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IMPACT OF GLOBALIZATION ON LABOR MARKET

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EXECUTIVE SUMMARY

ERIA Microdata research FY 2012 examines the impact of globalization on labor market outcomes. Globalization in this study is broadly defined to include trade and foreign direct investment (FDI) liberalization, trade (exports and imports), international capital flows, outsourcing and traded intermediate goods, while labor market outcomes are defined as wages and employment as well as volatility and dispersion of wages. This research cover the topic for many of the East and Southeast Asia countries, namely Australia, Indonesia, Japan, Korea, Malaysia, the Philippines, Thailand, and Vietnam.

Globalization and wage inequality between skilled and unskilled workers is a long-standing debated issue in international economics. Two competing explanations have been put forward as a cause for this phenomenon: trade and skill-biased technological progress. According to the standard *Heckscher-Ohlin* (H-O) theory and its companion Stolpher-Samuelson theorem, international trade is expected to increase the relative wages of the skilled workers in a skill-abundant country while decreasing it in a skill-scarce country. An alternative explanation is due to an increase in relative demand for skilled workers because of improvement in technology. Given these potential explanations, there is a consensus coming from early studies which suggests that skill-biased technological progress, rather than trade, is the principal cause for the increase in the inequality.

It may be more accurate to say however that what is not widely accepted is the view that trade causes wage inequality in the way predicted by H-O theory. There are observations that do not really accord the predictions and assumptions of the theory. First, while trade liberalization increases the wage inequality in skill-abundant developed countries and decreases it in skill-scarce developing countries, wage inequality in practice rises not only in developed countries but also in middle-income developing countries. Second, notwithstanding the theoretical prediction about the across-industries reallocation behind an aggregate increase in the relative employment, most empirical studies found that much of this increase, or at least part of it, occurs through within-industry mechanisms. Finally, although H-O theory is based on the

assumption of free labor mobility across industries, many empirical studies found that the inter-industry labor mobility following trade liberalization is very limited.

Given all these, our understanding of the issue is still far from satisfactory. There are several reasons for this, first, new theoretical frameworks, such as heterogeneous firm trade theories, together with the increased availability of firm-, plant-, or even product-level datasets, allow us to conduct in-depth analyses of the issue. Second, international outsourcing and trade in intermediate goods have expanded over the past two decades, and from the current analytics it is expected that the outsourcing could raise wage inequality. Third, previous studies of countries in East and Southeast Asia are scarce. Most of available studies are either on developed countries or on several middle-income countries in Latin America. Since countries in these regions comprise those ranging from skill-scarce, low-income, outsourced countries to skill-abundant, high-income, outsourcing countries, researching this issue using case studies of these countries provides an excellent case for a set of country studies.

The key questions addressed by this research are the following, whether globalization causes wage and income inequality to rise, the mechanisms at work, whether there are specific country effects, and whether there policies that can be adopted by a country to maximize the impact of globalization.

Country studies conducted under the research provide evidences that globalization does affect labor market outcomes and wage inequality (between skill and unskilled workers) in the countries covered by the research. Studies shows evidence that premium wage is affected by various forms of globalization. Moreover, almost all of these evidences underline the importance of firm/plant characteristics in shaping the nature or direction of the impact. In the the study of South Korea and Vietnam, for example, tariff cut and increase in trade rise the wage premium in R&D-performing plants (Korean study) or technology intensive (Vietnamese study). Meanwhile, the wage premium exists in Malaysia between exporters and non-exporters.

Two studies examine the issue in the context of international production networks that underlines the nature of outsourcing. The first, the study on Thailand, examines the effects of both the engagement with international production networks and the reductions in tariffs on wage skill premium within firm. Engaging with the production networks increases wage skill premium in skill-intensive firms while the tariff

reduction is found to reduce the skill premium within firms. The study on Japan investigates how the expansion of overseas activities by Japanese multinationals (MNEs) affects employment of the multinational in home country (Japan). This study does not find any negative effects of overseas expansion of the MNEs on the multinationals's employment at home. The studies instead find an expansionary effect.

In contrast to these, the study on Indonesia and the Philippines founds that globalization seems to have somehow smoothened its adverse impact on labor market outcomes. In the study on Indonesia, while there is evidence that firms pays higher wage for skilled workers, there is declining pattern of relative (skilled to unskilled) workers over the time. In the study on the Philippines, meanwhile, premium of skilled workers in terms of wage (wage skill premium) is found to have declined over the time, and it is attributed to the decline in trade protection.

The study using case study of Australia addresses a less frequently investigated channel through which globalization may affect the welfare in the domestic economy. It estimates the effect of domestic economy's exposure to international competition on individual labor income risk in Australia. The study finds evidence that an increase in import penetration is associated with an increase in permanent income risk, and this is found to be stronger in manufacturing than in services.

Many of the studies provide interesting results and one of them is a fact that the impact on labor market can not be separated from the impact on the other aspects. Policies promoting globalization are beneficial to firms and the economy in terms of technology adoption and knowledge accumulation.

The positive impact however is not without a cost. As many of the studies highlight, the impact on the outcome of labor market is not always positive. The gap between skilled and unskilled workers tends to widen in firms that upgrade technology capability, as the demand for skilled workers increases. The skilled-unskilled wage gap could be further widened because, at the same time, not all firms respond to the liberalizations by upgrading their technology capability; some of them choose to continue producing low-end products which sustains the high demand of unskilled workers.

The challenge in terms of policy therefore is to have right balance to manage all sorts of these impacts of globalization. Ideally, liberalization helps country, or firm in the country, to upgrade its technology capability and to accumulate knowledge but. At the same time though, other policies need to be in place to neutralize the potentially adverse effect on labor market. Two policy options are suggested for the latter. First, improving policies to develop human capital, by programs such as training and skill upgrading, is important. This will increase the pool of skilled workers in a country and therefore hiring them should be cheaper. Second, strengthening general social protection scheme, instead of having globalization-specific adjustment assistance, needs to be considered. Strengthening social protection is important because groups of workers that adversely affected are not always clear. In addition, globalization evidently also changes the expected risk of income in the future. All in all, complexity of these two demands a more general approach instead of the specific globalization adjustment program such as trade adjustment assistance (TAA), which targets only the displaced workers by FTA-related import penetration.

Applying these policies in a country however is not always a clear-cut, and the reason is, the mechanics of how globalization affects firms and labor market could be different from country to country. Studies in this project suggest that it depends at least on three factors: (i) the state of industrialization or general level of technology adoption in a country, (ii) the current state of labor market, and (c) the current state of education or human capital development. As in the more advanced country such as South Korea, for example, strengthening general social protection scheme could be put higher weight because the level of technology adoption in this country is relatively higher than the other Asian countries. In developing countries such as Indonesia or Vietnam, putting higher weight in training programs seems to be the more sensible approach since the level of technology adoption in general is low or at best varies tremendously across firms.

CHAPTER 1

Introduction and Overview

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1. Background and Objective

The objective of this report is to examine, utilizing firm- or plant-level micro data, the labor market effects of globalization and the mechanisms by which they operate, with a particular focus on the distributional effects of globalization. Specifically, this report aims to examine the effects of globalization—trade and foreign direct investment (FDI) liberalization, trade (exports and imports), international capital flows, outsourcing and traded intermediate goods—on labor market outcomes: wages and employment of firms as well as volatility and dispersion of wages. This report is the outcome of the ERIA research project *Impact of Globalization on Labor Market* done in Fiscal Year 2012, which was launched as part of a series of micro-data studies of globalization by ERIA started in 2008. Under this project, eight studies were conducted for eight countries in the Asia-Pacific region: Australia, Indonesia, Japan, Korea, Malaysia, the Philippines, Thailand, and Viet Nam.

As it is well understood, two notable and important economic trends have emerged during the past few decades. First, globalization has proceeded rapidly. Developing countries, in particular, have been increasingly exposed to international markets, resulting mainly from trade and FDI liberalization policies, deregulation, and technological progress, all of which contributed to a reduction in transaction cost in international economic activities. East Asia has been particularly noticeable in this regard. East Asian countries have been most rapidly integrated within the region as well as with the rest of the world through more liberalized trade and investment regime and also through increased trade and investment flows. Another trend is that in many middle- and high-income countries, wage and/or income inequality has also risen (Goldberg and Pavcnik 2007, IMF 2007). Did globalization cause the wage and income inequality to rise? If so, what are the mechanisms? If not, why? Do country specifics determine the effect of globalization on wage and income inequality? Are there any general lessons that we can draw from country experiences? What policies are needed to have the benefits of globalization more equally shared among economic agents and, hence, make the process of globalization contribute to economic growth and development on a more sustainable basis? These are the questions that run through this report.

Whether and how the wage inequality between skilled and unskilled workers is affected by globalization is a long-standing debated issue in international economics. The debate has been most active in the context of developed countries such as the United .States (US) where the relative wages of unskilled workers have secularly declined since the 1980s. Two competing explanations have been put forward as a cause for this phenomenon: trade and skill-biased technological progress. According to the standard Heckscher-Ohlin theory and its companion Stolpher-Samuelson theorem, international trade is expected to increase the relative wages of the skilled workers in a skill-abundant country while decreasing it in a skill-scarce country. So, the US as a skill-abundant country could be expected to experience a rise in skilled-unskilled worker wage inequality as a result of increased trade. An alternative explanation is that the rapid spread of computers and other information and communication technologies, which increased the relative demand for skilled workers in almost every industry, is the main cause. This latter view received wide support from many empirical studies which were conducted mostly in the 1990s based on industry-level data. The general consensus from early studies was that skill-biased technological progress, rather than trade, is the principal cause for the increase in wage inequality.

In fact, it may be more accurate to say that what was not widely accepted is the view that trade caused the observed rise in skilled-unskilled wage inequality *in the way the Heckscher-Ohlin theory predicted*. That is, there are important observations and results from empirical analyses which sit awkwardly with the predictions and assumptions of the Heckscher-Ohlin theory. First, while the H-O theory predicts that trade liberalization increases the wage inequality in skill-abundant developed countries and decreases it in skill-scarce developing countries, wage inequality rose not only in developed countries but also in many middle-income developing countries. Second, while the H-O theory predicts that the aggregate increase in the relative employment of the skilled workers occurs through the resource reallocation across industries, from low- to high-skill-intensity industries, most empirical studies have found instead that the within-industry increase in the relative employment of the skilled workers accounts for most of the aggregate increase in the skilled workers' relative employment. Finally, although the Heckscher-Ohlin theory is based on the

assumption of free labor mobility across industries, many empirical studies found that the inter-industry labor mobility following trade liberalization is very limited.

We think that our understanding of whether and how globalization affects wage and income inequality remains far from being satisfactory. There are several specific reasons on why we think a further scrutiny of these issues is warranted, particularly for countries in East Asia. First, new theoretical frameworks such as heterogeneous firm trade theories, together with the increased availability of firm-, plant-, or even product-level datasets, allow us to conduct in-depth analyses of these issues. As surveyed by Goldberg and Pavcnik (2007), more recent studies begin to reveal new mechanisms by which globalization affects wage inequality. There could be interactions between trade and skill-biased technological progress, trade-induced compositional change in firm's product portfolio, and complementarity between imported capital goods and skilled workers. To the extent that these mechanisms are important in reality, trade should be viewed as complementary to, rather than competing with, skill-biased technological progress in accounting for the observed rise in wage inequality. Second, outsourcing and trade in intermediate goods have expanded over the past two decades. This trend has been most noticeable in East Asia. As shown by Feenstra (1996, 1999), international outsourcing can raise wage inequality not only in outsourcing developed countries but also in "outsourced" developing countries. Third, previous studies on ERIA member countries, particularly on East Asian countries, are relatively scarce. Most of the available studies are on developed countries or on several middle-income countries in Latin America. Furthermore, since East Asia consists of various countries ranging from skill-scarce, low-income, outsourced countries to skill-abundant, high-income, outsourcing countries, East Asia provides an excellent case for a set of country studies.

Although the primary focus of this report is on the effect of globalization on wage inequality among workers, assessing other distributional effects, broadly defined, of globalization is also within the scope of this report. One issue that is addressed in this report is the effect of globalization on wage inequality between firms. Helpman, *et al.* (2010) show that when trade raises wage inequality among firms through revenue reallocations across firms, it also raises wage inequality among workers in a class of models which satisfy certain properties. In this regard, the effect on wage inequality

across firms could be a new channel by which globalization affects wage inequality among workers. In some countries, the wage inequality among firms, particularly between small and large firms, is *per se* a socio-political issue. Another issue is the effect of globalization on individual labor income risk. This is a topic for which existing studies are relatively scarce. If globalization increases wage volatility, it also serves as a new channel by which globalization affects welfare of domestic workers. Finally, in some country context, such as Japan and Korea, there is a concern that firms' overseas activities, though they may be beneficial by themselves, may not benefit domestic firms that are often small and supplying parts and components to globally engaged firms. This is probably one of the highlighted issues in policy discussions for which existing empirical research is most scant.

