within and across firms and industries. Such structural adjustment raises acute challenges. The requirement is for successful trade-related structural adjustment via the reallocation of labor and capital to more efficient uses, while minimizing adjustment costs for individuals, communities and society as a whole. The policy challenge is, therefore, to facilitate the change so as to take advantage of new possibilities while at the same time limiting adjustment costs.

In the context of the East Asian region, the process of structural adjustment is policy relevant, as it is related to the growing important phenomenon of cross-border movement of unskilled workers, driven by differences in economic development and demographic factors (i.e. aging population) (Salt, 1992; Global Commission on International Migration, 2005; World Bank, 2006: ILO, 2006). In theory, when a firm is undergoing a structural adjustment process as a result of labor market tightening and continued increase of (real) wages, three options are open; (1) hiring foreign workers, (2) capital deepening, and (3) capital exporting. The first option seems to be controversial. While labor-exporting and least developed countries have become increasingly active in helping their workers to work abroad, at least on a temporary basis, governments in labor- receiving countries have expressed their reluctance to allow flows of workers, and unskilled workers in particular, despite the presence of demand from their entrepreneurs. At best, they just allow such flows on a temporary basis and retain a high degree of policy discretion. Among numerous social and economic consequences resulting from importing unskilled foreign workers, one relates to possible negative consequences in the structural adjustment processes of firms. Particularly, when firms are allowed to hire unskilled foreign workers in order to undergo structural adjustment, they may become reliant on them. Subsequently, their investment and other decisions might be made on the premise that labor costs would continue to be held down by migration. As a result, firms will remain at the low end of the value chain and rely on low wages as a key factor in competing in the world market. This would eventually retard upgrading.[1]

However, there are not prior theoretical arguments suggesting that decisions to upgrade and to hire unskilled foreign workers have to be interrelated. This is especially true for export-oriented industries like clothing and footwear, where multinational enterprises play an important role in global trade (Humphrey & Schmitz, 1998; Rabellotti, 1997; Schmitz &Nadvi, 1999; Gereffi, 1999; Gereffi & Memedovic, 2003). When firms have not yet completed their upgrading activities, they might opt to hire unskilled foreign workers during their transition, so as to avoid drastic adjustment. While the choice to undertake structural adjustment is a matter for the firm, each type of firm seems to have an uneven opportunity to choose. In the context of developing countries, small and medium firms as well as indigenous firms might have difficulties in using Options 2 and 3, (Capital Deepening and Capital Exporting) partly due to market failure elsewhere such as a less-developed financial system, credit constraints and other kinds of distortion affecting these kinds of firms.

In addition, international organizations such as the Association of South East Asian Nations (ASEAN), the Asia Pacific Economic Cooperation (APEC), the World Trade Organization (WTO), and the International Labor Organization (ILO), started searching for a form of international cooperation to manage the flows of unskilled workers, so as to maximize benefits while preserving the integrity of borders and human rights. So far such cooperation is still at an early stage. There were also policy initiatives between Thailand and her neighbors sharing borders, reflected in a signed memorandum of understanding (MOU) about labor mobility across borders.[2] For example, unskilled labor movement has just been incorporated in the WTO multilateral negotiation, Doha Development round (i.e. Mode IV in the General Agreement of Trade in Services-GATS) (Schiff, 2007; Hanson, 2008). Another example is the launching of the ILO Multilateral Framework on Labor Migration: Non-binding Principles and Guidelines for a Rights-based Approach to Labor Migration. There was a movement in APEC where

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[1] Upgrading here is defined broadly covering service, product and functional-based. See the definition in Section 6.

[2] Thailand signed a Memorandum of Understanding (MOU) with Laos in 2002 (Ministry of Labor), Cambodia in 2003 (Ministry of Labor) and Myanmar in 2003(Ministry of Foreign Affairs) bilaterally in order to manage the cross-border flows of unskilled labor.

key immigration officials were brought together in a non-threatening atmosphere to discuss issues of mutual interest, which can be the basis for more detailed later engagement (Hugo, 2008).

All in all, these developments point to the need for a systematic micro analysis to understand firm behavior in hiring unskilled foreign workers, e.g. what employers are looking for, to what extent the labor market is segmented, and what are the available alternative responses. A better understanding of firm behavior would be helpful in designing sensible policy toward migrants. Therefore, this paper aims to provide an in-depth firm-level analysis of firm behavior in employing foreign workers. Our focus is on the responses of firms undergoing structural adjustment to rising wages, how firms maintain their competitiveness, the ability to compete in markets for goods or services.[3] This paper is in line with the recent research effort in the UK. The Migration Advisory Committee (MAC), a body of independent economists has been tasked to advise the UK Government. Insights revealed in this paper could well be a complement to the previous studies, which were mainly econometric-based and emphasized the impact of migration on wages and job opportunities for native workers.[4]

The clothing industry in Thailand is an excellent case study for the issue in hand. Clearly, an upward trend of real wages in Thailand indicates that the country is reaching the so called 'Lewisian' Turning Point, in which the excess supply of labor observed in the 1970s is running out (Figure 1). Among industries undergoing structural change, the Thai clothing industry receives special attention as it is the industry which is the most labor intensive, absorbs a sizable amount of manufacturing workers and contains numerous SMEs. Between the late 1980s and the early 1990s, the clothing industry was the most important in Thai manufacturing in terms of exports, value added and employment. Interestingly, many firms entered the industry as a result of policy-induced economic rents from a cascading tariff structure as well as from the quota system in global trade, known as the Multi-fiber Agreement (MFA) and then the

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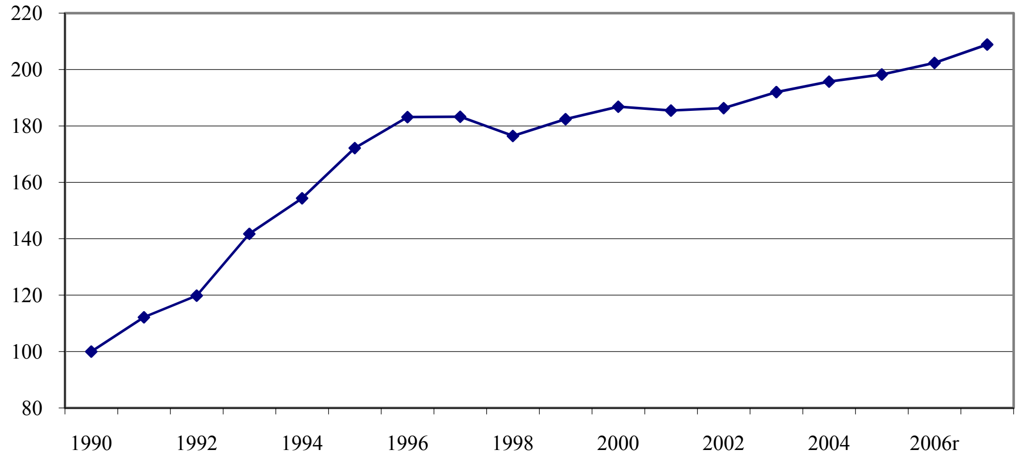
[3] Porter (2008: 174) argues that competitiveness at the firm level is clearly defined. What remains unclear is competitiveness at the national level.

[4] There are long lists of studies examining the impact of immigration on wages in labor receiving countries. For example, Borjas *et al.* (2008), Ottaviano, G. and G. Peri (2007), Borjas *et al.* (1997) Card (1990,2001,2005), Altonji & Card (1991); Borjas (1987), Grossman (1982) for the United States, Aydemir & Borjas (2007) for Canada, the US and Mexico, Roy (1997) for Canada.

Agreement of Textiles and Clothing (ATC). From 2005, structural adjustment in the clothing industry was triggered by the abolition of the ATC. In addition there are a number of clothing factories employing foreign workers in order to maintain their international competitiveness (Kohpaiboon, 2009).

Figure 1. Real Wage Index in Thailand (1990=100), 1990-2007



Note: Real wage is the ratio between (real) employment compensation and employedworkers, converted to a 1990 index (1990=100).

Sources: Employment compensation is compiled from the National Income Account, National Economic and Social Development Board (NESDB), and for employed workers from Key Indicators for Asia and the Pacific 2008, Asian Development Bank (ADB).

The paper is organized as follows; Section 2 discusses the analytical framework, illustrating choices for firms undergoing structural adjustment. In the following section, research methodology is discussed. Section 4 discusses the aggregate picture of migration in Thailand as well as policy responses so far by the Thai government. Section 5 presents the policy environment as well as the overall performance of the clothing industry. The firm-survey analysis is in Section 6. Conclusion and policy inferences are in the final section.

2. Analytical Framework

This paper's analytical framework is based on the open-economy version of the Lewis model (Lewis, 1954, 1958) developed in Athukorala & Manning (1999). In the original model, a labor-surplus economy consists of two sectors, namely the 'modern' sector and the 'subsistence' sector (i.e. it is a dual economy).[5] The production process in the modern sector makes use of capital and labor, while there are three primary inputs used in the subsistence sector, namely capital, labor and land. Note that the subsistence sector covers not only agriculture, but also handicraft workers, petty traders and domestic servants as well as farmers.

As the modern sector begins expanding, excess supply of labor moves from the subsistence sector. Employment in the modern sector is determined by the demand for labor. Given the low opportunity cost of labor in the subsistence sector, the modern sector can hire workers at a slightly higher fixed wage to compensate for the higher costs of town over rural life. Capital formation and technical progress in the modern sector do not raise wages, but increase the share of profits in the national income.

When the original model is applied to an open economy, the modern sector in a given economy must be a part of the expanding modern sector of the world. For the surplus labor economy, an opening economy means greater opportunities for output expansion through the export of goods that are intensive in unskilled labor. As the world division of labor becomes more finely articulated, countries will find their own niches in the world market. In this circumstance, labor cost becomes increasingly important for a labor surplus economy in determining the international location of production gains (Krugman 1995).

Note that labor surplus depletion in the open economy model would occur at a faster rate than happens in the closed economy model. When the labor market becomes tightened, wages begin to rise above the subsistence level and international competitiveness declines. This is the so-called 'Lewisian turning point'. When a

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[5] We follow the terminology used in Athukorala & Manning (1999). This is different from a number of previous studies that use 'industry' and 'agriculture'. This alternative terminology simply ignores micro enterprises in non-agricultural and informal sectors that are important in developing countries. In addition, such terminology gives the wrong impression that the model is not applicable to countries like Singapore, or to Hong Kong, where there is no agricultural sector, as such.

country is reaching the 'Lewisian turning point', three options are available for maintaining its international competitiveness, namely importing cheap labor from abroad, capital exporting (relocation of production to another low wage or surplus labor country) and capital deepening.

In Option 1, business can be expected to proceed in the same manner as during the labor surplus phase of development. The only difference is that abundant supplies of labor at subsistence wages are drawn from abroad. Nonetheless, in theory importing labor could retard technological progress. Once entrepreneurs become accustomed to the steady availability of unskilled workers, this would slow down productivity improvement. Investment and other decisions are made on the premise that labor costs would continue to be held down by migration. All in all, the reliance on migrant workers is likely to postpone capital deepening and technological advances in the labor receiving country. In addition, there are always concerns about the non-economic consequence of importing low-wage foreign workers, such as cultural contamination and disruption of social peace.

Option 2 is capital exporting. While in theory this option is widely open for all types of firms, in practice it is only available to large firms in tradable good sectors operating in an oligopolistic market environment. As postulated in the literature of foreign direct investment, a firm taking this step must be able to use abroad its proprietary technology, so as to offset the potential disadvantage against local firms possessing superior knowledge of the availability of factor inputs, business practices and/or consumer preferences in the host country (Dunning, 1993; Caves, 2007). In addition, foreign firms which have their global operation networks and more experience in doing business abroad would be in a better position to use this option, compared to indigenous firms. This is particularly true in the case of SMEs and also firms involved in diffused-technology product lines. In addition, relocating factories abroad would generally be a net loss to the given capital-exporting country (a reduction in national income).[6] The exception would be the relocation of locally owned firms because these

[6] Welfare improvement could result by shifting production abroad to foreign affiliates. This occurs when the entry of foreign affiliates is driven by tariff/protection motivation (Bhagwati 1973, Brecher and Diaz-Alejandro 1977, Brecher and Findlay 1983). In this circumstance, the investment-

would reap the rewards of their foreign operation and would increase the national product. Nevertheless, labor's share of the national product would be hurt.

Option 3 is to adopt labor-saving technology (Kindleberger, 1967). In theory this option would naturally occur. At the beginning, the expansion of output demand at a constant real wage leads to increased profits, savings and investment, so that the country's capital-labor increases over time. The public, especially in developing countries, views this option as far superior to the other options as it is seen as the indicator of success in the country's industrialization. In practice, a smooth adjustment does not automatically occur, but depends on how well preconditions, such as skilled workers and infrastructure, have been established. More importantly, many of these preconditions are directly related to the role of government. Another impact consideration is the involvement of multinational enterprises (MNEs). If their entry is based predominantly on the relative cost competitiveness of the given country on a global scale, and they operate in their own enclaves, they always have the option of relocating to another low-wage location rather than upgrading and/or adapting their production process to suit domestic market conditions.

As argued in Athurkorala & Minning (1999), choice among these three available options depends on both economic and non-economic factors, such as the relative importance of the non-tradable sector, industry composition, geographic factors, geo-political factors, ethnic diversity, history and geographical factors. Hence, there is not a universal solution appropriate to all countries; rather, it varies from country to country and industry to industry.

3. Research Methodology

The research methodology involved a flexible questionnaire approach. In the approach, a formal questionnaire was developed and filled-in by personal interview. Over and above filling-in the questionnaire, an additional personal interview was also

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receiving countries could experience immersing growth induced by the entry of foreign firms so that their departure could well increase (rather than reduce) national welfare.

conducted in order to gain insight of the issues at stake. This would minimize the likelihood of missing important facets of the story and maximize insight into what actually happens. In this study, sample firms were purposively chosen from information-rich cases for in-depth analysis related to the central issues under study, (Patton, 1990). Firms included must have been exposed to international competition to a certain extent. The interview period averaged one hour, and was conducted by the author.

The designed questionnaire is in Appendix 1. It starts with basic information about the firm; name, position, address, trade orientation and whether the firm employed foreign workers. The question about export status is used as the screening question. Section 1 aims to assess firms' performance in terms of changes in sales volume and value. They can be used as a proxy of the *ex post* competitiveness of firms.[7] We start with basic information on the enterprises; e.g. size, ownership, age, nature of export (OEM vs. own brand). We proposed 5 major categories (sports wear, baby wear, men's wear, women's wear and jacket/jumper). Suggested by previous studies, these five categories are different from each other in skill intensity, lead time, local content, the nature of buyers, and growth prospects. This might have impact on upgrading options. The next four questions in Section 1 are to assess firms' export capability. The interviewed firms were asked to reveal their past sales performance in terms of value and quantity. Since garments, like other products such as electronics, experienced price deflation in the past decade, solely focusing on export value decline might somehow mislead. The last two questions, the export-output ratio and export destination, are to take into account possible heterogeneity among exporters. Our hypothesis is that export to the Triad region (US, EU-15 and Japan) would be more sustainable and unlikely to be a once-and-for-all event. The last two questions are about employment and the degree of substitution among labor and capital.

Section 2 focuses on employing foreign workers and its rationale. Only enterprises hiring foreign workers answer this section. In this section, the last two questions are open widely to allow us to examine their rationale in choosing to employ foreign workers as opposed to the other two options (capital deepening and capital exporting).

[7] As discussed earlier, firm competitiveness refers to their ability to maintain their sales.

In Section 3, we examine the upgrading experience of enterprises and their difficulty in doing so. Upgrading options include updating existing machines (i.e. change to new models), installing new machines (new types of machines e.g. laser cut, seam sealed), introducing new product lines, having new suppliers, and starting e-business. Most of these are about capital deepening. Section 4 is open for any comments from the enterprise.

50 firms were interviewed between November 2009- 14 February 2010. The sample was well distributed in terms of employment size (Table 1). There are 20 firms whose employment is less than 200 workers. Their employment accounted for 40 per cent of the total interviewed samples. The large-sized firms whose employment exceeds 500 workers accounted for another 40 per cent of the total sample. There are another 10 firms whose employment was between 200 and 500 workers. In the new millennium, research attention has shifted toward structural adjustment as a consequence of liberalized global trade in garments (i.e. the abolition of the Agreement on Textiles and Clothing-ATC), so those exports firms are our focus group in the sampling process. As a result, firms whose export share is greater than 60 per cent accounted for 60.5 per cent of the total samples (Table 2). To ensure the absence of sample selection bias, domestic-oriented firms are also covered in the sample in spite of the limited number.[8]

Table 1. Employment Structure of Sample

Numbers of Workers	2008	As of June 2009
50 ≤	3 (6)	3 (6)
51 – 200	17 (34)	18 (36)
201– 500	10 (20)	9 (18)
501 – 1,000	9 (18)	8 (16)
> 1,000	11 (22)	12 (24)
Total	**50 (100)**	**50(100)**

Note: Numbers reported are the numbers of firms and those in parentheses are the percentage of total firms.

Source: Firm survey conducted by authors.

[8] In the sample, 43 out of 50 firms exported their products in 2008.

Table 2. Exports Structure of Sample

Percentage of Export to Total Sales	2008	January - June 2009
20% ≤	7 (16.3)	8 (18.6)
21 – 40%	4 (9.3)	4 (9.3)
41 – 60%	6 (14)	6 (14)
> 60%	26 (60.4)	25 (58.2)
Total	**43(100)**	**43 (100)**

Note: Numbers reported are the numbers of firms and those in parentheses are the percentage of total firms.

Source: Firm survey conducted by authors.

4. Migration in Thailand and Policy Responses

4.1. Patterns of Migrant in Thailand

Cross-border migration from neighboring countries is not a new phenomenon but was recognized long before the economic boom in the late 1980s. Most migrants during the 1970s and early 1980s were refugees from neighboring countries fleeing the conflict and devastation of civil wars and most of them were re-settled in third countries or repatriated (Supang, 1993). Since the late 1980s Thailand has experienced a surge of unskilled foreign workers, especially from neighboring countries. For example, the total of legal immigrant workers in Thailand was 98,243 persons in January-November 2003 (Chalamwong, 2004: 515), gradually increasing from 63,600 and 69,750 workers in 1997 and 1998, respectively (Chalamwong, 2001: 12). This is in a sharp contrast to estimates of unskilled workers in Thailand that increased from 38,000 workers in 1987 to 717,000 and 986,889 workers in 1997 and 1998 (Chalamwong, 2001: Table 4). In 2004-6, the estimate reached 2.2 million workers (Hugo, 2008: Table 1.10). Most of the unskilled workers are from three neighboring countries, namely Cambodia, Lao, and Myanmar (CLM).