The rest of this chapter provides a synopsis of what follows and summarizes main policy implications that arise out of this report.

2. Summary of Country Studies

Hahn and Choi's paper examines the effects of output and input tariff reductions on within-plant wage skill premium in Korean manufacturing plants. They find evidence that output tariff reduction interacts differently with plants' R&D and investment behaviors, respectively, to affect wage skill premium. More specifically, output tariff reduction increases wage skill premium mostly in R&D-performing plants while reducing it mostly in plants making positive facility investments. While there is weak evidence that input tariff reduction increases wage skill premium, no such interactive effects are found. One story behind the results is that although both R&D and facility investments may respond to changes in profit opportunities due to output tariff reductions, R&D raises the relative demand for the skilled workers while facility investment, an activity of increasing production capacity, raises the relative demand for the unskilled (production) workers.

The results found in this study suggest that trade liberalization brings about not only benefits but also costs: increased disparity between skilled and unskilled workers in the labor market outcomes. The authors argue that a country liberalizing its trade

should also consider strengthening general social protection scheme in order to make the benefits from liberalized trade more equally shared among economic agents. They go on further and argue that, although strengthening the general social protection scheme is considered to be a better approach than strengthening the trade adjustment assistance (TAA) program, which targets only displaced workers by free trade agreement (FTA)-related increased import competition, the relationship between TAA and general social protection scheme should be more carefully examined and discussed. Another point the authors make based on the study is that we can maximize the benefits from trade liberalization and make them more politically supported when trade liberalization is pursued as part of a broader growth strategy. Given the interdependence of trade, innovation, and income distribution, as shown in this study, key elements of such growth strategy should at least include trade policy, innovation policy and redistribution policies. Establishing an effective policy governance scheme for such a strategy is likely to be an important issue.

Using establishment data of medium and large Indonesian manufacturing, Takii and Narjoko examine how greater exposure to international trade and foreign direct investment affects the extent of skill premium in wage and a firm's employment intensity. Takii and Narjoko used recent data, i.e., for the period 2000-2008, to capture the more open trade and investment in the country for the post-1997/98 Asian financial crisis period. The descriptive of their paper says that over this period, on average for the whole manufacturing, there is a declining pattern in the relative (skilled to unskilled) wage with a slight increase in the trend of skilled employment. Moreover, by comparing the descriptive statistics between different groups of plants, Takii and Narjoko find that plants involved with international trade and/or with foreign ownership pay higher wage to their skilled workers and employ more of these workers compared to local and domestic-oriented plants.

The econometric estimations of Takii and Narjoko find that tariff cut for the group of intermediate inputs in Indonesian manufacturing significantly reduced statistically the extent of relative wage for the period 2000-08. This confirms the earlier finding by Amiti and Cameron (2012) who also examined the impact of tariff cut on relative wage in the industry using 1990s data. This means the gap in the wage of skilled and unskilled workers in the industry has narrowed over time, which is consistent with

traditional trade theory which predicts that liberalization will reduce the relative demand for skilled workers in a less-skilled worker abundant economy.

Takii and Narjoko also find an interesting pattern (relationship) suggesting that the tariff cut has made local plants with low share of imported input as well as non-importing plants hire more skilled workers. A possible explanation for this is that it is a result of an efficiency measure adopted by the plants in response to more pressure from foreign competition. The declining trend in the relative wage has made it easier for these plants to hire more skilled workers.

Aldaba's paper examines how openness to trade affects wage skill premium within firms in the Philippine manufacturing sector. As measures of openness, she considers industry-level trade policy variables—effective protection rate (EPR), output and input applied MFN tariff rate, and ASEAN CEPT tariff rate—as well as the firm-level export share. She first starts by showing that the wage skill premium in the aggregate manufacturing sector has been declining for the past decades. The main empirical results of her econometric analyses are as follows. Foremost, trade liberalization, as measured by the reduction of EPR, decreases the wage premium. Her interpretation of this result is that in the face of more intense foreign competition due to trade liberalization, an import-substituting firm may decide to concentrate on the low value added stage of the production process, which requires relatively less skilled workers. She finds qualitatively similar results when she uses ASEAN tariff rate as a trade policy measure. However, she finds a rather contrasting result that the reductions in ASEAN tariff rates are associated with increases in wage skill premium in skill intensive firms.

Based on the results, Aldaba emphasizes the need to transform and upgrade manufacturing and shift toward more diversified and sophisticated export products, which would require climbing the industrial ladder and moving into higher value added sectors as sources of production advance. To drive the demand for skilled labor and skill intensive manufacturing processes, she argues that technological upgrading, along with further upgrading of education levels, promoting productivity growth, and increasing technological capability, would be required.

Thangavelu's paper examines the impact of trade and technology on the wage gap of skilled and unskilled workers, utilizing a firm-level dataset for the Vietnamese

manufacturing sector. It is found that trade tends to have skill-biased effects in terms of increasing the returns of skilled workers relative to unskilled workers. It is also found that firms that adopt new technologies and restructure their organization are likely to experience an increase in the wage gap between skilled and unskilled workers. He goes on to examine whether skill-biased technological changes are induced by globalization and finds some evidence consistent with this hypothesis. That is, he finds that firms that are part of international production networks are likely to undertake more restructuring.

Based on the results, the author also suggests that government has an important role in managing the negative effects of globalization without sacrificing its positive effects. In this regard, the author emphasizes general human capital development as well as training and skill-upgrading programs, to be crucial in moving unskilled workers displaced by technological changes and globalization to more productive sectors in the economy.

Kohpaiboon and Jongwanich's paper examines, using firm level data from Thai manufacturing, the effects of both the engagement with global production networks and the reductions in tariffs on wage skill premium within firms. They particularly focus on the effects of engagement with global production networks by arguing that there is growing concern among developing countries' policymakers that participating in global production sharing could make their enterprises trapped in low-skilled or low quality workers and retard technological advancement. They find that the engagement with global production networks increases wage skill premium in skill-intensive firms. With regard to the effect of tariff reduction, they find that output tariff reduction reduces wage skill premium within firms.

Based on the results, the authors argue that being a part of the global production sharing can bring in various benefits which include not only technological improvement but also the opportunity of moving up to more skill intensive activities. The authors emphasize, however, that this opportunity may not be available to those firms that are less skill-intensive. The authors suggest that policy focus should be on providing adequate and qualified skilled workers supply to allow firms to benefit from the global production sharing.

Palangkaraya's paper aims to contribute to a better understanding of the effects of globalization on domestic economic performance by considering a less frequently investigated channel through which globalization may affect the welfare in the domestic economy. Specifically, he estimates the effect of the domestic economy's exposure to international competition on individual labor income risk in Australia. In theory, globalization may result in domestic workers facing higher economic uncertainty and income and, therefore, experiencing a reduction in their welfare even if it does not reduce average income. If such welfare reducing effect from increased income risk due to globalization is significant and if it is not recognized in the policy making process, the resulting domestic policy response to globalization may be sub-optimal. He finds statistically and economically significant evidence that increased import penetration is associated with increased permanent income risk. The effects appeared to be stronger in manufacturing than in services. However, the evidence is mixed for transitory shocks.

Based on the results, the author emphasizes the need for taking the above negative impacts into account in formulating trade liberalization strategies. The author suggests specifically that it is important to make sure that there exist institutional mechanisms which can mitigate possible adverse income shocks and, hence, help achieve a fast and smooth labor reallocation process in the process of trade liberalization.

Lee's study empirically examines how various aspects of globalization— exporting, employment of foreign workers, foreign ownership, and trade liberalization— affect wage inequality, both between and within firms, using three firm-level datasets from the Malaysian manufacturing sector. This topic is of particular importance for Malaysia given the country's export-oriented development strategies and its continued reliance on foreign labor. Regarding the effect on between-firm wage inequality, he first finds some, albeit relatively weak, evidence that firms that export pay higher wages than non-exporter firms, consistent with many previous studies. He also finds that firms that employ a higher share of foreign workers pay lower wages and that trade liberalization has a weak, but positive, effect on wage levels. Regarding the effect on within-firm wage skill premium, the results vary depending on how skilled and unskilled workers are measured. Among others, he

finds evidence that trade liberalization raises the wages of management workers relative to skilled or unskilled production workers.

The author notes that the Malaysian government has been very interested in undertaking reforms in the labor market to upgrade the skill profile of the labor force, and explains that the implementation of minimum wage, which changes the incentives to use high skilled workers, is one such policy. He argues that this policy will work only if the country reduces the employment of foreign workers especially those in the skilled production category and that the key policy challenge is on how to enhance exporting via trade liberalization without dependence on foreign workers.

Ito and Tanaka's paper focuses on non-internationalized supplier firms and investigates how the expansion of overseas activities by their main customer firms impacts on the supplier firms' employment, utilizing a unique dataset that includes information on buyer-supplier transaction relationships for Japanese manufacturing firms for the period 1998-2007. Although a considerable number of empirical studies based on a matched dataset of parent firms and their affiliates overseas find no evidence that the expansion of overseas operations reduces the multinational enterprises (MNEs)' home employment, these studies do not consider the effect that the expansion of the overseas operations of MNEs has, on other hand, non-internationalized firms. The authors do not find any negative effects of top buyers' overseas expansion on domestic supplier's employment; they find a significantly positive effect instead. In other words, contrary to fears of a potential hollowing out of domestic supporting industries, the evidence suggests that domestic suppliers may increase their employment if their main customers are successful in foreign markets and increase foreign activities.

Based on the results, the authors argue that overseas expansion itself should not be criticized but promoted through policy support. The authors emphasize in particular the need for government policies which support domestic supplier firms' efforts to establish a new transaction relationship with the "good" downstream multinational firms.

3. Implications for Policy

As indicated in the beginning, this project aims to examine the impact of policies toward globalization, i.e., trade and investment liberalization, on labor market and the mechanism by which they operate. Many of the studies provide interesting results; one of which is that the impact on labor market cannot be separated from the impact on the other aspects. What seems to be clear from these studies is that policies promoting globalization are beneficial to firms and the economy in terms of technology adoption and knowledge accumulation. There is evidence that trade and investment liberalization encourages investment in more advanced technology which, in the long term, will increase knowledge accumulation and hence improve productivity.

The positive impact on technology upgrading and knowledge accumulation, however, turns out to be not without a cost. As many of the studies highlight, the impact on the outcome of labor market is not always positive. The gap between skilled and unskilled workers tends to widen in firms that upgrade technology capability as the demand for skilled workers increases. Also, as in the Australian case, globalization has proven to increase the risk of expected income in the future. The skilled-unskilled wage gap could be further widened because, at the same time, not all firms respond to liberalization by upgrading their technology capability; some of them choose to continue producing low-end products which sustains the high demand for unskilled workers.

The challenge in terms of policy therefore is to have the right balance to manage all sorts of these impacts of globalization. Ideally, liberalization helps a country, or firms in the country, to upgrade its technology capability and to accumulate knowledge but, at the same time, other policies need to be in place to neutralize the potentially adverse effect on the labor market. On the latter, two policy options are suggested by the studies in this project. First, improving policies to develop human capital through training and skills upgrading programs is important. This will increase the pool of skilled workers in a country, thereby making their hiring cheaper. Overall, this will facilitate technology upgrading by firms which choose to do so. This policy could also encourage other firms not to stay at producing low-end products.

Second, strengthening the general social protection scheme, instead of having globalization-specific adjustment assistance, needs to be considered. Strengthening social protection is important because it is not always clear what groups of workers are adversely affected. At the same time, globalization evidently also changes the expected risk of income in the future; therefore, complexity of these two factors demands a more general approach instead of the specific globalization adjustment program such as trade adjustment assistance (TAA), which targets only the displaced workers by FTA-related import penetration.

Applying these policies in a country however is not always clear-cut, the reason being that the mechanics of how globalization affects firms and the labor market could be different from country to country. Studies in this project suggest that it depends at least on three factors: (i) the state of industrialization or general level of technology adoption in a country, (ii) the current state of labor market, and (c) the current state of education or human capital development. As in the more advanced countries such as South Korea, for example, strengthening the general social protection scheme could be given a higher weight because the level of technology adoption in this country is relatively higher than in the other Asian countries. In developing countries such as Indonesia or Viet Nam, on the other hand, putting higher weight in training programs seems to be the more sensible approach since the level of technology adoption in general is low or at best varies tremendously across firms. The policy to neutralize the adverse globalization impact on labor market therefore needs to combine developing human capital and strengthening the social protection scheme albeit with different weights between countries.

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CHAPTER 2

Trade Liberalization and the Wage Skill Premium in Korean Manufacturing Plants: Do Plants' R&D and Investment Matter?

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This paper examines the effects of output and input tariff reductions on within-plant wage skill premium in Korean manufacturing plants. We find evidence that output tariff reduction interacts differently with plants' R&D and investment behaviors, respectively, to affect wage skill premium. More specifically, output tariff reduction increases wage skill premium mostly in R&D-performing plants while reducing it mostly in plants making positive facility investments. While there is weak evidence that input tariff reduction increases wage skill premium, no such interactive effects are found. One story behind our results is that, although both R&D and facility investments may respond to changes in profit opportunities due to output tariff reductions, R&D raises the relative demand for the skilled workers while facility investment, an activity of increasing production capacity, raises the relative demand for the unskilled workers.

Keywords: trade liberalization, skill premium, wage inequality, R&D, investment
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1. Background and Objective

For the past several decades, the impact of globalization on wage inequality between skilled and unskilled workers (wage skill premium) has drawn much attention in the academic and policy circles. Earlier studies based on the traditional Heckscher-Ohlin theory were generally skeptical to the view that trade is an important cause for the rising wage inequality. Recent theories, however, highlight several new mechanisms—interaction between skill-biased technological progress (SBTC) and trade (Wood, 1995, Thoenig and Verdier 2003, Bustos 2007, 2011), complementarity between imported capital goods and skilled workers (Acemoglu, 2003), or trade-induced compositional change in firm's product portfolio (Verhoogen, 2008), for example—by which trade liberalization increases wage skill premium. Although there are a growing number of empirical studies finding that globalization increases wage skill premium[1], whether and how globalization increases wage skill premium is an issue which deserves further scrutiny.

In this paper, we examine empirically the effect of trade liberalization on within-plant wage inequality between skilled and unskilled workers[2] utilizing plant-level dataset in the Korean manufacturing sector. As in Amiti & Davis (2012) and Amiti & Cameron (2012)[3], we examine separate roles of output and input tariffs and consider possibly differential effects among plants. The latter approach is broadly in line with the spirit of the recent heterogeneous firm trade theories which predict differential

[1] See Goldberg & Pavcnik (2007) for an extensive review of the related literature.

[2] Our focus on within-plant wage skill premium is motivated by Hahn & Park (2012), which shows that around half of the increase in the aggregate share of the skilled employment and wages is accounted for by the within-plant effect in Korean manufacturing during the period of our analysis.

[3] While Amiti & Cameron (2012) focus on the effects on within firm wage inequality between skilled and unskilled workers as in this paper, Amiti & Davis (2012) analyze the effects on between-firm wage inequality.

responses of firms to trade liberalization depending on the firm characteristics.

In this paper, we focus on plants' R&D and investment behavior as the key plant characteristics determining the effect of import tariff reductions on within-plant wage skill premium. So, our paper can be broadly related to the literature examining the possible interaction between trade and SBTC as a mechanism through which trade affects wage skill premium. While there is a growing interest in this subject, empirical studies which examine this mechanism explicitly are surprisingly scant.[4]

The following is a brief sketch of the story that explains our focus on plant's R&D and investment behavior. According to the well-known heterogeneous firm trade theories, such as those developed and reviewed by Amiti & Davis (2012), trade liberalization or reductions of trade costs increases the revenue and profit of firms with higher productivity while decreasing them with lower productivity. The increase (decrease) of the revenue and profit, or the prospect of it, will enhance (reduce) the incentive to do R&D[5] and/or to make investments in production facilities since these are basically investment activities motivated by profit opportunities. However, the effect of import tariff reductions on within-plant wage skill premium might differ depending on firms' behaviors in R&D and facility investment in response to import tariff reductions. Above all, R&D itself is likely to be a skilled-labor-intensive activity. Thus, if a firm increases R&D activity in response to trade liberalization, it will increase the relative demand for the skilled workers, leading to an increase of the wage skill premium when wages are determined at the firm level. Furthermore, R&D might be aimed at more skill-intensive products or processes under the increased

[4] Bustos (2007, 2011) are a few exceptions.

[5] Costantini & Melitz (2008) and Aw, *et al.* (2011) theoretically analyze this mechanism in the context of heterogeneous firms and trade.

import competition.[6] Alternatively, if a firm decides to increase its production capacity by investing in equipment and production lines given existing technologies, it is likely to increase relative demand for the production or unskilled workers. So, firms that increase production capacities in response to trade liberalization may experience a reduction in wage skill premium.[7] So, our analysis allows for differential effects of tariff reductions among plants engaged in R&D, plants making facility investments, and those that do neither. We find evidence consistent with the above conjecture. We think that this is a novel feature of our paper.

As mentioned above, we are interested in estimating the separate effects of output and input tariff reductions on wage skill premium as in Amiti & Cameron (2012). We think that conducting similar analyses for Korea's case is a meaningful exercise *per se*. Amiti & Cameron (2012) find that the reduction in intermediate input tariffs *lowers* wage skill premium in Indonesian manufacturing while they find no significant effect from the output tariff reductions. Their interpretation of the wage-inequality-reducing effect of input tariff reductions is as follows. As Indonesian manufacturing plants import more skill-intensive intermediate inputs mostly from developed countries, the reduction in input tariffs induces firms to switch from in-house production of skill-intensive intermediate inputs to importing, which decreases the relative demand for the skilled labor within firm. They give no detailed explanations on the insignificant effect from output tariff reductions.

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[6] Thoenig & Verdier (2003) theoretically show that firms respond to globalization by engaging in "defensive innovation", i.e., by biasing the direction of their innovations towards skilled-labor-intensive technologies.

[7] It is well known that only a small fraction of plants are engaged in R&D and a much higher fraction of plants, although not all plants, are making positive investments at a point in time. This pattern is also observed for Korean manufacturing, as we will show below. Thus, focusing on R&D alone in response to trade liberalization might not be sufficient to understand the effect of import tariff reductions on within-plant wage skill premium and might lead to an omitted variable bias problem.

In our view, however, there is no guarantee that similar results will be found for Korea or in other countries or contexts. First and foremost, we expect that the reduction of output tariffs widens wage skill premium mostly in R&D-doing plants and narrows wage skill premium mostly in plants expanding their production capacity. Next, regarding the effect of input tariff reductions, we think that the expected effect of the reduction in input tariffs is ambiguous for empirical and theoretical grounds. Amiti & Cameron's interpretation of their own results is based on the observation that Indonesia is a skill-scarce country which imports intermediate inputs from skill-abundant developed countries. However, the source-country composition of Korea's intermediate input imports is different from that of Indonesia'. Although high-income countries account for a major share of Korea's intermediate input imports during the period from 1992-2003, the share of low-income countries has steadily risen, from 22 to 32 percent.

More importantly, in our view, the effect of the reduction in intermediate input tariffs is likely to be theoretically ambiguous even if imported intermediate inputs are typically more skill-intensive than domestically produced ones. The relative-cost-based choice between in-house production and importing of intermediate inputs, as explained by Amiti & Cameron, is one mechanism. However, there could be another mechanism through which the reduction in input tariffs affect within-firm wage skill premium. As theoretically shown by Amiti & Davis (2012), for example, when there are increasing returns from a greater number of input varieties, the increase in the number of available intermediate inputs caused by input tariff reductions decreases the marginal cost of production for firms which import intermediate inputs, which increases their revenues and profits. If, again, the increase in profit opportunity strengthens the incentive to do R&D, the input tariff reductions are expected to

increase, rather than decrease, the wage skill premium within plants.[8] So, the combined effect is ambiguous. Under this story, which we think is very plausible, the effect of input tariff reductions on within-plant wage skill premium is an empirical matter.

This paper is organized as follows. In the next section, we explain our data and present trends in wages and employments of skilled and unskilled workers in the aggregate manufacturing. We also review trends in the average tariff rate. In section III, we explain estimation strategy and provide summary statistics in the key variables in our regressions. In section IV, we provide our main empirical results. The final section concludes.

2. Data

In our empirical analyses, we will utilize two data sources. The first one is the "Mining and Manufacturing Census" conducted by the KNSO (Korea National Statistical Office) during 1992~2003. This census data covers all plants with five or more employees in the mining and manufacturing sectors. For each year, the numbers of and the wage bills paid to production and non-production workers are available at plant-level in this survey. We construct within-plant wage inequality between production and non-production workers by dividing average wage of non-production workers by that of production workers. This data also provide information about various plant characteristics: status of R&D, investment and export,

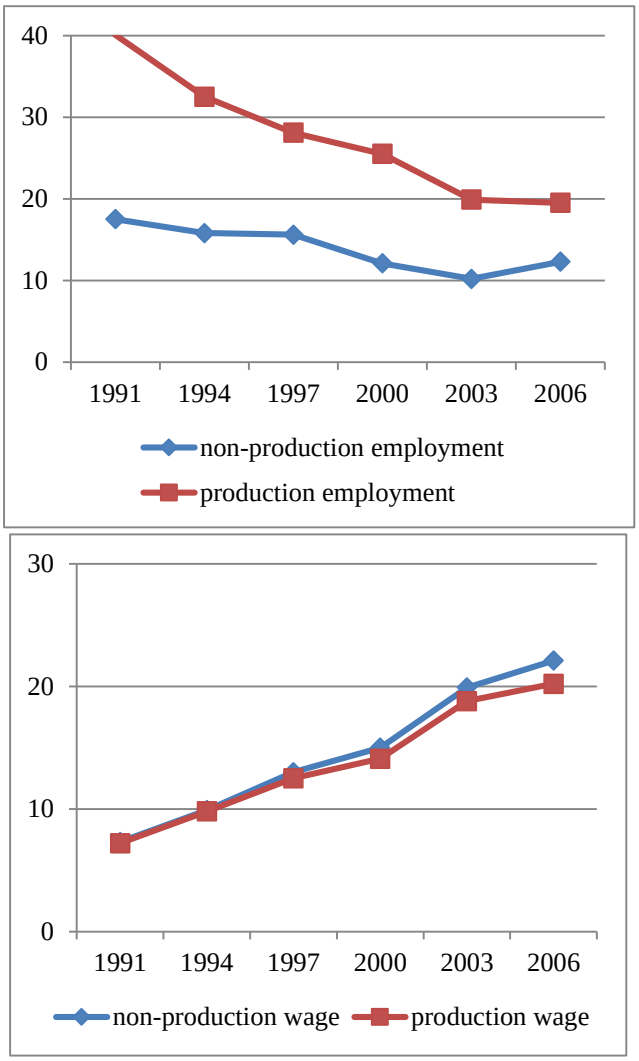
[8] We must acknowledge that, unlike Indonesia analyzed by Amiti & Cameron (2012), plant-level intermediate input imports data are not available for Korea. So, the results of this paper are not directly comparable to their paper.

size (measured by the level of total employment), skill intensity (measured by the ratio of the number of non-production workers to that of production workers).

Finally, yearly import tariff data comes from the KCS (Korea Customs Service) at the 10-digit level with HS code system. They provide data on the value of applied tariff and import for each HS category and the output tariff can be directly calculated by dividing the value of applied tariff by the value of import. This tariff data with HS code system has been converted to 141 Korea's Input-Output industry codes to calculate average industry-level output tariffs using the matching table provided by the Bank of Korea. We combine these industry-level output tariffs with the Korea's Input-Output table in 2000 to calculate the input tariffs for the corresponding industry.

Figure 1 shows the trends in average wage and employment of production and non-production workers in Korean manufacturing sector from 1991 to 2006, calculated from Mining and Manufacturing Census. First of all, the relative wage of non-production workers has risen slightly, if at all, over the period. Next, although the employments of both production and non-production workers have declined secularly, the pace of the decline was more pronounced for the employment of production workers. In this paper, we use non-production and production workers as proxies for skilled and unskilled workers, respectively. Then, trends shown in figure 1 suggest that the relative demand for skilled workers have been rising in Korean manufacturing for the past two decades.

Figure 1: Employment and Wage of Production and Non-production Workers



3. Empirical Specification

In order to investigate how (both input and output) tariff reduction and its interaction with R&D, investment and export activity affect within-plant wage inequality, we run the following regression:

$$\ln(w_s/w_u)_{p,i,t} = \alpha_p + \alpha_t + \beta_1 * \text{output tariff}_{i,t} + \beta_2 * \text{input tariff}_{i,t} + \beta_3 * \text{output tariff}_{i,t} * CH_{i,t} + \beta_4 * \text{input tariff}_{i,t} * CH_{i,t} + \Gamma' X_{p,i,t} + \varepsilon_{p,i,t} \quad (1)$$

where the dependent variable is the skilled wage premium, measured by the log of the ratio of the average wage of non-production workers to that of production workers (w_s/w_u). The output and input tariffs are measured at 141 input-output industry-level. *CH* denotes three different channels that can interact with trade liberalization: R&D, physical investment and export activity of each plant. *X* represents a vector of plant-specific characteristics such as size, total factor productivity and skill intensity. α_p and α_t are plant-fixed and year-fixed effect, respectively.