Table 3 illustrates the pattern of registered unskilled foreign workers between 1998 and 2009. Since figures in the table are official, their distribution to a certain extent was related to the degree of policy restrictiveness toward unskilled foreign workers. Despite the presence of such shortcoming, the pattern observed in the table would reflect trends and patterns of unskilled foreign worker demand. Clearly an export-oriented manufacturing sector like garments, plastics and electronics became an increasingly important destination for these workers. In 1998, foreign workers were highly concentrated in the construction, domestic services, fishery and agricultural sectors, in total accounting for nearly 90 per cent. Their share dropped to 57.3 in 2009 (Table 3). The manufacturing sector was an important destination absorbing these workers. Its share increased from 6.3 in 1998 to 18.2 and 18.7 in 2003 and 2009, respectively. Within the manufacturing sector, garments are the third largest destination, accounting for 20 per cent of the total.

Table 3. Sector Distribution of Registered Unskilled Foreign Workers, 1998, 2003 and 2009

Occupation	1998	2003	2009
Helper	13.6	18.2	9
Agricultures	32.2	23.0	16.9
Fishery & Related	14.2	19.3	14.7
Construction	30.7	n.a.	16.7
Manufacturing	6.2	18.2	18.7
Subtotal	97	78.7	76
A number of registered workers	89,862	288,780	1,310,690

Sources: Compiled from an official source, Department of Employment, Ministry of Labor.

Migration in Thailand is largely an economic phenomenon determined by a combination and interaction of supply-push and demand-pull factors, and government policies. Thailand has passed through a full migration cycle, moving from being a major source of labor to the Middle East, and the more advanced economies of Asia, to becoming an important destination for unskilled migrant workers from neighboring low-income countries, mostly on an irregular basis. Real wages in Thailand show a steady upward trend since the late 1980s (Figure 1). Even though it dropped after the 1997/98 crisis, its growth rate has remained positive. It suggests that the country has reached the so called 'Lewisian' Turning Point, in which the excess supply of labor observed in the

1970s is running out. There are jobs that are shunned by native workers, such as domestic services, fishery, sugar and palm plantations and construction.

Reflected in Table 4, there is tendency that flows of unskilled workers from CLM to Thailand will continue. Demographic indicators such as expected growth of workforces, and the ageing index, tend to suggest that the labor market in Thailand will remain tight. While economic advance has been observed in the past few years for three neighbors sharing the common border (i.e. Cambodia, Lao, and Cambodia), the income gap will remain wide in the next decade.

Table 4. Population, Population Growth and Population Ageing Index

Country	Total population in 2007 (mil)	Projected Growth of the Population Aged 15-64 (%)			Ageing Index 2007	(PPP) GDP per capita 2007($)	Forecasted Growth Rate (%) 2010-14
		2005-10	2010-20	2020-30			
Thailand	65.2	0.96	0.47	-0.01	47.5	7,941.65	5.0
Thailand's neighbors which share common borders							
Cambodia	14.6	1.03	1.018	1.015	16.2	1,949.12	6.1
Laos	6.2	1.03	1.02	1.017	13.3	1,979.48	7.0
Myanmar	51.5	1.0	1.0	1.0	28.1	1,110.02	5.0
Other ASEAN members							
Brunei	0.4	2.7	1.9	1.3	17.4	50,902.03	1.4
Indonesia	228.1	1.5	1.2	0.6	30.9	3,721.78	5.5
Malaysia	26.2	2.4	1.7	1.0	23.5	13,400.57	4.8
Philippines	85.9	2.4	1.9	1.3	18.5	3,379.75	4.1
Singapore	4.4	1.8	0.2	-1.1	74.8	50,448	4.3
Vietnam	86.4	2.3	1.3	0.7	26.5	2,607.15	6.4

Source: UN, World Population Ageing 2007; International Monetary Fund, World Economic Outlook Database, October 2009.

4.2. Policy Responses

The Thai government began managing flows of foreign workers from the late 1980s when the economy experienced rapid economic expansion and the labor market was tightening and, hence, the number of illegal migrants increased rapidly. The general policy response during the past two decades is classified as active intervention (Hugo, 2008). In general, Thailand keeps open the option of hiring unskilled foreign workers on a temporary basis and uses it in a discretionary manner, as reflected in the Alien Working Act, a piece of primary legislation to govern flows of foreign workers, introduced in 1978 (Article 12) and amended in 2008 (Article 14).

Trial and error experiments were observed during the period 1990 and 2008 in aimed at managing illegal migration and ensuring the entry of these migrants on a temporary basis only. The first registration system was trialed in 1992, allowing employers in 9 provinces with certain occupations listed under Category C of the Alien Business Laws, to recruit foreign migrants. There was policy inconsistency, as foreign workers could alternatively receive purple cards, a substitute for a work permit, from the Ministry of Interior at no cost, so the effectiveness of the policy measures was unsatisfactory. In 1996, registration was set up on a regular basis and policy inconsistencies such as the purple cards were removed. The number of provinces was extended from 9 to 43 in 1996. Two-year work permits were granted but it was clearly anticipated that the work permits would be extended another two years (Martin, 2004). As a result, the number of registered workers increased from 700 in 1992 (Archavanitkul, 1998:8) to 323,123 workers between September and November 1996 (Chintayananda *et al.*, 1997).

In early 1998, there was a short-lived policy reversal on migrants. The government announced a new plan to remove 300,000 migrants by not renewing work permits for these workers, simply because of the concern that the 1997/98 crisis would impact on employment opportunities for native workers. Nevertheless, despite the crisis, certain kinds of jobs that are shunned by local workers remained, and there was demand for unskilled foreign workers. For example, the Tak Industrial Council in January 2000 complained that 20,000 migrants were removed, and only 6,000 Thais applied for their jobs. As a result, the government resumed their stance of renewing work permits for these migrants until 2000 (Martin, 2004).

From 2001, the government's objective has been clearer. Economic needs for unskilled foreign workers seem unavoidable and policy focus should be on how to manage them to avoid permanent settlement and any adverse potential effect such as rising demand for public services, reduction of social cohesion and an increasing incidence of disease and crime. To meet this policy objective, a new registration system was introduced. In the new system, no restriction on types of industries and geographical areas was imposed as it had before. These workers are allowed to work in Thailand for a maximum of 4 years under the new system. All foreign workers must be registered and all migrants had to be photographed and fingerprinted. In order to implement these measures effectively, Thailand signed Memorandum of Understanding (MOU) with Lao (October 2002), Cambodia (May, 2003) and Myanmar (Jun 2003). The signed MOUs are to facilitate the repatriation process and to protect basic rights for the migrants. Interestingly, there is an additional option for provinces at the border to hire foreign workers, as expressed in Article 14 of the 2008 Act.

5. First Look at the Thai Clothing Industry

The policy environment influencing firms in the Thai clothing industry is dominated by a cascading tariff structure, in which tariffs on fabrics and yarns have always been lower than those on clothing since the mid 1980s. This encourages local enterprises to produce finished goods, as opposed to intermediate goods. Non-tariff measures were used only between 1971 and 1987.[9] By 2007, the tariff rate for clothing was 30 per cent - far higher than the country's average - whereas its intermediates (i.e. fabrics and yarns) are subject to 5 per cent tariff rates (Jongwanich & Kohpaiboon, 2007). Similar to other export-oriented industries, exporters can apply for various tariff exemption/rebate schemes such as the Board of Investment (BOI) tariff exemptions, tariff drawbacks (Section 19 of the Customs Laws) given by the Department of Customs, and tax rebate schemes given by the Fiscal Policy Offices (FPO) to mitigate the effect of input tariffs on exports.[10]

There are two adverse effects arising from this policy environment on the industry's development process. In this policy environment setting, firms have two choices; first to operate under the cascading tariff structure by producing goods for the highly protected domestic market and second to export by making use of the competitive wage

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[9] During this period spinning and weaving industries were subject to non-tariff measures and controls of production capacity (Kohpaiboon, 1995). As a result, clothing firms experienced a negative effective rate of protection (ERP) (Suphachalasai, 1992: p. 31).

[10] From 1990, there have been another three alternatives, i.e.(i) duty relief for goods placed under the Custom Bonded Warehouse scheme; (ii) duty exemption for goods taken into the Free Zones established by Customs; (iii) duty exemption for goods taken into the Export Processing Zones (EPZ). Except for (ii) these measures are directly under the administrative responsibility of the Thai Customs Department to grant duty drawback and duty exemption. Measure (ii) is under the control of the Industrial Estate Authority of Thailand.