The coefficient β_1 has the meaning of the effect of output tariff on the within-plant skilled wage premium for the plants with *CH* = 0: for example, the effect of output tariff on the wage premium without doing any R&D activity. The coefficient on the interaction term, β_3, represents the heterogeneous response of R&D-doing plants in response to output tariff reduction: if output tariff reduction lead to increase the demand for the skilled-labor of the R&D-doing plants (and therefore widen the skilled wage premium), we expect that β_3 would be estimated to be significantly negative. This interpretation can be applied to other different channels: investment and export activity.

Likewise, β_2 measures the effect of input tariff on the skilled wage premium for the plants with *CH* = 0. If input tariff reduction affects the skilled wage premium of, for example, R&D-doing firms differentially, β_4 would be significantly different from zero.

The basic statistics of the key variables used in this paper are summarized in Table 1 and 2. In Table 1, we can see that both output and input tariffs show decreasing trend although the rate of decrease is not substantial.[9] In Table 2, the average skilled wage premium in our sample is 1.151 with substantial heterogeneity across plants. On average, R&D, investment and export activities are implemented by 8.4%, 48.6% and 12.9% of plants, respectively.

Table 1: Korea's Output Tariffs and Input Tariffs: 1992~2003

	Output Tariff		Input Tariff	
Year	Mean	Std. Dev.	Mean	Std. Dev.
	(1)	(2)	(3)	(4)
1992	0.109	0.083	0.053	0.023
1993	0.092	0.077	0.046	0.02
1994	0.089	0.084	0.043	0.02
1995	0.111	0.16	0.05	0.035
1996	0.094	0.085	0.044	0.023
1997	0.092	0.077	0.043	0.025
1998	0.094	0.079	0.042	0.022
1999	0.088	0.069	0.044	0.019
2000	0.087	0.071	0.044	0.02
2001	0.084	0.069	0.043	0.021
2002	0.086	0.072	0.043	0.021
2003	0.086	0.081	0.041	0.022
1992~2003	0.091	0.084	0.044	0.022

Note: Table reports the means and standard deviations of output and input tariffs across 141 industries. Input tariffs are constructed using 2000 input-output table provided by the Bank of Korea.

[9] Korea's major tariff reform took place in 1984 and 1989 (See Cheung & Ryu, 2003). In each year, the average output tariffs for manufacturing goods were reduced to around 20% and 15%. It would be ideal to include these early periods in our sample. But unfortunately, detailed tariff data are not available for these reform periods.

Table 2: Summary Statistics of Other Variables

	Observation	Mean	Std. Dev.	Min	Max
Skilled wage Premium	509,211	1.151	0.676	0.02	107.143
R&D Dummy	742,585	0.084	0.278	0	1
Investment Dummy	706,503	0.486	0.5	0	1
Export Dummy	633,506	0.129	0.335	0	1
Ln(TFP)	737,558	0.194	0.4	-11.905	15.787
Size	742,574	2.544	0.92	0.693	10.219
Skill Intensity	742,346	0.223	0.228	0	1

Note: Skilled wage premium is defined by the ratio of the average wage of non-production workers relative to that of production workers. Export, R&D and Investment dummies take the value of 1 if the value of export, R&D and investment are positive, respectively and the value of 0 otherwise. TFP is measured using the chained-multilateral index number approach as developed in Good (1985) and Good, *et al.* (1997). Size is the natural logarithm of employment and skill intensity is the ratio of the number of non-production workers to that of production workers.

4. Empirical Results

4.1. Main results

We first estimate equation (1) with plant fixed effects and Table 3 shows the results. In all specifications, we include plant-specific characteristics of size, TFP and skill intensity, all of which are statistically different from zero at 1% level. It shows that the skilled wage premium is higher when the size is larger, the productivity is lower and the skill intensity is lower. These results are almost identical to the case of Indonesia as shown in Amiti & Cameron (2012).[10]

[10] Amiti & Cameron (2012) did not include TFP level in their regressions. But our empirical results do not change in any material way when we drop TFP variable in our analyses.

Table 3: Fixed Effects Estimation Results

	(1)	(2)	(3)	(4)	(5)
Output tariff	-0.040*		-0.024	-0.062**	-0.059**
	(0.022)		(0.023)	(0.028)	(0.029)
Input tariff		-0.249**	-0.226**	-0.221*	-0.057
		(0.098)	(0.104)	(0.127)	(0.140)
Output tariff * R&D			-0.076*	-0.103**	-0.105**
			(0.043)	(0.044)	(0.049)
Input tariff * R&D			0.135	0.216	0.16
			(0.193)	(0.201)	(0.222)
Output tariff * INV				0.073***	0.076***
				(0.026)	(0.028)
Input tariff * INV				0.006	-0.045
				(0.118)	(0.129)
Output tariff * EXP					-0.022
					(0.056)
Input tariff * EXP					-0.138
					(0.221)
R&D			0.008	0.007	0.011
			(0.008)	(0.008)	(0.010)
INV				-0.004	-0.002
				(0.005)	(0.006)
EXP					0.018*
					(0.010)
Size	0.126***	0.126***	0.125***	0.128***	0.133***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Ln(TFP)	-0.066***	-0.066***	-0.066***	-0.066***	-0.067***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Skill Intensity	-0.345***	-0.345***	-0.346***	-0.342***	-0.383***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)
Constant	-0.269***	-0.259***	-0.257***	-0.266***	-0.279***
	(0.009)	(0.010)	(0.010)	(0.011)	(0.012)
Year Effect	Yes	Yes	Yes	Yes	Yes
Plant Effect	Yes	Yes	Yes	Yes	Yes
Number of Plants	157,409	157,409	157,409	155,275	143,589
Number of Observations	506,376	506,376	506,376	478,424	413,072
R-Squared	0.026	0.026	0.026	0.027	0.028

Note: Robust standard errors clustered at the plant level are in parentheses. *, **, and *** denote that the estimated coefficients are significant at 10%, 5% and 1% level, respectively.

In columns (1) ~ (3) of the table, we include either output/input tariffs or both. When we include output or input tariff separately, both coefficients on these variables are estimated to be significantly negative. This means that the reductions of both output and input tariffs are associated with the increase of the skilled wage premium, which is in sharp contrast with the main findings from the Indonesian data by Amiti & Cameron (2012). In the case of Korea, it seems that trade liberalization (in terms of both output and input) leads plants to increase the demand for skilled-labor. Then what are the important channels through which trade liberalization affect the demand for skilled-labor?

As explained in section 2, the interaction of trade liberalization and R&D might be an important channel that explains this skilled wage premium in the Korean context. To explore this, in column (3) of Table 3 we include the interaction term of output tariff and R&D dummy and we find that its coefficient is estimated to be significantly negative. This suggests that trade liberalization, as measured by output tariff reduction, had an effect of increasing skilled wage premium within R&D-performing plants. This result is supportive of the view that trade liberalization, in interactions with skill-biased technological change, contributed to the increase in the skilled wage premium. We do not find, however, any significant effect of the reduction in intermediate input tariffs on within-plant skilled wage premium, which is in contrast with the results by Amiti & Cameron (2012).

As explained in section 2, if trade liberalization affect skilled wage premium of R&D-doing plants differently, it would be a natural empirical question to ask whether investment-doing plants also respond differently to trade liberalization. Thus, in column (4) of Table 3, we additionally include the interaction term of investment with trade liberalization. After adding investment-related variables, the coefficient on

output tariff becomes significantly negative again which means that even the plants without any R&D and physical investment increase the demand for skilled labor. In addition, the coefficient on the interaction of R&D with output tariff becomes larger in its absolute value and more significant. R&D-performing plants further increase the demand for skilled labor. However, the coefficient of the interaction of investment dummy with output tariff is estimated to be positively significant. This means that the plants with physical investment respond in the opposite direction compared to the plants with R&D investment. The investment-performing plants increase their demand for unskilled-labor and their skilled wage premium decreases. To the extent that R&D activity is associated with higher demand for human capital (or skilled labor) and physical investment with lower demand for skilled labor, this positive sign of the estimated coefficient on the interaction of investment with output tariff is not surprising.

In column (5) of the table, we include export-related variables in the regression additionally. None of the coefficients on the interaction terms of export with output and input tariffs are significant but the coefficients on the interactions terms of R&D and investment remain to be significant and have the same sign as in column (4).

As an alternative specification, we estimate equation (1) in the five-year differences. Taking five-year differencing would reduce the problems of measurement errors and any concern of unit roots that may exist in a levels equation. The dependent variable is the log difference of skilled wage premium and output tariff, input tariff and other plant characteristics (size, productivity and skill intensity) are also differenced at five-year interval. For R&D, investment and export dummies, we

take the initial year's value.[11] Table 4 reports the estimation results of this specification which are very similar to those in Table 3 with fixed effects. R&D-doing plants and physical investment-doing plants respond differently to output tariff reduction in the opposite direction in terms of skilled wage premium.

Table 4: Alternative Specification: Five-year Differences

	-1	-2	-3
Δ Output tariff	-0.037	-0.132**	-0.134**
	(0.038)	(0.059)	(0.059)
Δ Input tariff	-0.011	0.404	0.460*
	(0.167)	(0.273)	(0.278)
Δ Output tariff * $R\&D_{t0}$	-0.184*	-0.256**	-0.258**
	(0.109)	(0.115)	(0.117)
Δ Input tariff * $R\&D_{t0}$	0.323	0.344	0.386
	(0.453)	(0.468)	(0.471)
Δ Output tariff * INV_{t0}		0.163**	0.161**
		(0.074)	(0.074)
Δ Input tariff * INV_{t0}		-0.605*	-0.557
		(0.338)	(0.342)
Δ Output tariff * EXP_{t0}			0.028
			(0.117)
Δ Input tariff * EXP_{t0}			-0.352
			(0.378)
$R\&D_{t0}$	-0.017**	-0.018**	-0.018***
	(0.007)	(0.007)	(0.007)
INV_{t0}		-0.010**	-0.011**
		(0.005)	(0.005)
EXP_{t0}			0.003
			(0.006)
Δ Size	0.099***	0.099***	0.100***
	(0.004)	(0.004)	(0.004)
Δ Ln(TFP)	-0.059***	-0.058***	-0.058***
	(0.005)	(0.005)	(0.005)
Δ Skill Intensity	-0.409***	-0.405***	-0.405***
	(0.014)	(0.014)	(0.014)
Year Effect	Yes	Yes	Yes
Number of Observations	74,110	70,403	70,403
R-Squared	0.028	0.028	0.028

[11] The reason why we take the initial year's values for these dummy variables instead of taking five-year differences is due to the convenience of the interpretation. If we mechanically take five year differences of these dummies then they will have the values of -1, 0 or 1 whose coefficients are difficult to be interpreted.

4.2.Endogeneity Issue

As in other empirical studies focusing on the effects of tariff reduction, we may address the concern of the potential endogeneity of trade liberalization if politically powerful industries are able to successfully lobby government for trade protection. However, in the previous literature, the degree of endogeneity of tariff reduction seems to vary depending on the specific country and the sample period that is being analyzed. For example, in the case of Indonesia, Amiti & Cameron (2012) used instrumental variable approach in order to treat this endogeneity issue but it turns out that the endogeneity problems is not that severe. On the other hand, Topalova & Khandelwal (2011), which analyzed the effect of industry level output and input tariffs on plant's total factor productivity using Indian plant data, provided several evidences on the exogeneity of tariff reduction in India and did not treat the endogeneity issue explicitly.

In this subsection, we follow the methodologies in Topalova & Khandelwal (2011) in order to check whether Korea's tariff reduction should be treated as endogenous in our sample. Before we proceed, it would be worthwhile to note that in Korea two major tariff reform took place in 1984 and 1988 before our sample period of 1992~2003 as mentioned in section 2. Moreover, during our sample period, there were several international events under which any political consideration in favor of some industries is unlikely to play an important role in determining tariff endogenously: the end of the Uruguay round in 1994, the establishment of the WTO in 1995, Korea's accession to OECD in 1996 and the IMF-supported program for Korea starting from 1997 after the financial crisis.

Nevertheless, we first follow Topalova & Khandelwal (2011) to test whether tariff reductions are correlated with politically important characteristics by regressing the changes in output and input tariffs over 1992~2003 on various industrial characteristics

in 1992. These industrial characteristics include average wage, production worker share, capital/labor ratio, shipment and employment. The results are shown in Table 5. In panel A, the correlation between changes in output tariff and these characteristics are reported and there exist no statistical correlation between output tariff and any of the industrial characteristics. In panel B, with the only exception of significantly positive correlation between changes in input tariff and shipment, none of the other industry characteristics is correlated with input tariff reduction.