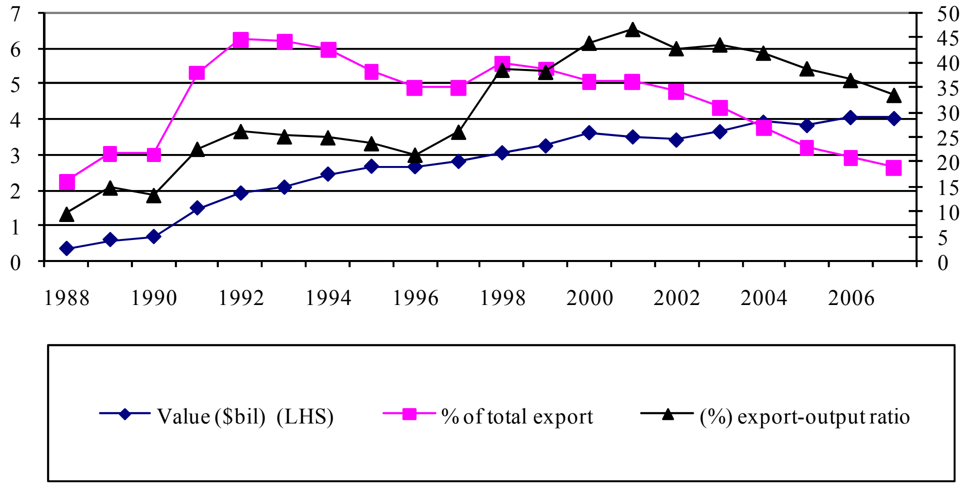
rate in the manufacturing sector and the then only partially utilized export quota of Thailand.[11] Given low barriers to entry, entrepreneurs are free to choose one over the other. While some decided to be integrated in the production networks of worldwide brand owners e.g. Nike, Addidas, Decaron, Calvin Klien, Enfant, many chose to serve the highly protected domestic market. This could dampen the technological learning activities of firms, as participating in a global network gives opportunities for suppliers to learn the advanced technology associated with the network. When firms are active in the highly protected domestic market, they are likely to be less active in improving their technological capability, as well as in addressing requests for improvements in the quality and price of the goods they offer (Bell *et al.,* 1984; Everson & Westphal, 1995; Moran, 2001). Rather, firms are more likely to produce low quality clothing in order to maximize the benefits entailed from the tariff structure. In addition, under the high tariff on intermediates, connection between clothing exporters and the domestic textile industry is unlikely. It is costly for clothing exporters to source locally manufactured fabrics and yarns because of input tariffs. Rather, they source imported fabrics and yarns and apply tariff exemption/drawbacks.

In regard to the industry's economic performance, clothing was the foremost manufacturing export of Thailand between the mid-1980s and the early 1990s (Figure 2). The surge in exports began during the mid-1980s. The dollar value of exports soared from $ 419 million during the first half of the 1980s to almost $2,000 million in the second half. Its share as a proportion of total exports was around 5% in the early 1980s before rising to 12% during the period 1987-93. Its share when compared to total manufacturing exports exhibited a more or less similar trend. In 1996, Thai clothing exports experienced a sharp drop to $3,000 million from $4,800 million in 1995. This was due to the successive overvaluation of real exchange rates between 1988 and 1996 (Jongwanich, 2008). From then on, export value gradually rebounded and reached about $4,000 million by 2007. Its share of total manufacturing exports declined

[11] Thailand was a member of the MFA between 1975 and 2000. In the early years, the MFA provided export markets for Thailand by curtailing the exports of the three major exporters-Hong Kong, the Republic of Korea and Taiwan. The utilization of Thai export quotas remained moderate during the early 1980s. See the utilization rate of Thai clothing exports to the United States and European Union in Tables 6.3 and 6.4 of Suphachalasai (1992: p. 58-59).

markedly because of the relatively slower growth rate compared to electronics and electrical appliance exports, as well as vehicle export.

Figure 2. Thai Clothing Exports, 1970-2007



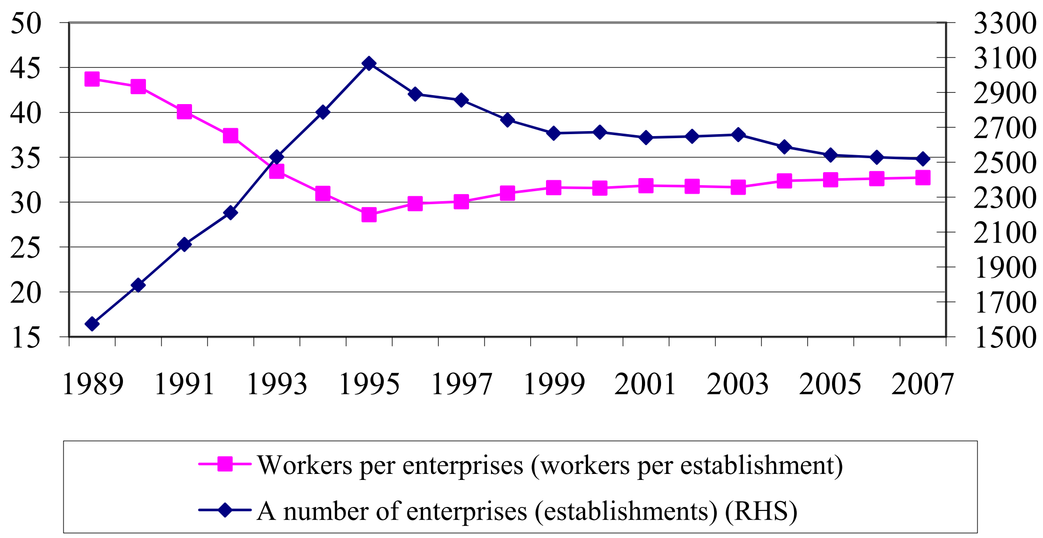
Note: Clothing here includes HS 6101, 6102, 6103, 6104, 6105, 6106, 6107, 6108, 6109, 6110, 6111, 6112, 6113, 6114, 6115, 6116, 6117, 6201, 6202, 6203, 6204, 6205, 6206, 6207, 6208, 6209, 6210, 6211 and 6212.

Source: Author's compilation from UN Comtrade Database.

The clothing industry is labor intensive and its barriers to entry are relatively low as opposed to some other industries. As a result, Thais employed in the clothing industry accounted for a considerable section of the total workforce in the manufacturing sector. The number of workers increased considerably from 688,000 in 1989 to 862,000 in 1996, which represented around 22.4% of total employment in the manufacturing sector during that period. Despite experiencing a steady export growth, the industry's employment level was more than 800,000 workers for the decade ending in 2007. Nevertheless, its relative importance in the manufacturing sector had noticeably declined to 15% by 2006. This is a reflection of the growing importance of other labor-intensive industries, such as the assembly of electrical appliances and electronics.

Interestingly, firms in the clothing industry tend to respond to policy-induced economic incentives. The number of enterprises increased significantly during the export boom, from 1,574 s in 1989 to 3,066 enterprises in 1995. Interestingly, they are likely to be small and medium enterprises (SMEs). The ratio of the number of workers to that of enterprises dropped from 43.7 workers per firm in 1989 to 29.8 workers per firm in 1996 (Figure 3). This suggests that the private sector and SMEs in particular prefer the 'first' policy option (the policy-induced incentive offered by the cascading tariff structure) to the 'second' option (tariff exemptions/drawbacks). When non-tariff protection on fabrics and yarns was lifted in 1987 and the Effective Rate of Protection (ERP) turned out to be positive, SMEs entered the sector to benefit from the highly protected domestic market. Such an explanation is in line with the export-output ratio, observed in Figure 1, which was rather flat during the export boom. It also reflects the nature of relatively low entry barriers in the clothing industry.

Figure 3. Number of Enterprises and Workers per Enterprise (1989-2007)



Source: Thai Textile Development Institute.

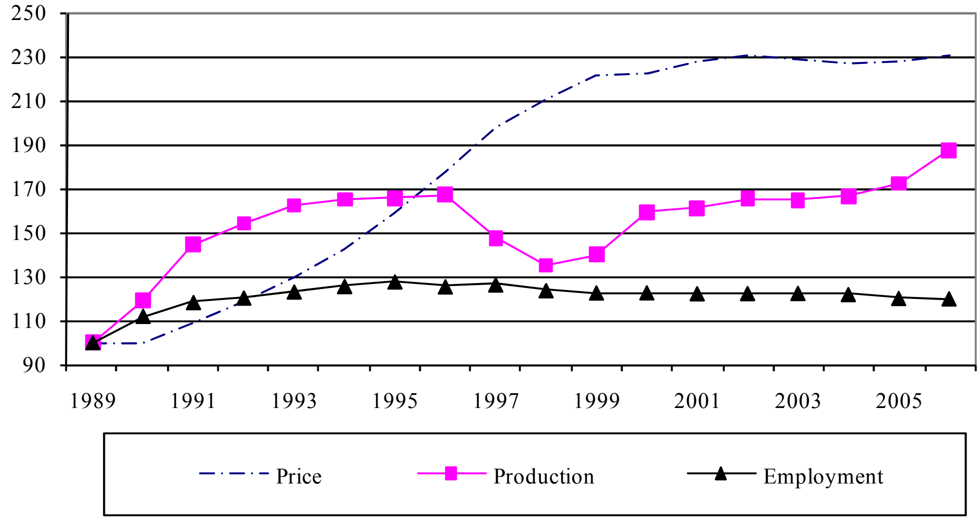
With the limited size of the domestic market, firms tended to compete with each other. This led the domestic price to fall and made clothing tariffs unlikely to be binding. In the meantime, while wage rates continued to grow as a consequence of the countrywide economic boom, the international competitiveness of the Thai clothing industry eroded, along with indirect export opportunities. Since 1995, therefore, the number of enterprises operating has dropped. Between 1996 and 2006, 36 enterprises exited the clothing industry every year. By 2007, there were 2,519 enterprises in the clothing industry.

As the international competitiveness of the Thai clothing industry was faltering, the industry was forced to upgrade its production to higher value products, where wage rates are not the key factor in determining international competitiveness. However, technological learning and upgrading is a complex, difficult, and lengthy process that must be undergone before being able to reap the economic and environmental gains associated with shifts to more efficient technologies. Thus, firms must commit substantial resources to a long-term incremental and cumulative effort to expand their technological capability. Those operations that were unable to upgrade their products often exited the industry. Many of these were SMEs, as the ratio of the number of workers to that of enterprises has increased steadily since 1996. The number of workers per enterprise increased to 32.7 in 2007, from 28.6 in 1995 (Figure 3).

Of note is the fact that the above noted exit did not have a significant impact on the number of workers employed in the industry (Figure 4). The number of workers declined slightly to 824,500 workers in 2007, from its peak of 870,000 workers in 1995, so that the rate of employment per enterprise increased. Combined with the upward trend in the export-output ratio observed during the same period, the mild decline in employment within the industry suggests that exporting firms can move up to higher-value clothing. Therefore, workers who used to work in companies that shut down can be reallocated to work with larger and more export-oriented clothing firms.

In the new millennium, the global trade in textiles and clothing became more liberal as a consequence of the abolition of export quotas. This became a major push factor in the structural adjustment process. Between 1970 and 1995, global trade in textiles and clothing was carried out under the voluntary export restraints (VERs) governed by the Multi-fibre Arrangement (MFA). In the presence of the MFA, countries which are competitive in textiles and clothing exports are likely to be constrained by the imposed quota. On the other hand, for those that have not yet been competitive, the MFA gave opportunity to participate in the global trade and earn economic rents induced by the quota.

Figure 4. Indices of Price, Production and Employment of Thai Clothing Industry (1989=100) 1989-2006



Source: Author's compilation. Export data are from UN Comtrade Database whereas gross output is obtained from the National Economics and Social Development Board. Employment and a number of enterprises are from the Thai Textile Institute.

When the Uruguay round of the General Agreement on Tariffs and Trade (GATT) was concluded, all GATT members agreed to gradually bring the global trade in textiles and clothing under more or less the same rules as other manufactured goods under the World Trade Organization (WTO) system. During the transition period, their global trade was governed by the Agreement of Textiles and Clothing (ATCs). Since 2005, global trade in textiles and clothing was expected to be more liberalized. Exports would be determined by the country's competitiveness and global competition would be more intense.

6. Firm Survey Analysis

Firm interview evidence suggests that garment firms in Thailand, and export-oriented ones in particular, are in the process of structural adjustment, largely driven by the ATC abolition. Its effect has been observed since 2004 where more than 60 per cent of global trade in textiles and clothing was liberalized. Interestingly, firm adjustment varies significantly from firm to firm. Some firms perform better in the quota-free era.[12] Three options, including capital deepening, exporting capital, and hiring unskilled foreign workers have been used in the structural adjustment process. From the firms viewpoint, these three options are not entirely mutually exclusive, i.e. there are some firms employing all of them simultaneously. This is due to the fact that garment production is labor intensive and the degree of substitution between capital and labor is very limited. Regardless of the levels of technology employed, full automation seems impossible for clothing firms, so that labor cost remains an important item in the cost structure, accounting for 20-30%. This estimate is more or less the same as that in the mid 1990s, although wage rates between two periods are far different.

6.1. Who Hires Unskilled Foreign Workers?

According to our firm interviews, 23 out of 50 firms report that they do not employ unskilled foreign workers. ‘Not hiring unskilled foreign workers’ is their choice, rather than a consequence of failing to find foreign workers, or policy constraints. The common characteristics of firms that do not hire these foreign workers are; they are relatively large (in terms of employment and sale value), they performed well in the past five years in terms of sales growth, and they successfully maintained their price-cost margin, as opposed to those hiring unskilled foreign workers. For example, 11 out of 23 firms employ more than 500 workers (Table 5). Another 11 firms had sales value records exceeding 250 million baht a year (2008 estimates) (Table 6).

[12] See Amann & Nixson (2009) and works cited therein for the most recent empirical studies on this issue.

Table 5. Employment Structure in 2008 Classified by Decision to Hire Unskilled Foreign Workers

Numbers of Workers	Hiring Foreign Workers		Not Hiring Foreign Workers
	Bangkok and Vicinity	Border Area	
50 ≤	1(7.7)	0 (0)	2 (8.7)
51 – 200	4 (30.8)	8 (57.1)	5 (21.7)
201– 500	4 (30.8)	1 (7.1)	5 (21.7)
501 – 1,000	2 (15.4)	4 (28.6)	3 (13.0)
> 1,000	2 (15.4)	1 (7.1)	8 (37.8)
Total	**13 (100)**	**14 (100)**	**23(100)**

Note: Numbers reported are the numbers of firms and those in parentheses are the percentage of total firms.
Source: Firm survey conducted by authors.

Table 6. Sale Value Structure in 2008 Classified by Decision to Hire Unskilled Foreign Workers

Million Baht	Hiring Foreign Workers		Not Hiring Foreign Workers
	Bangkok and Vicinity	Border Area	
100 ≤	5 (38.5)	12 (85.7)	8 (34.8)
101 - 250	5 (38.5)	2 (14.3)	4 (17.4)
251 - 500	1 (7.7)	0 (0)	3 (13.0)
501-1,000	1 (7.7)	0 (0)	2 (8.7)
> 1,000	1 (7.7)	0 (0)	6 (26.1)
Total	**13 (100)**	**14 (100)**	**23 (100)**

Note: Numbers reported are the numbers of firms and those in parentheses are the percentage of total firms.
Source: Firm survey conducted by authors.

On the other hand, firms with unskilled foreign workers are relatively small. Their performance varies across firms significantly. The average employment size of firms with unskilled foreign workers was 422 workers in 2008. The corresponding figure for those without unskilled foreign workers is 622 workers (Table 5).[13] In addition, there are only three firms (out of 27) whose sales value exceeds 200 million baht a year, whereas the others' sale value is below 200 million baht a year. Many of the firms hiring foreign workers complain about squeezed profit margins and raise concerns about business uncertainty.

Firms who employ foreign workers can be further disaggregated into two sub-groups. The first sub-group is medium-sized firms located in Bangkok and its vicinity.

[13] Mid-point estimate is used.

There are 13 firms in this subgroup. Firms in the first sub-group just started hiring foreign workers about 3-4 years ago on average. Their ratio of foreign workers to total workers was about 31.6 % in 2008, and increased to 38 % in the first half of 2009. This is due to the fact that unskilled workers from CLM have been legalized since 2003. For this sub-group, hiring foreign workers is not the first option to be chosen, as opposed to the other adjustment options. Generally, foreign workers are less productive (measured in terms of capability to do very complicated garments, output per worker, dedicated, etc.) than natives. Many respondents in this subgroup reported that the productivity of foreign workers is about 70-75% of the productivity of native workers. There are also problems associated with this option such as communication, worker cohesion in the factory, and other bureaucratic issues related to migrant living.[14] The main reason for hiring foreign workers is simply the labor shortage, i.e. difficulty in finding native workers and to keeping current native workers. When they want to keep their business running, this option seems unavoidable.

The second sub-group consists of 14 firms located at the border between Thailand and Myanmar, in Tak province and Myawaddy province in particular. These firms have long-term experience in hiring foreign workers. They have hired unskilled foreign workers for more than 4 years because these foreign workers are allowed to cross the border on a daily basis to Mae Sot sub-province, the gateway between Thailand (Tak province) and Myanmar (Myawaddy province). There are a number of Burmese workers who work in Mae Sot sub-province during the day and return to their home after work. As a result, the ratio of unskilled foreign workers to total workers is nearly 100 per cent, 86.2% in 2008 and the first half of 2009. Most garment factories in this area are small. Twelve out of 14 firms in this subgroup have sales value less than 100 million baht (Table 6). The other two have sales value recorded between 101 and 250 million baht. There are only 5 out of 14 firms that employ more than 500 workers. The others' employment is in the range of 51 to 200 workers (Table 6). The majorities are subcontractors of bigger firms in Bangkok, and perform only certain activities, and

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[14] For example, as revealed by a former chief supervisor of the factory, migrants must stay only in a location registered. There were many cases where these migrants visited their friends and relatives in other provinces and were caught by the police. When such a case occurred, it was the responsibility of the factory's owner to bail out these workers.

sewing activities in particular (i.e. the most labor intensive activities in garment manufacturing). Similar to the first sub-group, firms in this sub-group reveal their difficulty in maintaining price-cost margins.[15] To a certain extent, firms in the second sub-group are an outcome of the structural adjustment of existing firms, which are usually located in Bangkok and its vicinity. When wages increased and hiring unskilled foreign workers was prohibited in Bangkok, many Bangkok-based firms either set up new factories or outsourced sewing activities to smaller firms in Mae Sot sub-province, both of which were to access low wage unskilled foreign workers. On average, they were established in 2002.

6.2. Upgrading Experience

As discussed earlier, one concern related to hiring foreign workers is the negative effect on upgrading and growth sustainability. In general, upgrading can occur in several ways, such as service, product, and functional-based upgrading (Gereffi & Memedovic, 2003; Gereffi & Tam, 1998; Gibbon, 2003; Palpacuer *et al*., 2005). Service-based upgrading refers to the ability to provide a broader range of services beyond simple assembly, including product design, fabric sourcing, inventory management and management of production sourcing. Product-based upgrading refers to the ability to manufacture higher quality products for higher priced market segments; and functional-based upgrading involves reduced inventories and waste through the adoption of modern management techniques such as the lean production system.