Table 5: Initial Industrial Characteristics and Subsequent Tariff Change

Ln(wage)	Production Worker Share	Capital/Labor Ratio	Ln(shipment)	Ln(employment)
(1)	(2)	(3)	(4)	(5)
Panel A: Regression of Changes in output tariff on ….				
0,002	-0,035	0,000	0,004	0,004
(0,004)	(0,025)	(0,001)	(0,003)	(0,005)
Panel B: Regression of Changes in input tariff on …				
0,002	0,002	0,000	0.003***	0,002
(0,002)	(0,016)	(0,001)	(0,001)	(0,002)

Note: Each cell represents a separate regression of either changes in output tariffs (panel A) or changes in input tariffs (panel B) during 1992~2003 on the variable in the column heading in 1992. The number of observation in each regression is 141 industries. Robust standard errors are in parentheses. *, **, and *** denote that the estimated coefficients are significant at 10%, 5% and 1% level, respectively.

The second way to check the endogeneity of tariff reduction is to investigate whether tariffs were adjusted in response to industry's skilled wage premium. If this were the case, the current level of skilled wage premium would be able to predict future measures of tariff. In Panel A and B of Table 6, we regress the changes in output and input tariffs from t to t+1 on the skilled wage premium at time t. For the whole

sample period (1992~2003) and before and after the Korean financial crisis (1992~1996 and 1998~2003), the correlations between current skilled wage premium and future changes in tariffs are indifferent from zero.

Table 6: Current Wage Premium and Subsequent Tariff Change

Period	1992~2003	1992~1996	1998~2003
	(1)	(2)	(3)
Panel A: Regression of Changes in output tariff from *t* to *t*+1 on …			
Skilled wage	-0,009	-0,051	-0,003
premium at t	(0,007)	(0,034)	(0,007)
Observations	1.183	332	755
Panel B: Regression of Changes in input tariff from *t* to *t*+1 on …			
Skilled wage	0,001	-0,003	0,002
premium at t	(0,002)	(0,005)	(0,003)
Observations	1.183	332	755

Note: The table regresses either changes in output tariffs (panel A) or changes in input tariffs (panel B) from t to t+1 on industry-level skilled wage premium in period t. Industry-level skilled wage premium is calculated as a real shipment-weighted average of plant-level skilled wage premium. All regressions include industry and year fixed effects. Robust standard errors are in parentheses. *, **, and *** denote that the estimated coefficients are significant at 10%, 5% and 1% level, respectively.

Overall then, we conclude that Korea's tariff reduction at least during our sample period does not suffer endogeneity problem as in the case of Indian data investigated by Topalova & Khandelwal (2011).

5. Summary and Policy Implications

In this paper we examine the effects of output and input tariff reductions on within-plant wage skill premium in Korean manufacturing plants during the periods of 1992~2003. Our empirical results can be summarized as follows. First, both output and input tariff reductions are associated with the increase of the skilled wage premium unlike the case of Indonesia. Second, trade liberalization, as measured by output tariff reduction, had an effect of increasing skilled wage premium within R&D-performing plants. This result is supportive of the view that trade liberalization, in interactions with skill-biased technological change, contributed to the increase in the skilled wage premium. But there is no significant effect of the reduction in intermediate input tariffs on within-plant skilled wage premium. Third, for investment-performing plants output tariff reduction had an effect of decreasing skilled wage premium. These may reflect that while R&D activity is associated with higher demand for human capital (or skilled labor) physical investment is associated with higher demand for unskilled labor.

The results found in this study suggest that trade liberalization brings about not only benefits but also costs: increased disparity between skilled and unskilled workers in the labor market outcomes. So, a country liberalizing its trade should also consider strengthening general social protection scheme in order to make the benefits from liberalized trade more equally shared among economic agents. Strengthening general social protection scheme is considered to be a better approach than strengthening the trade adjustment assistance (TAA) program, which targets only at displaced workers by FTA-related increased import competition. More generally, the relationship between TAA and general social protection scheme should be more

carefully examined and discussed. Another policy implication from this study is that we can maximize the benefits from trade liberalization and make it more politically supported when trade liberalization is pursued as a part of a broader growth strategy. Given the interdependence of trade, innovation, and income distribution, as shown in this study, key elements of such growth strategy should at least include trade policy, innovation policy and redistribution policies. Establishing an effective policy governance scheme for such a strategy is likely to be an important issue.

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Appendix

Table A1: Fixed Effects Estimation Results with Industry Fixed Effects

	(1)	(2)	(3)	(4)	(5)
Output tariff	-0.051**		-0.043*	-0.081***	-0.068**
	(0.025)		(0.025)	(0.030)	(0.031)
Input tariff		-0.192	-0.150	-0.157	0.086
		(0.131)	(0.135)	(0.154)	(0.165)
Output tariff * R&D			-0.078*	-0.103**	-0.103**
			(0.043)	(0.045)	(0.049)
Input tariff * R&D			0.195	0.263	0.173
			(0.194)	(0.202)	(0.223)
Output tariff * Investment				0.074***	0.075***
				(0.026)	(0.028)
Input tariff * Investment				0.022	-0.038
				(0.118)	(0.129)
Output tariff * Export					-0.036
					(0.056)
Input tariff * Export					0.015
					(0.226)
R&D dummy			0.006	0.005	0.010
			(0.008)	(0.009)	(0.010)
Investment dummy				-0.005	-0.003
				(0.005)	(0.006)
Export dummy					0.012
					(0.010)
Size	0.125***	0.125***	0.124***	0.128***	0.132***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Ln(TFP)	-0.066***	-0.067***	-0.067***	-0.067***	-0.067***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Skill Intensity	-0.345***	-0.345***	-0.346***	-0.342***	-0.383***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)
Constant	-0.279***	-0.272***	-0.270***	-0.279***	-0.301***
	(0.009)	(0.012)	(0.012)	(0.012)	(0.014)
Year Effect	Yes	Yes	Yes	Yes	Yes
Plant Effect	Yes	Yes	Yes	Yes	Yes
Industry Effect	Yes	Yes	Yes	Yes	Yes
Number of Plants	157,409	157,409	157,409	155,275	143,589
Number of Observations	506,376	506,376	506,376	478,424	413,072
R-Squared	0.026	0.026	0.026	0.027	0.028

Note: Robust standard errors clustered at the plant level are in parentheses. *, **, and *** denote that the estimated coefficients are significant at 10%, 5% and 1% level, respectively.

Table A2: Alternative Specification: Five-year Differences with Industry Fixed Effects

	(1)	(2)	(3)
ΔOutput tariff	-0.046 (0.040)	-0.135** (0.062)	-0.136** (0.062)
ΔInput tariff	-0.166 (0.204)	0.210 (0.300)	0.251 (0.302)
ΔOutput tariff * $R\&D_{t0}$	-0.204* (0.110)	-0.271** (0.116)	-0.272** (0.118)
ΔInput tariff * $R\&D_{t0}$	0.384 (0.459)	0.397 (0.474)	0.452 (0.477)
ΔOutput tariff * INV_{t0}		0.157** (0.074)	0.155** (0.074)
ΔInput tariff * INV_{t0}		-0.536 (0.340)	-0.490 (0.344)
ΔOutput tariff * EXP_{t0}			0.026 (0.120)
ΔInput tariff * EXP_{t0}			-0.367 (0.390)
$R\&D_{t0}$	-0.016** (0.007)	-0.017** (0.007)	-0.018** (0.007)
INV_{t0}		-0.010** (0.005)	-0.010** (0.005)
EXP_{t0}			0.003 (0.006)
ΔSize	0.100*** (0.004)	0.100*** (0.004)	0.101*** (0.004)
ΔLn(TFP)	-0.063*** (0.006)	-0.062*** (0.006)	-0.062*** (0.006)
ΔSkill Intensity	-0.410*** (0.014)	-0.405*** (0.014)	-0.405*** (0.014)
Year Effect Industry Effect	Yes Yes	Yes Yes	Yes Yes
Number of Observations R-Squared	74,110 0.031	70,403 0.031	70,403 0.031

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

CHAPTER 3

Revisiting How Globalization Affects Wage Skill Premium in Indonesian Manufacturing

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This paper addresses the topic of globalization and skill premium (i.e. the gap in wage and the extent of skilled workers hired by a firm) using the plant-level data of Indonesia manufacturing. It asks the question of how the greater trade and investment openness, as a result of trade and investment liberalization in the 1990s and early 2000s, affect the skill premium and intensity within firms, the mechanisms at work, and which theories can explain the relationship between the liberalizations and skill premium. The descriptive analysis shows a declining pattern in the relative wages while there is a slightly increasing trend in relative employment. As a result, there is rather declining trend in the share of skilled workers in wage bills. The descriptive also find that the trend in relative wage and demand for skilled workers are different between fore-gin-owned and local plants and that relative wages for skilled workers in foreign-owned plants, which were much higher, has been declined faster than that for local plants. The econometric results confirms the input tariff cut leads to lower skill intensity (i.e., lower share of skill workers in total wages bill) as suggested by Amiti & Cameron (2012). However, the impacts are concentrated in foreign-owned plants. On the other hand, the results also suggest that the input tariff cut leads to higher skill intensity in local plants in the Indonesian manufacturing.

***Keywords*:** wage skill premium, trade liberalization, investment liberalization, Indonesian manufacturing

1. Introduction

The impact of trade and/or investment liberalization on inequality always attract the attention of policy makers, for the reason that it may determine the extent of public support for the engagement of a country in more globalized economic activities. Research on this topic, unfortunately, has so far not been able to provide a clear idea on the direction, mechanics, or even the extent of the impact, leaving ample of room for more public debate which may not be effective in deciding a general policy direction of a country. This paper attempts to provide more insight into this topic, by addressing the inequality in the form of skill premium and intensity *within a firm (plant)* (i.e., the gap in wage and the extent of skilled workers hired by a firm) in Indonesian manufacturing. The availability of data for this study allows it to address the topic at plant level.

The motivation of this study is threefold. First, little is known about the extent and pattern of skill premium and intensity over the time and across industries. Amiti & Cameron (2012), which also examined this topic in the same industry (i.e. the Indonesian manufacturing), has provided us with some information on the extent of the skill premium, but not so much on the pattern of it, either between industries or over the time. The long-span of time coverage covered by this study allows us to have a good observation for overtime pattern.[1] This study, in this sense, enriches our knowledge by making contribution to the literature on the basic facts skill premium and intensity in developing countries. Second, this study explores the possibility whether other factors other than trade liberalization determine the extent of within-plant skill premium in the Indonesian manufacturing. This is in regard, the recent study done by Amiti & Cameron (2012) indeed finds some evidence that trade

[1] The time period of the data covered by this midterm report is still limited to the period 2000-08; the 1990s period is yet to covered by the report because the authors have not yet been able to acquire the detail input-output table for the 1990s period. The authors however will include the 1990s period in for the final report; the 1990s input-output table is currently still being processed by the statistical agency/BPS.

liberalization, through the liberalization of input tariff, reduced the extent of the gap in wage between skilled and unskilled workers in Indonesian manufacturing in the 1990s.

What motivates this paper lead to some specific questions on the topic for the Indonesian manufacturing, that is: how does the greater trade and investment openness in Indonesia, as a result of trade and investment liberalization in the 1990s and early 2000s, affect the skill premium and intensity within firms (plants)? What are the mechanisms at work? Can the liberalization of foreign investment also explain the within-plant skill premium and intensity? Are other theories, such as the 'outsourcing'/'production sharing theory of Feenstra & Hanson (1996, 1997) and/or the 'skill biased technical change' (SBTC) theory, able to explain the within-plant variation in the skill premium and intensity? These are the key questions that this paper attempts answer.

The rest of this paper is organized as follows. The next section presents a review of literature, consisting description of policies affecting industrial development in Indonesia since the 1990s and a brief description of the literature surrounding the topic of skill premium. Section 3 presents some descriptive analysis on the measures the measures of labor-market outcome between skilled and unskilled workers. Section 4 explains our estimation method and describes the data and variables and presents our econometric results and Section 5 presents our conclusion.

2. Literature Review

2.1. Evolution of Trade and Investment Policy in Indonesia[2]

Indonesia provides a good case study to examine the impact of trade or investment liberalization, and obviously labor market policy, on relative demand for skilled labor (relative to the demand of unskilled labor). The country saw episodes of trade and investment liberalization as well as a dramatic change in labor market policy over the span of the last twenty years or so.

[2] See Pangestu (1996), Hill (1996), and Aswicahyono, *et al*. (2010) for more detail description about the evolution of the policy.