Our firm interviews reveal that upgrading decisions seem to be independent of firm behavior in hiring foreign workers. Although efforts to upgrade vary significantly across firms, they all reveal upgrading activities such as in installing new models of production equipment (e.g. sewing machines), producing more complicated orders, and undertaking more tasks beyond manufacturing. Foreign buyers play a key role, and have a tremendous effect on upgrading, in the global trade of clothing like other traditional labor-intensive products (e.g. toys, footwear), reflected in the global value chain literature. The chains are seen as buyer-driven value chains. These buyer-driven

[15] There is an exception among them which has performed well in the past few years. The owner doubled production capacity in 2009 from 500 to 1,000 workers in spite of the global recession. As revealed by the owner, his factory would be the largest cotton yarn producer in Thailand in 2009.

chains are those in which large multinational retailers, marketers, and branded manufacturers play pivotal roles in setting up decentralized production networks in a variety of exporting countries, typically in developing countries. Nike, Adidas, Decaron, Patagonia, Wal-mart, and Carrefour are obvious examples of these buyers.[16] These buyers operate in many countries and have considerable influence on local suppliers (Hone, 1974: p.149; Keesing, 1983: p.339; Rhee *et al*., 1984: p.54). They not only negotiate price and delivery times, but also demand that suppliers perform specific procedures in fulfilling orders. This is especially true for North-South trade, where there is a wide range of required quality parameters, including input specifications and quality, product design, and labeling and packaging (Keesing 1983: p.339; Rhee *et al*., 1984: p.61). While some of these aspects may not even be of interest in developing countries, consumers in developed countries are highly sensitive to them and therefore they are vital to market success. As a result, the manufacturing process is far beyond simple manufacturing, and the final product is the result of several activities, comprising research and development (R&D), product design, marketing, and manufacturing.

A consensus is reached in our interviews about the relative importance of the buyers though our respondents' attitudes towards these buyers are not always positive. These buyers usually visit local suppliers to check their production process, and to conduct assessments of their capability, before placing orders. After finding potential suppliers, the buyers provide technical information for improving existing facilities. Hence, these buyers and their requests are to a certain extent a major push factor for upgrading in the manufacturing plant. This is especially true in the new millennium, since these buyers have gained more freedom in sourcing clothing (Interview with two buyers' representatives, one was an MNE representative, and the other a local agent). Since orders from these buyers seem to be large and continuous, firms have incentives to comply with any requests from them.

Not all kinds of upgrading can be forced by the buyers. Upgrading driven by these buyers is largely service and product-based, all of which are needed for fulfilling their orders. As global trade becomes more liberalized, *the buyer* requests suppliers to perform more tasks than before, including such things as pattern development, marker

[16] Hone (1974: p.149), Keesing (1983), Kohpaiboon (2006 and 2008) refer them as MNE Buyers.

making, and sample making. As a result, the Thai producers are no longer doing just the basic manufacturing process (cutting, sewing and packing), but are engaged in service-based upgrading. In addition, buyers operating worldwide have good knowledge of inter-country competitiveness, reflected in their order allocation between countries. As (real) wages in Thailand continue to increase, it is not surprising that orders have become more complicated and that workers handling them must be relatively skillful. As a result, in many cases, manufacturing new orders frequently involves installing new machines needed in the production process. A clear example is the use of laser cutting and seal taping techniques in the industry, as a result of more complicated orders and product-based upgrading. Therefore, service- and product-based upgrading is commonly observed in Thai firms.

Where functional upgrading is concerned, *the buyer*'s role seems to be limited. Functional-based upgrading includes modern management techniques such as the lean production system (also known as the Toyota Production System: TPS), the Continued Productivity Improvement System (CPIS) and high performance work systems (Appelbaum & Gereffi, 1994), the Quality Control Circle (QCC), multiple skill development programs or flexible specialization (Piore & Sabel, 1984; Brusco 1982).[17] Generally functional-based upgrading incurs a certain amount of sunk cost, takes time for firms to benefit from it, and must be carried in a continuous manner as revealed in our firm survey. This is different from service- and product-based upgrading which give benefit instantaneously. In such circumstance, it is difficult for the buyer to force suppliers to commit to functional upgrading.

When firms' upgrading behavior is analyzed, all interviewed firms can be categorized into 3 groups. The first group (Group 1) comprises those firms that implemented all kinds of upgrading. There are 19 firms in this group. All kinds of upgrading are being implemented simultaneously. They are export-oriented and relatively large in terms of both employment and sales values (Tables 7 and 8). In 2008, 8 out of 19 firms employed more than 1,000 workers whereas the others are in the range

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[17] A rudimentary idea is that workers should be able to cross functions and have cross skills (multi skills). The former means, for example, that the workers could be able to interchangeably do their functions such as cutting, ironing, and packing. The latter, for example, means that the workers could be able to interchangeably do their sewing jobs such as collars, arms, and sides. Therefore, workers could be able to substitute for their colleagues with least cost.

of 201 to 1,000 workers. There is only one firm in this group employing 51 – 200 workers. Of the total, 8 firms reported that their average sales in 2008 are higher than 500 million baht. Interestingly, they are those who do not rely on unskilled foreign workers in their structural adjustment, although some are constrained by their buyers' requirements.

Table 7. Employment Structure in 2008 Classified by Upgrading Behavior

Numbers of Workers	Group 1	Group 2	Group 3
50 ≤	0 (0)	3 (16.7)	0 (0)
51 – 200	1 (5.3)	8 (44.4)	8 (61.5)
201– 500	6 (31.6)	3 (16.7)	1 (7.7)
501 – 1,000	4 (21.0)	2 (11.1)	3 (23.1)
> 1,000	8 (42.1)	2 (11.1)	1 (7.7)
Total	**19 (100)**	**18 (100)**	**13 (100)**

Note: Numbers reported are the numbers of firms and those in parentheses are the percentage of total firms. Group 1 undertakes all kinds of upgrading whereas Group 2 refers to those undertaking mainly service- and product-based upgrading and beginning functional upgrading. Group 3 is those solely undertaking only service- and product-based upgrading.
Source: Firm survey conducted by authors.

Table 8. Sales Values in 2008 Classified by Upgrading Behavior

Million Baht	Group 1	Group 2	Group 3
100 ≤	3 (15.8)	11 (61.1)	11 (84.6)
101 - 250	5 (26.3)	4 (22.2)	2 (15.4)
251 - 500	3 (15.8)	1 (5.6)	0 (0)
501-1,000	3 (15.8)	0 (0)	0 (0)
> 1,000	5 (26.3)	2 (11.1)	0 (0)
Total	**19 (100)**	**18 (100)**	**13 (100)**

Note: Numbers reported are the numbers of firms and those in parentheses are the percentage of total firms; See notes about firm groups are the same as in those in Table 7.
Source: Firm survey conducted by authors.

Performance of firms in this group is outstanding. They are gradually moving up the quality ladder and targeting high-end markets such as the EU-15 in which customers are fashion-conscious. 12 firms in this group have started becoming involved in product design activities e.g. original design manufacturing (ODM) and original brand-name manufacturing (OBM), some of which have their own brands sold in either international high-end markets, i.e., New York City, or domestic high-end markets. Despite experiencing an export contraction during the recent global recession, most firms have recovered in export volumes since October 2009. More than half of them reported that they have run at full capacity in their production lines since October 2009. In some firms, confirmed forward orders from their buyers up to the end of 2010 have been received. All claim that their outstanding performance was derived from the three upgrading options.

To deal with the labor shortage problem, they set up new factories in rural areas to access rural workers, whose urban-rural wage premium remains negative.[18] For example, one firm with 4,000-5,000 workers set up their additional factories in Northeastern region (2 factories in Khon Kaen province and one in Korat province). The factory manager in Khon Kaen province is very positive about running the business in rural areas. There are 5 more firms who told more or less the same story. Many of them invested in the "near abroad" for example in Laos, Cambodia, and China. Note that capital relocation (i.e. setting up factories in rural areas) as well as capital exporting are over and above capital deepening.

The last common characteristic among these 19 firms is the nature of the firm owners. Their owners are either western-educated entrepreneurs or else people who assign a high value to modern management systems in productivity improvement. This highlights the role of the entrepreneurial factor. The entrepreneurial factor seems to play a pivotal role when it comes to longer-term and highly uncertain projects like functional upgrading.

The second group (Group 2) comprises those firms that have focused on service- and product-based upgrading, and just began involvement in functional upgrading. There are 18 firms in this group, most of which are medium size, and are located in Bangkok and its vicinity. The average employment size is about 338 workers. 61.1 per cent of firms within the group had annual sales less than 100 million baht in 2008. So far their upgrading seems to follow a passive strategy, and focuses on upgrading their machinery and equipment. Effort to introduce new management systems (functional-

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[18] In the context of developing countries, industrialization would promote resource reallocation, shifting excess supply of labor from relatively lower productive primary sectors, usually in rural areas, to more productive industrial sectors in urban area, i.e. urban-rural migrants. For a worker in a rural area, the decision to migrate also depends on net gains, the so called urban-rural premium. This is the difference between a higher wage expected to be earned in town and the higher living costs. Migration occurs only when the net earning is positive (Sjaastad, 1962; Harris & Todaro, 1970; Lucus, 1970; Bernanke, 1989; Athukorala Manning, 2003).

based upgrading) has been limited and is at an early stage. The general impression observed in the interview suggests that just enough upgrading was undertaken to maintain their production volumes and/or sales values. When global trade in clothing has been liberalized, service- and product-based upgrading are clearly inadequate to compensate for successively rising wages and tightening in the labor market. As a consequence, they started undertaking functional upgrading few years ago.

This group's business performance was poor in comparison to the first group. Firms in Group 2 experienced severely tightened profit margins and expressed their concern about industry prospects. Half the firms in this group rely heavily on exports (i.e. their export-output ratio exceeds 60 per cent) (Table 9). They were severely affected by the recent global recession. Even though there were signs of recovery in their export orders, there is still a high degree of uncertainty. In addition to hiring foreign workers, they are shifting away from developed country markets towards regional markets like Southeast Asia as well as domestic markets during their structural adjustment. The latter export destination seems to be less competitive but is subject to high market uncertainty (i.e. fluctuations in volume). For example, 5 firms in this group are developing their own brands and/or establishing their own shops to serve domestic middle to low-end markets.

Table 9. Export Structure in 2008 Classified by Upgrading Behavior

Percentage of Sales Values	Group 1	Group 2	Group 3
20% ≤	2 (10.5)	2 (13.3)	1 (11.1)
21 – 40%	2 (10.5)	3 (20.0)	0 (0)
41 – 60%	3 (15.8)	1 (6.7)	2 (22.2)
> 60%	12 (63.2)	9 (60.0)	6 (66.7)
Total	**19 (100)**	**15 (100)**	**9 (100)**

Note: Numbers reported are the numbers of firms and those in parentheses are the percentage of total firms; for notes about firm groups see Table 7.
Source: Firm survey conducted by authors.

Labor availability is becoming a serious matter. Particularly, the decision to stay on in the business depends on the likelihood of access to labor. This is consistent with the finding about the necessity of labor in the clothing manufacturing process mentioned above. Some firms made a strong claim during the interview that firms would be immediately shut down unless unskilled foreign workers were legally allowed. Hence, 10 out of 18 firms are opting to hire foreign workers and the others are preparing to hire. From their point of view, alternatives like relocating to rural areas or outward direct investment in more labor abundant countries are unlikely to be affordable options. In particular, these alternatives incur significant sunk cost and involve a high degree of uncertainty. Given the current relationships with buyers, no firm prefers an alternative option to hiring foreign workers.

The last firm group (Group 3) comprises those that lagged behind in upgrading activities as compared with the first two groups. Firms in this group are small firms located at the Thailand-Myanmar border. Although they are new entrants (established in about 2002), they seem to operate with traditional and local management models as they are subcontractors from clothing factories in the second group. Roughly speaking, firms in this group can be regarded as sewing departments of the second group. Their main manufacturing activity is sewing, undertaken by unskilled foreign workers. Hence the squeezed profit margins revealed in the second group is passed through to firms in this group. Their service- and product-based upgrading decisions are largely related to the requirements of the second group.

6.3. Impacts on Firm's Competitiveness and Upgrading Efforts

Three implications for a firm's competitiveness can be made from the discussion in Sections 6.1 and 6.2. First, the decision to upgrade seems to be independent of that to hire unskilled foreign workers. This is especially true for export-oriented firms, the majority in our sample. Their decision to carry out service- and product-based upgrades is largely influenced by *the buyer*. It is functional-based upgrading whose decision depends on the vision of firm's owners because of its nature, i.e. sizable sunk cost, continuity, and time-consuming. This can happen whether firms hire unskilled foreign workers or not. The fact that one firm in Tak province entirely relies on unskilled foreign workers, is strongly committed to functional upgrading, and outperforms other firms in the province provides strong support for the independence of these two kinds of decision (upgrading and hiring foreign workers).

Secondly, it seems there is a negative relationship between hiring unskilled foreign workers and a firm's competitiveness, measured in terms of sales growth between 2005 and 2008. As illustrated in Table 10, firms experiencing sales contraction between 2005 and 2008 are likely to be those hiring unskilled foreign workers. The picture is even clearer when the 2008 period, where the global crisis began to effect the industry, is excluded (Table 10). One must be cautious in interpreting the negative relationship. Generally, when firms perform poorly (e.g. low productivity, unable to deliver on time, poor quality), this would be reflected in their sales performance. In other words, they are losing their competitiveness.

Table 10. Firm Characteristics Classified by Decision to Hire Unskilled Foreign Workers

	Not Hiring Foreign Workers	Hiring Foreign Workers	
		Bangkok and Vicinity	Border Area
Numbers of Firms (2008)	23	13	14
Employment (2008) (Numbers of Workers)	727	496	418
Sale Values (2008) (Mil baht)	624.85	300.31	93.64
Export Orientation (2008) (% of Sale Values)	56.7	68.00	67.50
Δ Sale Values [a, b]	13 (1)	11 (6)	13 (0)

Notes: [a] Numbers of firms experiencing a negative growth rate in their sales values from 2005 to 2008. [b] Numbers in parenthesis are numbers of firms experiencing a negative growth rate in their sales values from 2005 to 2007.

Source: Firm survey conducted by authors.

This would have a negative impact on the firms' ability to compete for primary inputs like workers. When the labor market becomes tight, firms must offer higher wages to attract workers. Hence, the ability of a firm to attract workers is related to its performance. The situation in the clothing industry is obvious, where the industry's workers earnings are based on their performance (e.g. baht per piece). Daily earnings of their workers are usually higher than minimum wage. The higher the workers' productivity, the more they receive. Worker productivity is also influenced by the overall performance of their firm. Hence, workers' earnings depend on the overall factory's performance. The better the firm's performance, the better the expected earnings for workers. It also enhances the firm's ability to attract new workers. Additionally, firms which perform well are able to offer other fringe benefits for their workers. Only firms with good performance can easily attract workers. Firms which perform poorly and/or struggle to maintain their competitiveness experience a severe labor shortage. To keep their business running they have to hire unskilled foreign workers. This also explains the systematic difference in firm characteristics between those with and without unskilled foreign workers.

Thirdly, functional-based upgrading is crucial in determining the current and future performance of firms. Firms which undertook functional-based upgrading outperformed those that had just begun functional upgrading. This is especially true for longer-term competitiveness. It is the second and third groups of firms discussed in Section 6.2 that expressed serious concern about squeezed profit margins. To a certain extent, profit margin reflects the firm's longer-term competitiveness. In general, *the buyer* assesses the competitiveness of their suppliers and then sets a production efficiency benchmark. All suppliers regardless of where they are located must follow the benchmark. If a supplier performs below the benchmark, this would negatively affect expected profit margin, as well as the incoming orders in the future. It takes time for firms which undertake functional-based upgrading to benefit from it. Hence, hiring unskilled foreign workers seems to be useful for firms in the middle of a structural adjustment process.

Table 11 illustrates the relation between the presence in a firm of foreign workers, and the firm's upgrading efforts. The general impression from Table 11 is that allowing firms to hire unskilled foreign workers is likely to make them reluctant to upgrade. All firms not hiring unskilled foreign workers were actively undertaking all kinds of upgrading, whereas upgrading for those with unskilled foreign workers is limited to service- and product-based upgrading only. In fact the relationship is rather reversed, i.e. firms which were slow and non-responsive in upgrading activities had been forced to hire unskilled foreign workers. This rationale is in line with the relationship between foreign workers and the firm's competitiveness. Nonetheless, given the limited number of firms in the sample covered in this paper (due to resource and time constraints), we cannot make a strong claim here. Instead of refusing any possibility of an adverse effect on competitiveness and upgrading, our finding suggests less concern about the impact of hiring unskilled foreign workers on the firm's competitiveness. Measures toward allowing firms to hire unskilled foreign workers must, however, take into account such a possibility.

Table 11. Upgrading Behaviors of Interviewed Firms

Percentage of Total Samples in that Group	Not Hiring Foreign Workers (23 firms)	Hiring Foreign Workers (27 firms)	
		Bangkok and Vicinity (13 firms)	Border Area (14 firms)
Service-based Upgrading	100	46.2	28.6
Product-based Upgrading	100	92.3	42.9
Functional-based Upgrading	100	30.8	14.3

Note: a Numbers of firms experiencing a negative growth rate in their sales values from 2005 to 2008.
Source: Firm survey conducted by authors.

Currently the government recognizes the necessity demand for unskilled foreign workers from all sectors and allows recruitment on a temporary basis. Policy measures are designed in one-size-fit-all styles, with a maximum allowed employment period of 4 years. Nevertheless, what we have discovered in the case of the clothing industry is that there are industry-specific factors playing an influential role on how firms maintain their competitiveness, as well as how they decide to upgrade their existing production capacity. It seems unlikely that evidence found in the case of the clothing industry can be applicable for other industries countrywide. Instead the clothing industry's experience could be applicable for export-oriented industries where *the buyer* plays a crucial role in the global trading system. In summary, our finding provides a warning against implementing one-size-fit-all styles.