The first episode happened between the end of 1980s to right before the 1997/98 Asian financial crisis. During this period, especially in the beginning of the 1990s, the government undertook a rather massive policy reform with the aim to switch the country's industrial approach from import substitution to export oriented. Trade and investment regime were radically liberalized along with major reforms in banking sectors. All these were taken to reduce export bias, that is, reducing the cost for exporting, increasing the flow of investment, and establishing stronger banking-sector intermediary function. In practice, incentive system such as duty drawback system was introduced for the first time, tariffs were substantially reduced, and many non-tariff barriers (NTBs) were eliminated. As for investment reform, among other, the maximum share of foreign share for a joint venture was relaxed, minimum capital requirement for foreign investment was reduced by about 75 percent, and the government opened more sectors, which mostly are services sectors, to foreign investors.

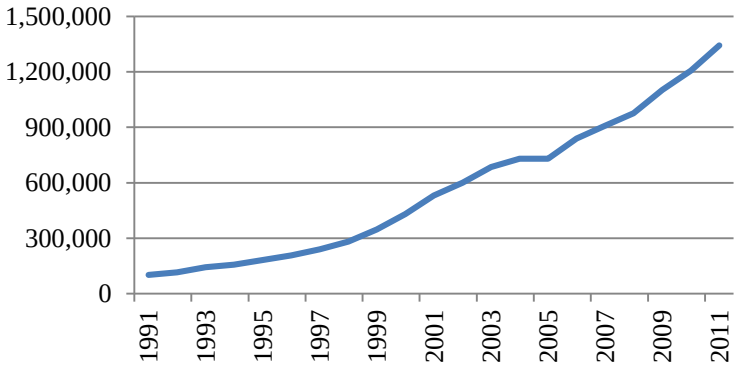
The second episode fall within short period of during the 1997/98 Asian financial crisis. Further trade liberalization was undertaken over the 1998-99 period as a part of the agreement between the government and the International Monetary Fund (IMF) under the Fund's crisis support program. Tariffs were further reduced and more NTBs were eliminated. All in all, as a result of trade reforms in the mid-1990s and the acceleration of the reforms per the IMF agreements, simple average tariff rates were reduced from 20% in 1994 to 9.5% in 1998 and 7.5% in 2002 (WTO 1998, 2003).

There was no major trade and investment liberalization occurred in the period after the 1997/98 crisis, which can defined as the third episode in the policy making related to industrialization in Indonesia. The openness in trade regime stayed relatively the same as right after the crisis. As for investment policy, there was a rather significant change when a new investment law was introduced in 2007. This is in the effort to revive the declining trend of investment, both foreign and local, in the country.

What makes the third episode special is a change in labor market policy in early 2000s that marks a change in the labor market regime since until present day. The labor market regime before the crisis was more or less accorded with "East Asian norms". Trade unions existed but were heavily managed, and minimum wages were prescribed but they were generally below market levels in the formal sector, and were

not enforced systematically. During the crisis, real wages fell sharply, but unemployment rose only modestly. After the crisis, powerful pro-labor pressures emerged, and the constraints on trade unions were largely removed. Under successive ministers of manpower, the government strongly supported worker entitlements and wage claims. Two of the most controversial outcomes were the significant increase in the regulated minimum wage (see Figure 1) and there were incidences that point to rigidities into hiring processes; firms from taking on additional labor (Manning & Roesad, 2006).

Figure 1: Average Monthly Minimum Wage 1991-2011



2.2. Impact of Globalizations on Labor Market

As pointed out by Goldberg and Pavcnik (2007), there seems to be an agreement that shift in demand for skilled workers is the main reason driving the widening gap in the wage between skilled and unskilled workers (or, as noted, 'skill premium'). This means that wages for skilled workers and skilled employment move in the same direction. While the demand-shift mechanism is clear, there is however not much agreement on how the demand curve is shifted. In other words, there are questions with clear answers on which factors driving the demand shift and how these factors do so.

The neoclassical Heckscher-Ohlin (H-O) theory is not always able to explain the trend and pattern of the skill premium, especially those in developing countries. The theory, as in Stolper-Samuelson model, predicts the distributional changes in developing countries, which usually are endowed with unskilled workers, should favor unskilled workers more than the skilled ones should there is liberalization in their trade

regime. In other words, this theory predicts a lower gap in the wages between skilled and unskilled workers.

A recent study done by Amiti & Cameron (2012) provide some support for the H-O model (or, trade theory) in explaining skill premium in developing countries, by examining the effects of tariff reduction on wage skill premium in Indonesian manufacturing. Amiti & Cameron examined the effects of output and input tariffs separately, and found that reducing input tariffs reduced the wage skill premium within firms that import their intermediate inputs. The intuition of the result is that relative demand for skilled labor was decreased because domestic production of relatively skill-intensive intermediate inputs was replaced by imports.

The results of Amiti and Cameron, along with the main prediction of trade theory, however is contrary to findings emerged from other studies of other developing countries. There is indeed evidence from these studies that globalization increases wage skill premium in not only developed countries but also developing countries (Goldberg & Pavcnik, 2007).

Two alternative explanations are put forward in the literature to date. The first is the 'outsourcing' or 'product sharing' theory of Feenstra & Hanson (1996, 1997). The theoretical model developed by Feenstra and Hanson expects that foreign direct investment (FDI) increases relative demand for skilled labor and thus wage skill premium. The model emphasizes the growing importance of trade in intermediate inputs. The implication derived from the model is that the relative demand for skilled labor is increased because production of relatively skill-intensive intermediate inputs is shifted to developing countries. While the shifted products are characterized as less skill-intensive from a developed country's perspective, they are likely skill-intensive from the perspective of developing country.

The second explanation is the one often termed as skill-biased technological change (SBTC). SBTC argues that the new technology embodied in imported capital goods – through channels such as a more open trade regime or an increase in FDI as a result of investment liberalization – increases the demand for skilled workers (in host countries). In other words, the technical changes induced by trade and FDI liberalizations have some effect (i.e., the 'bias') to increase the demand for skilled workers. The argument that the technology is brought by trade or FDI means that the

technology itself is endogenous to openness; this is how globalization is responsible for the skilled-bias (Goldberg & Pavcnik, 2007).

Wood (1995) is among the first who take this endogeneity in model of firms. He introduced the term 'defensive innovation' to describes the response of firms to trade openness, in which hypothesize that an intensified competition from import may induce firms to engage in R&D activities that they have little incentive to adopt before trade liberalization (Goldberg & Pavcnik 2007). Giving support for this, Attanasio, *et al*. (2004) document that the increase in skill labor demand in Columbia was the largest in the sectors that experienced the largest cuts in tariff. Another model of endogenous technology is suggested by Acemoglu (2003), who argues that technological change in developing countries may take the form of increased in imports of machinery and other capital goods that are complimentary to skilled workers. In his model, trade liberalization reduces the price of the machinery and capital goods and therefore increases the imports of these goods; demand for skilled workers is induced by the increase in the supply of these imported goods.

To this end, it is useful to make some comment on the different view between traditional trade theory and the suggested by Feenstra & Hanson (1996, 1997). The main difference comes from the different expectation how globalization changes the production of skill-intensive inputs. The former expects a decrease in the production because many of the intermediate inputs are replace by the imported ones. Feenstra & Hanson's theory, meanwhile, predicts that the production is increased, because now many of intermediate inputs are produced locally by the 'outsourced' firms. All these indicate that the magnitude and direction of the impact of globalization on wage skill premium depend on the changes in production of relatively skill-intensive intermediate inputs. In this respect, one of the most important factors determining the impact is therefore 'quality upgrading', which can induce an increase in relative demand for skilled labor.

3. Descriptive Analysis

3.1. Trend and Pattern of Trade and Investment

Before presenting the descriptive of the outcome variables on relative wages and demand for skill labors, it is useful to present some statistics to describe how the trade and investment liberalization affect the general trade and investment performance.

First, trade liberalization of the 1990s has evidently increased the extent of international trade regime for manufacturing goods. As it is shown in Table 1A, which reports the nominal tariff rates across two-digit industries (based on ISIC Revision 2) over the period 1990-2007, there is a declining trend in the tariff rates over the period 1990-2007. Moreover, it is important to note that much of this decline happened within the period 1990-2000; the tariff rates – at least for the MFN ones – then flattened for the rest of the period. The reduction within the 1990s is also significant; and to show this, the whole-industry average tariff rate in 2000 was recorded to about half of the rate in 1990. This reflects the fact the intensive trade liberalization undertaken by the government in the 1990s and during the 1997/98 crisis.

Looking at the cross section variation of the tariff rates (Table 1A), it is clear the only sector that did not undergo tariff cut is food and beverage; the tariff rate practically did not change within the whole period. It is observed that the lowest tariff rates are recorded for paper products, non-metallic chemical, basic metal, and machinery-and-transport equipment sectors.

As noted, the tariff rates were more or less flat after 2000. It is worth noting however there is further decline, albeit slightly, in the effective tariff rates (see Table 1B), and this is observed more clearly when one compares the effective with MFN rate in textile-and-garment, wood products, basic metals, and machinery-and-transport equipment. This pattern may be due trade liberalization coming from Indonesia's commitments in regional integration (e.g., ASEAN Free Trade Agreement, AFTA) or bilateral agreements (e.g., FTA with China or Japan).

Table 1A: Nominal Tariff Rates (%, MFN)

ISIC/Industry	1990	1995	2000	2005	2007
31 Food and beverage	24.9	20.0	30.8	30.7	28.8
32 Textile and garments	25.9	21.9	12.4	9.0	10.1
33 Wood products	27.8	23.1	11.1	8.5	8.0
34 Paper products	22.6	11.9	7.7	4.5	4.6
35 Chemical, rubber and plastics	13.5	13.0	8.9	7.0	7.0
36 Non-metallic mineral products	24.7	18.5	5.6	5.0	8.7
37 Basic metal industries	9.3	8.8	7.0	6.7	5.6
38 Machinery and transport equipment	19.7	16.4	7.9	6.7	6.3
39 Other manufacturing	31.6	24.7	14.0	10.4	10.5
Average	22.2	17.6	11.7	9.8	9.9

Source: WITS Database

Table 1B: Nominal Tariff Rates (%, Effective Rates)

ISIC/Industry	1990	1995	2000	2005	2007
31 Food and beverage	26.3	19.9	28.9	29.8	27.6
32 Textile and garments	24.8	20.9	12.0	7.3	7.9
33 Wood products	27.9	23.8	10.8	6.9	6.8
34 Paper products	23.4	11.8	8.2	4.9	5.0
35 Chemical, rubber and plastics	13.2	12.8	9.1	6.7	6.4
36 Non-metallic mineral products	21.3	15.7	5.3	4.4	7.0
37 Basic metal industries	10.1	9.7	7.2	5.9	5.0
38 Machinery and transport equipment	18.5	15.4	7.6	5.5	5.2
39 Other manufacturing	33.1	25.2	14.2	8.7	8.2
Average	22.1	17.2	11.5	8.9	8.8

Source: WITS Database

The impact of the trade liberalization in the 1990s on trade performance is immediately visible. As reported by Table 2, the growth of Indonesian manufacturing exports was phenomenal, that is, 29.5 percent over the period of 1990-93; this was the period immediately after many radical reforms done by the government in an attempt to reduce export bias. The growth however lessened in the next three years after the period (i.e., the period 1994-96) despite the fact it was still recorded at about at 10 percent. What is important to note is the export performance after the 1997/98 crisis. During this period (i.e., after 2000), the exports seem to have been sluggish, not being able to move back to the pre-crisis average. Disappointing performance – relative to pre-crisis performance – was recorded by exports of goods under the resource-based labor intensive and electronics products. The former is rather puzzling given a

commodity boom during the first half of 2000s. A potential explanation for the weak performance is it may have been affected by the more rigid labor market situation after the crisis and in particular this could have been caused by the jump in minimum wages in this period.[3]

Table 2: Trade and Foreign Direct Investment in the Indonesian Manufacturing

	1990-93	1994-96	1997-99	2000-02	2003-05	2006-08
Manufacturing export growth	29.5	9.6	0.8	9.9	7.9	
% of exporters in total mfg.	17.1	20.3	13.8	17.5	21.9	13.8
- Local plants	15.3	17.3	11.8	16.5	13.1	11.2
- Foreign-owned plants	45.8	56.7	33.0	45.6	39.9	36.5
% of importers in total mfg.	23.8	20.7	21.4	19.2	20.8	21.4
- Local plants	21.1	17.0	16.7	14.7	16.9	17.5
- Foreign-owned plants	69.9	66.4	66.0	61.1	56.3	55.5
Average share of imports to output	23.7	22.9	24.0	23.0	20.9	20.3
- Local plants	22.2	20.6	21.0	20.0	17.8	17.1
- Foreign-owned plants	30.9	30.3	31.3	29.7	29.4	29.1
% of foreign-owned plants	5.7	7.5	9.6	9.5	9.9	10.1
Foreign share of output	23.1	29.2	34.4	33.8	35.1	35.1

Note: Average share of imports to output was calculated using sample of importers only.