7. Conclusions and Policy Inferences

This paper probes the structural adjustment process using evidence from the Thai clothing industry, with a view to informing the policy debate about international migration. The analysis is based on in-depth interviewing with 50 clothing firms in Thailand during the period November 2009- February 2010. The key finding is that not all firms opt to hire unskilled foreign workers (henceforth foreign workers). There are systematic differences in firm characteristics between firms who hire foreign workers and those who do not. The latter are relatively large in size (both in employment and in sales), perform better, and actively undertake a variety of upgrading activities. The former are struggling in maintaining their profit margin, are relatively small, and invest inadequately in upgrading activities. Interestingly, hiring foreign workers is not the first response of firms, but reflects the fact that firms have yet to succeed in undertaking functional upgrading. While there are many kinds of upgrading (service, product and functional), our finding points to the relative importance of functional upgrading for long-term and more sustainable development. Firms which were late in undertaking functional upgrading are likely to hire foreign workers during their structural adjustment process. Allowing unskilled foreign workers on a temporary basis would be a win-win-win solution for labor importing and exporting countries as well as the migrants themselves. Nevertheless, any condition imposed on firms wanting to hire unskilled foreign workers must be related to preventing any retarding effect on their upgrading effort.

Three policy inferences can be made from this paper. First, there are potential mutual benefits for countries in the region. While labor-importing countries can minimize costs incurred during their structural adjustment process, accumulated skill in industries like clothing can be beneficial for labor exporting countries in the later stage of development. Inter-country unskilled worker mobility seems to continue for countries in the Indochina region which share common land borders and exhibit vast differences in terms of job opportunities. There is room for international organization to materialize such potential.

The second inference is that it seems risky to use one-size-fit-all policy measures to manage flows of unskilled foreign workers, because of the significant role of industry-specific factors. Given resource and time constraints, our study is unlikely to provide a comprehensive recommendation to all sectors. Our finding suggests that a more appropriate way to proceed is to introduce measures according to broader industry groups, such as export-oriented, import-competing and non-tradable/service sectors. For the export-oriented industries, such as clothing, where global trade remains under the influence of multinational firms, insights into firm behavior revealed in this paper suggest that there are private benefits induced by hiring unskilled foreign workers.

Hence, policy measures for an export-oriented industry could be fee-based and open for individual firms to apply. Work permits would be on a temporary basis, and jointly set with the fee. The longer the period over which firms want to hire unskilled foreign workers, the higher the fee rate. This is to prevent any adverse effect on the firm's competitiveness. As revealed in our firm survey, there are growing concerns about policy uncertainty and the emergence of rent-seeking behavior in the migrant business; the proposed policy measures must go hand in hand with transparency and a pragmatic approach towards the private firm, so as to avoid any hidden costs and facilitate their structural adjustment process.

The last inference is about the heterogeneity we found in the developmental impact of upgrading. Evidence in this paper highlights the pivotal role of functional-based upgrading while firms are undergoing structural adjustment. Such upgrading makes firms more likely to reach a more sustainable level of industrial development. This emphasizes the need to strengthen the role of the capital markets to finance long-term investment, such as functional upgrading.

APPENDIX 1

Questionnaire # ____________________

Questionnaire Survey

International Labor Migration and Competitiveness:

Firm-level Analysis of Thai Clothing Industry

Type of interview:

☐ Face-to-face ☐ Telephone

Name of enumerator: ________________________________

Date of interview: _______ Day________Month__________Year

Name of establishment: ____

Location of Headquarters (if applicable): _______________________________

Respondent Name and Designation: _Mr/Ms___________________________________

Mobile Phone Number (optional): ____

City/Tambon: ____

District: ____

Province: ____

Grouping Questions

1. Has your firm employed foreign workers?

☐ **Yes** ☐ **No**

2. Has your firm exported?

☐ **Yes** ☐ **No**

All information will be kept confidentially and will be revealed only to a research team. Importantly, the report will not mention both the name of establishment and the name of respondent.

BLOCK A: Basic Information on the Firm

1. In what year did your firm begin operations _______________

2. Most important product produced by your firm

☐ Sportswear ☐ Baby and Children wear ☐ Jackets/Jumpers ☐ Male wear

☐ Female wear ☐ Others, please specify_____________________

3. According to Q2, are those product

☐ OEM ☐ Your own brand ☐ Others, please specify _____________

4. Where is a major source of raw materials for your firm?

☐ Domestic ☐ Foreign, please specify ___________________

Please give reasons for using that source raw materials for your firm

____

____

____

____

5. Value Sales in the last five years (To track dynamics)

Approximately what are the value sales of your firm in year?

	Less than 100 million baht	100 - 250 million baht	251 - 500 million baht	501-1,000 million baht	1,001 – 2,000 million baht	More than 2,000 million baht	Approximate (million baht)
2005	☐	☐	☐	☐	☐	☐	
2006	☐	☐	☐	☐	☐	☐	
2007	☐	☐	☐	☐	☐	☐	
2008	☐	☐	☐	☐	☐	☐	
2009 (Jan – Jun)	☐	☐	☐	☐	☐	☐	

6. Volume Sales in the last five years (To track dynamics)

Approximately what are the volume sales of your firm in year?

	Less than 1 million unit	1 - 20 million unit	21 - 50 million unit	51-100 million unit	101 – 200 million unit	More than 200 million unit
2005	☐	☐	☐	☐	☐	☐
2006	☐	☐	☐	☐	☐	☐
2007	☐	☐	☐	☐	☐	☐
2008	☐	☐	☐	☐	☐	☐
2009 (Jan – Jun)	☐	☐	☐	☐	☐	☐

7. Has your firm successively exported in the last five years (since year 2005)?

☐ Yes ☐ No

(Export is defined as enterprises tailored made their products to specific demand by the buyers, i.e. brand owners or agents)

8. Nature of Exports in the last five years

(Export sales relative to total sales: in the traded sector, performance in the international marketplace is a direct measure of firm's competitiveness)

	Less than 20 per cent	20 – 39 per cent	40 – 59 per cent	More than 60 per cent
2005	☐	☐	☐	☐
2006	☐	☐	☐	☐
2007	☐	☐	☐	☐
2008	☐	☐	☐	☐
2009 (Jan – Jun)	☐	☐	☐	☐

9. Main Export Destinations

If your firm exports, please identify the biggest destination country based on export revenues in year.

	US	EU - 15	Japan	Other
2005	☐	☐	☐	☐
2006	☐	☐	☐	☐
2007	☐	☐	☐	☐
2008	☐	☐	☐	☐
2009 (Jan – Jun)	☐	☐	☐	☐

10. Employment in the last five years (To track dynamics)

Approximately how many employees were employed in your firm as of?

	Less than 50 workers	51 – 200 workers	201 – 500 workers	501 – 1,000 workers	More than 1,000 workers
December 2005	☐	☐	☐	☐	☐
December 2006	☐	☐	☐	☐	☐
December 2007	☐	☐	☐	☐	☐
December 2008	☐	☐	☐	☐	☐
June 2009	☐	☐	☐	☐	☐

11. Labor Costs per Unit in the last five years (To track dynamics)

Approximately how much were labor costs per unit of your firm in year?

	Less than 10 per cent	11 – 20 per cent	21 – 30 per cent	More than 30 per cent
2005	☐	☐	☐	☐
2006	☐	☐	☐	☐
2007	☐	☐	☐	☐
2008	☐	☐	☐	☐
2009 (Jan – Jun)	☐	☐	☐	☐

BLOCK B: Migration Workers Information on the Firm

1. If your factory has employed foreign workers, please identify the relative size of foreign workers. Otherwise, skip to **BLOCK C**

	Less than 25 per cent	25 – 49 per cent	50 – 74 per cent	More than 75 per cent
2005	☐	☐	☐	☐
2006	☐	☐	☐	☐
2007	☐	☐	☐	☐
2008	☐	☐	☐	☐
2009 (Jan – Jun)	☐	☐	☐	☐

2. Please identify the level of satisfactory of the current level of foreign workers employed

☐ Highly Satisfied because ____

☐ Satisfied because ____

☐ Moderate because ____

☐ Dissatisfied because ____

☐ Highly Dissatisfied because ____

3. Please provide and rank reasons for importing foreign workers

	No	Yes (please rank)	Rank
Difficulty to find local workers	☐	☐	☐
Lower wage benefits	☐	☐	☐
Sufficient skill	☐	☐	☐
Others, please specify __________________			☐

4. Is there any alternative option available in replacing importing foreign workers?

____

____

____

____

____

5. Are there any obstacles for enterprises to import workers?

____

____

____

____

____

BLOCK C: Competitiveness

Please identify productivity upgrading activities of your factory <u>in the last five years</u> (since year 2005)

	Yes, significantly	**Yes, somewhat**	**No**
1. Updating existing machines	☐	☐	☐
2. Installing new machines	☐	☐	☐
3. Changes in product coverage (new product line/ product diversification?)	☐	☐	☐
4. Having new suppliers	☐	☐	☐
5. Starting E-Business	☐	☐	☐

If answer 'Yes' in Q1. and Q2., otherwise go to BLOCK D.

6. Do you experience any difficulty of upgrading?

☐ No ☐ Yes, please identify and rank the following problems

	Rank
Financial constraint	☐
Uncertainty about sale order	☐
Lack of knowledge	☐
Other, please specify……………………………………………………	☐

BLOCK D: Expected Assistances

1. What type of support in terms of <u>products</u> are you getting?

____

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2. What type of support in terms of <u>foreign workers</u> are you getting?

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3. What do you think the government can do to support in terms of <u>foreign workers</u> for your establishment?

____

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____

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