Reflecting the performance of aggregated manufacturing exports, the percentage of exporters in total manufacturing swing over time. The percentage increased from 17.1 percent during 1990-93 to 20.3 percent during 17.1 before declining to 13.8 percent during the economic crisis. The percentage of exporters in foreign-owned plants is far higher than that of local plants. More than the half of foreign-owned plants were exporting in 1994-96 but the percentage tended to have declined even after the economic crisis, reflecting that the number of non-exporting foreign-owned plants increased relative to exporting foreign-owned plants. On the other hand, the percentage of importers tended to have increased slightly in the 2000s. While the percentage in local plants was increasing, the percentage in foreign-owned plants was decreasing. The average share of imported material to output also tended to have declined mainly in local plants. The corresponding share of foreign-owned plants was higher than that of local plants, but was declining more slowly.

[3] See Section 2 on the evolution of policy affecting industrialization in the country after the 1997/98 crisis.

An increasing trend is observed for foreign direct investment, which reflects to large extent the impact of the investment liberalization that occurred in the 1990s, and to lesser extent the impact of the new investment law introduced in 2007. As shown in Table 2, the percentage of foreign-owned plants in total number of manufacturing plants and the share of the whole manufacturing output produced by firms with foreign equity share continuously increased over the long period 1990-2008. The increase was very significant within the first half of this period (*i.e.*, over the period 1990-2000). The pace of the increase has however has somewhat lessen after 2000.

It is important to observe how the increase in the output produced by foreign investment across the industries. That is, it is indicated that the increase was not observed only for sectors that mostly produced final goods; it was suggested that the increase also occur – in fact at much higher rate – in sectors/subsectors that produce intermediate inputs. To illustrate, the foreign-output share of sectors in which many machinery parts and components were classified under (*i.e.* sectors of ISIC 27 to 35) experience a rapid increase and the extent to which the output is produced by foreign investment in these sectors are mostly way above the whole-industry average. This indicate a large 'outsourcing'/'production sharing' activities done by foreigners and is likely reflect the behavior represented by the model of Feenstra & Hanson (1996, 1996).

3.2. Relative Wages and Demand for Skilled Workers

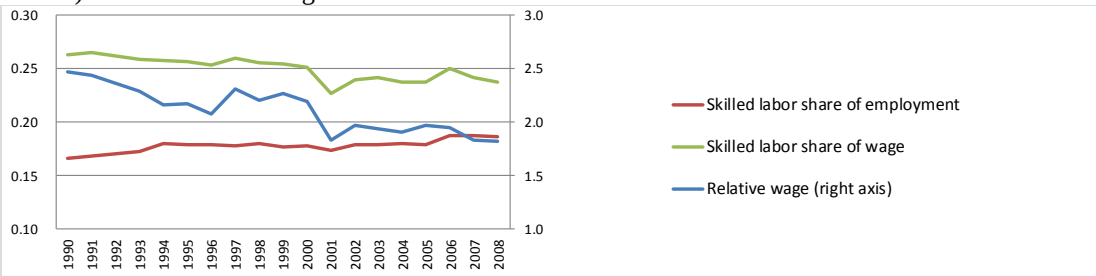
Figure 2 present the statistics of the main interest of this paper, that is, relative wages, relative employment, and the skilled-labor share of total in wages. As in Feenstra & Hanson (1997), the latter measures the relative labor demand that incorporates the former first two. The statistics of all the three variables computed as the plant-average for each two-digit ISIC industries are shown in Appendix Tables 1-3.

It is observed that the average relative wage is declining for the whole manufacturing during last decades. In the 2000s, it is more or less flat up until 2005 with a tendency of a decline toward the end of the period (2008). Looking at the pattern across the more disaggregated industries, it is revealed that some of these industries exhibit a rather fluctuating pattern, especially within the first ten year of the

period (i.e., from 1990 to 2002). There are also industries that actually show an increasing trend up until 2002 (*i.e.*, machinery and equipment, and motor vehicles and trailers). It is however almost a regular pattern that the industries (almost all of them) experience a decline in the relative wage at the latter part of the period (between 2002 and 2008). As for the cross-section pattern, it is observed that the relative wages recorded for the following industries is consistently above the whole manufacturing average: tobacco products, chemical products, basic metals, fabricated metal products, office, accounting and computing machinery, electrical machinery and apparatus, and radio, television and communication equipment and apparatus.

Figure 2: Relative Wage, Employment and Wage Share of Skilled Workers

Panel a) Total manufacturing



Looking at the skilled worker share in total employment, a general trend that emerges is a moderately increasing one. For the whole manufacturing, the average share of skilled workers at each plant increased from 11.9 percent in 1990-93 to 18.4 percent in 2006-08. This indicates that the relative demand of skilled workers was increased over the period. On the other hand, as mentioned above, the relative wage of skilled workers was reduced during the period. These suggest that the relative wages were also affected by supply-side factors. There is not much of variation to this general pattern across industries. As for cross-section pattern, some labor-intensive industries (i.e., textiles, apparel, and leather and footwear; tobacco and wood products) exhibit a relative employment figures below the average for the whole manufacturing. The other industries record either above or about the average of the whole manufacturing.

The patterns of plant-average skilled-labor share of total wages more or less 'summarize' the pattern observed from the previous two figures because, as noted, the

share incorporates both relative wages and relative employment. Indeed, this seems to be the case. The share tended to have moderately declined over the period reflecting the faster decline in relative wages compared to the increase in relative employment. Cross-sectional pattern also persists, where some industries are observed to record the skilled-labor share above the average for the whole manufacturing, and many of these industries are the subset of the industries that record the above-average relative employment. It is worth to underline that, for Indonesian manufacturing, the share of skill-labor in total wages is about 20 percent in Indonesian manufacturing. This may be considered low for developing country standard. The skilled share in Mexican manufacturing, for example, is about 30 percent (Feenstra & Hanson 1997).

What then can we learn from the descriptive statistics presented by the previous three tables? First, there is a tendency of a declining pattern in the relative wages while there is a slightly increasing trend in relative employment. As a result, there is rather declining trend in the share of skilled workers in wages. Second, this overtime pattern is consistent with the findings and conclusion of Amiti & Cameron (2012). The descriptive presented in Figure 2 and Appendix Tables, however, is not yet been able to confirm whether or not the declining trend is due to cut in tariff rates as Amiti and Cameron tested. This is especially for the later part of the period (*i.e.*, the period after 2000), for the reason of rapid overtime increase in minimum wage in Indonesia. Third, with respect to the minimum wage, one may speculate that the sharp increase in the minimum wage may have affected the decision of firms in hiring workers and this, in turn, may explain why there is a tendency of declining trend in the demand for skilled workers in 2000s. Fourth, the fact that cross-section variation (across industries) also exists leads one to speculate that there should be other factors that may explain this variation other than trade liberalization (or tariff cut) as proposed by Amiti and Cameron. The observations that many of the sectors/industries with above-average statistics are capital-intensive and consist of many parts and components industries more support for the importance of 'outsourcing'/'production-sharing' theory of Feenstra & Hanson (1996, 1997) in explaining the cross-sectional variation.

3.3. Comparisons of Globalized Plants and Others

As explained in subsection 3.1, export and import status and ownership have been changing during last decades. This subsection compares relative wages, skilled workers' share in total employment and wages between globalized plants and other. There is evidence that exporters employ a higher share of white-collar workers than non-exporting plants in developing countries (e.g., Harrison & Hanson 1999), which indicates that firms in developing countries are required to employ a relatively large number of skilled workers to meet a demand for higher quality from developed countries. Furthermore, a related study by Amiti & Davis (2011), which examined the effect of tariff reduction on wages in Indonesian manufacturing, suggests that the wage consequence of a tariff change depends on the mode of globalization of the firm at which a worker is employed.

Top two panels of Figure 3 make a comparison between non-exporting and exporting plants. One of the clear differences between them is that exporters pay higher relative wages for skilled workers compared to non-exporters, while the employment share of skilled worker is almost same. As a result, skill intensity, which is measured as the share of skilled workers in total wage, is higher for exporters than for non-exporters. The difference between globalized plants and others is more apparent when we compare non-importing and importing plants (middle panels) and local and foreign-owned plants (bottom panels). Importing or foreign-owned plants pay higher relative wages for skilled workers but the relative wages are decreasing over the period. In addition, importing or foreign-owned plants employ a relatively large number of skilled workers compared to not only non-importing or local plants but also exporters. These suggest that importing and/or foreign ownership is more important determinants of relative wage and employment at a plant-level. Another difference of importers and foreign-owned plants from other groups is that the employment share of skilled workers does not seem to increase over the period, while the corresponding shares for other groups are slightly increasing. As a result, the average wage share of skilled workers or skill intensity in foreign-owned plants (and importing plants) decreased relatively faster compared to others.

4. Effects of Tariff Reduction on Wage Skill Premium and Skill Intensity

4.1. Input and Output Tariffs and Other Variables

Indonesia's tariffs on imported manufacturing goods are taken from World Bank's World integrated Trade Solutions (WITS).[4] The dataset includes not only MFN applied rates but also effectively applied rates which take account for available preferential tariff rates. These rates can be classified at a 4-digit ISIC level, which are calculated as simple averages of corresponding tariffs at a 9 or 10-digit HS level. The tariffs at a 4-digit ISIC level are used as output tariffs in our analysis.[5]

To construct input tariffs, we basically follow the method used in Amiti & Konings (2007), in which input tariffs are calculated from output tariffs and cost shares of intermediate inputs. In our analysis, input tariffs on a good in industry *i* at a 4-digit ISIC level in year *t* are calculated as follows:

$$\text{input tariff}_{it} = \sum_{i} w_{ji} \times \text{output tariff}_{jt},$$

where w_{ji} is cost share of intermediate input from industry *j* in total intermediate inputs of industry *i*. The cost shares are calculated at an industry-level aggregating intermediate inputs of each plant in the manufacturing dataset in 2006.

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[4] In 2004, Indonesia adopted the ASEAN Harmonized Tariff Nomenclature (AHTN, 10 digit codes) for classifying imports and exports as part of its commitments under AFTA. Until then, the Harmonized Commodity Description and Coding System (HS, 9-digit codes) had been used.

[5] While Amiti & Konings (2007), Amiti & Davis (2011) and Amiti and Cameron (2012) used output tariffs at a 5-digit ISIC level (revision 2), we use output tariffs at a 4-digit ISIC level (revision 3) partially because tariffs at a 5-digit ISIC level are not available in the WITS and partially because a concordance between 9 or10-digit HS codes and 5-digit ISIC codes is not available.

Combining the tariff data, we examine a plant-level panel dataset which covers Indonesian manufacturing plants with 20 workers or more in 2000-2008. In the rich dataset, various kinds of variables are available. An advantage of the dataset is that it contains wage bills (R) as well as the number of workers (L) by type, non-production workers and production workers, which have been used as proxies for skilled and unskilled workers, respectively, in many previous studies. Therefore, we can used average wages (R/L) for non-production and production works as skilled wage and unskilled wage. It also contains plant's value added, physical capital, ownership and other variables which enable us to estimate relative wage equations and skilled worker share of total wage bill explained below.[6]

4.2. Wage Skill Premium Equation

To examine the effects of input and output tariff reduction on wage skill premium, Amiti & Cameron (2012) estimated a following relative wage equation (Eq.1) using data for 1990-2000:

$$\ln\left(\frac{w_s}{w_u}\right)_{f,i,t} = \alpha_f + \alpha_{l,t} + \beta_1 * \text{input tariffs}_{i,t} + \beta_2 * \text{input tariffs}_{i,t} * \text{impshare}_{f,i,t} + \beta_3 * \text{output tariffs}_{i,t} + \beta_4 * \text{output tariffs}_{i,t} * \text{expshare}_{f,i,t} + Z_{f,i,t}\Gamma + \varepsilon_{f,i,t},$$

where w_s and w_u are wage for skilled workers (non-production workers) and unskilled workers (production workers), respectively. The subscripts f, i, t and l denote firm (plant), industry, year and location, respectively. Therefore, α_f refers to firm-specific time-invariant effects, and $\alpha_{l,t}$ refers to location-year fixed effects. In addition to input

[6] Value added was deflated using wholesale price index at a two-digit level of ISIC, revision 3. Deflated physical capital was calculated as sum of building deflated by price index for building material, machinery deflated by price index for imported machinery, vehicle deflated by transport machinery, and others deflated by wholesale price index for manufacturing goods. The price indices were taken from BPS-Statistics, *Economic Indicators*.

and output tariffs, an interaction term between input tariffs and firm's share of imported material to output, as well as another interaction between output tariffs and firm's export share, are included on the right-hand side. The empirical results supported the hypothesis that reduction of input tariffs reduces wage skill premium for skilled workers and the effect is strongest for importers as indicated by the positively significant coefficients on both input tariffs and the interaction with the import share.

This paper re-estimated the model using more recent data for 2000-08. The results of estimation are shown in Table 3. In the first column, the relative wage of skilled workers is regressed on input and output tariffs.[7] The coefficient on input tariffs is significantly positive but the coefficient on output tariffs is not statistically significant. The magnitude of the former coefficient, 0.830 suggest that 10 percent input tariff reduction induces 8 percentage point reduction of wage skill premium. In column 2, the estimation included the interacting term between input tariff and import share as well as another interacting terms between (plant-level) export dummy variable and output tariffs. This is to follow the exercise done by Amiti and Cameron (2012).[8] The estimation only gives weakly significant estimate to the interaction between input tariff and import share, and the sign of this estimate is positive. This is a similar result with the one coming from Amiti and Cameron (2012), which suggest that reduction in input tariffs reduces relative wage in plants with relatively high import share of (intermediate) input. This is also consistent with an expectation of trade theory, which hypothesizes that relative wage of skilled workers decreases because production of skill-intensive inputs is replaced by imports within a firm in an unskilled-worker abundant economy. The result does not change after including dummy variable which takes one if the plant is foreign-owned (Column 3). However, when we include interaction terms of foreign ownership dummy with input tariffs and output tariffs (Column 4), the coefficients on input tariffs and the interaction of input tariffs and imported material share turns to be insignificant. Instead, the interaction of input

[7] Amiti & Cameron (2012) included the year-island effects (DKI Jakarta, Java, Sumatra, Kalimantan, Sulawesi, other islands). The main results does not change including the year-island effects instead of year dummies.

[8] Because of data constraint, we use export dummy instead of export shares.

tariffs and foreign ownership dummy is significantly positive. This result suggests that reduction of input tariffs reduces wage skill premium only in foreign-owned plants that has paid higher relative wages for skilled workers. The inclusion of other plant characteristic variables, plant size measured by total number of workers (ln L) and the employment share of skilled workers (S_{ls}), do not affect the result.

Table 3: Effects of tariff reduction on wage skill premium (dependent variable: ln (ws/wu))

	[1]	[2]	[3]	[4]	[5]	[6]
T^{input}	0.83	0.687	0.675	0.371	0.361	-0.087
	[0.343]**	[0.348]**	[0.348]*	[0.358]	[0.357]	[0.336]
$T^{input} \times S_{imp}$		2.942	3.003	1.303	1.502	2.42
		[1.625]*	[1.620]*	[1.669]	[1.671]	[1.580]
$T^{input} \times D_{fs}$				3.294	3.49	3.62
				[0.975]***	[0.974]***	[0.916]***
T^{output}	-0.035	-0.031	-0.031	0.004	0.004	-0.002
	[0.063]	[0.064]	[0.064]	[0.067]	[0.067]	[0.065]
$T^{output} \times D_{exp}$		-0.014	-0.013	-0.019	-0.018	0.035
		[0.117]	[0.117]	[0.116]	[0.117]	[0.111]
$T^{output} \times D_{fs}$				-0.307	-0.293	-0.1
				[0.227]	[0.227]	[0.212]
S_{imp}		-0.056	-0.059	0.032	0.013	-0.03
		[0.097]	[0.097]	[0.099]	[0.099]	[0.093]
D_{exp}		0.001	0	0	-0.004	-0.007
		[0.012]	[0.012]	[0.012]	[0.012]	[0.012]
D_{fs}			0.108	-0.038	-0.06	-0.083
			[0.056]*	[0.074]	[0.074]	[0.070]
In L					0.088	0.052
					[0.008]***	[0.008]***
S_{ls}						-1.906
						[0.033]***
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Plants	36,547	36,547	36,547	36,547	36,547	36,547
Observation	146,182	146,182	146,182	146,182	146,182	146,182
AR^2	0.007	0.007	0.007	0.007	0.01	0.103
F	68.169	49.683	46.612	41.473	45.692	222.145

Notes: "***", "**", "*" indicate statistically significant at 1 percent, 5 percent, or 10 percent level, respectively.

4.3. Skill Intensity

The results presented in previous subsection suggest that input tariff reduction reduces wage skill premium (especially in foreign-owned plants). This is consistent with the prediction of trade theory that the distributional changes in developing countries, which usually are endowed with unskilled workers, should favor unskilled workers more than the skilled ones. The mechanism underlying this prediction is that relative demand for skilled workers is decreased because domestic production of relatively skill-intensive intermediate inputs is replaced by imports and thus relative

demand for skilled workers decreases. However, as seen in previous section, relative demand for skilled workers tended to have slightly increased in the Indonesian manufacturing. To explore the mechanism, this subsection examines how plants respond to the tariff reductions in terms of skill intensity. The skill intensity has been used as a measure of skill upgrading (Bernard & Jensen, 1997) and the change in the variable incorporates the changes in relative wages and relative employment, as noted above.

The equation of skill worker share of total wages has been typically estimated in previous studies that examined firm-level datasets based on a theory of (trade-induced) skill-biased technological change (see Chennels & Van Reenen, 1999 for review). The equation is derived from a quasi-fixed translog cost function with two variable factors (skilled workers and unskilled workers) and two quasi-fixed factors (physical capital and technology). Given the restrictions that ensure that cost is homogeneous of degree one in prices and Shaphard's lemma, an equation of skilled workers share of total wage bill can be derived as follows:[9]

$$\left(\frac{R_s}{R}\right)_{f,i,t} = \alpha_s + \beta_s * \ln\left(\frac{w_s}{w_u}\right)_{f,i,t} + \beta_q \ln Q_{f,i,t} + \beta_k \ln K_{f,i,t} + \beta_\tau \ln \tau_{f,i,t},$$

where R_s is wage bill paid for skilled workers and R is total wage bill. Q, K and τ are value added, physical capital and technology, respectively. If that the cost share is independent of the levels of value added and the quasi-fixed factors (homotheticity of the structure of production: $\beta_q + \beta_k + \beta_\tau = 0$), a following estimated model with control variables Z is derived (Eq. 2):

$$\left(\frac{R_s}{R}\right)_{f,i,t} = \alpha_f + \alpha_t + \beta_s * \ln\left(\frac{w_s}{w_u}\right)_{f,i,t} + \beta_k \ln\left(\frac{K}{Q}\right)_{f,i,t} + \beta_\tau \ln\left(\frac{\tau}{Q}\right)_{f,i,t} + Z_{f,i,t}\Gamma + \varepsilon_{f,i,t},$$

[9] See Chennels & Van Reenen (1999) for the derivation in more detail.

A positive and significant coefficient β_τ indicates the skill biased technical change. The model that emphasizes the presence of traded intermediate inputs assumes that firms split apart their production process across countries (Feenstra, 2004, p. 100).

In our present analysis, input and output tariffs and the interactions introduced in the previous subsection are added to the equation 2. The estimation results are shown in Table 4. In these estimations, the relative wage variable on the right hand side is measured as an industry-average, assuming that plants are price takers. After accounting for the change in average relative wages at an industry-level, the result shown in column 1 suggests that the reduction of input tariffs increases skill intensity while the reduction of output tariffs does not affect significantly. The magnitude of the effect of input tariff reduction on skill intensity depends on the extent to which a plant imports intermediate material (Column 2 and 3). The positive coefficient on the interaction term of input tariffs and import share suggests that plants with lower import share increases skill intensity more responding to input tariff reduction, compared to plants with higher import share. The point estimate of coefficient on the input tariffs variable, -0.217 suggest that 10 percent input tariff reduction increases skill intensity by 2.17 percentage point for non-importing plants. On the other hand, the marginal effect of input tariff reduction calculated assuming the import share is 10 percent (average import share for importing local plants is about 20 percent) based on estimation results shown in Colum 3 was -0.103 and statistically insignificant. These results suggest that input tariff reduction have impacts on skill intensity for not-globalized plants.

Table 4: Skilled worker share of total wages, tariffs and industry/plant-specific factors.

Dependent variable	R_s/R (skilled worker share of total wages) .					
	[1]	[2]	[3]	[4]	[5]	[6]
$\ln(\overline{w_s/w_u})$	0.004	0.004	0.004	0.004	0.004	0.004
	[0.002]**	[0.002]**	[0.002]**	[0.002]**	[0.002]**	[0.002]**
T^{input}	-0.164	-0.216	-0.217	-0.281	-0.29	-0.29
	[0.082]**	[0.084]**	[0.084]***	[0.085]***	[0.085]***	[0.085]***
$T^{input} \times S_{imp}$		1.136	1.14	0.65	0.645	0.644
		[0.398]***	[0.397]***	[0.430]	[0.430]	[0.430]
$T^{input} \times D_{fs}$				0.834	0.834	0.834
				[0.266]***	[0.266]***	[0.266]***
T^{output}	-0.011	-0.012	-0.012	-0.011	-0.011	-0.011
	[0.017]	[0.018]	[0.018]	[0.018]	[0.018]	[0.018]
$T^{output} \times D_{exp}$		0.009	0.009	0.004	0.004	0.004
		[0.024]	[0.024]	[0.024]	[0.024]	[0.024]
$T^{output} \times D_{fs}$				0.01	0.012	0.012
				[0.080]	[0.080]	[0.080]
S_{imp}		-0.051	-0.051	-0.024	-0.024	-0.024
		[0.025]**	[0.025]**	[0.026]	[0.026]	[0.026]
D_{exp}		-0.002	-0.002	-0.002	-0.002	-0.002
		[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
D_{fs}			0.014	-0.031	-0.032	-0.032
			[0.014]	[0.017]*	[0.017]*	[0.017]*
In (K/Q)	0.003	0.003	0.003	0.003	0.003	0.003
	[0.001]***	[0.001]***	[0.001]***	[0.001]***	[0.001]***	[0.001]***
$S_{foreign\ capital}$					0.005	0.005
					[0.003]	[0.003]
$R_{machinery/total\ capital}$						0.001
						[0.004]
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Plants	25,667	25,667	25,667	25,667	25,667	25,667
Observation	95,828	95,828	95,828	95,828	95,828	95,828
AR^2	0.002	0.002	0.003	0.003	0.003	0.003
F	8.171	7.055	6.694	6.738	6.555	6.248

Notes: "***", "**", "*" indicate statistically significant at 1 percent, 5 percent, or 10 percent level, respectively. Column 6 presents the estimation result of between-effects model.

Column 4-6 additionally includes interactions of input and output tariffs with foreign ownership dummy, and share of capital stock in foreign-owned plants at a 4-digit industry-level ($S_{foreign\ capital}$) and plant-level ratio of machinery to total capital

stock ($R_{machinery/total\ capital}$) as variable that capture technological changes. The coefficient on the interaction of input tariffs with the ownership dummy is significantly positive while the interaction with import share turns to be insignificant. The marginal effect of input tariffs evaluated for local plants was -0.255, while corresponding effect for foreign owned plants was evaluated as 0.578. These indicates that 10 percent input tariff reduction increases skill intensity for local firms by 2.5 percentage point and decreases for foreign-owned plants by 5.78 percentage point.

The estimation results in previous subsection suggest that the relative wages for skilled workers vary among plants. Table 5 shows the estimation results of equation 2 which includes the relative wages at a plant-level instead of an industry-average as in Table 4. The results of fixed-effect model (Columns 1 and 2) suggest similar results with Table 4, indicating that input tariff reduction increases skill intensity in local plants and decreases in foreign-owned plants. However, these estimates may suffer from endogeneity problem because the relative wage at a plant-level is apparently an endogenous variable in the skill-intensity equation. Columns 3 and 4 show the results of regression using GMM technique developed by Arellano & Bond (1991). In this estimation, the relative wage and K/Q were assumed to be endogenous and their 1^{st} differences were instrumented by the level of 3-year lags in the differenced equation. Even after accounting for the endogeneity, main results of previous estimation do not change.

To examine the impact of input tariff reduction on skill intensity in local plants, equation 2 was estimated excluding foreign-owned plants from estimation sample (Column 5). The estimation result was similar with Column 3 in Table 4.

Table 5: Skilled Worker Share of Total Wages, Tariffs and Industry/plant-Specific Factors.

Dependent variable	R_s/R (skilled worker share of total wages) .					
	[1]	[2]	[3]	[4]	[5]	[6]
R_s/R_{-1}						0.746
						[0.123]***
ln (w_s/w_u)	0.084	0.084	0.071	0.072	0.069	-0.016
	[0.001]***	[0.001]***	[0.009]***	[0.008]***	[0.008]***	[0.015]
T^{input}	-0.237	-0.307	-0.253	-0.303	-0.284	-0.146
	[0.078]***	[0.080]***	[0.084]***	[0.080]***	[0.081]***	[0.090]
$T^{input} \times S_{imp}$		0.463		0.507	0.898	0.91
		[0.374]		[0.380]	[0.514]*	[0.481]*
$T^{input} \times D_{fs}$		0.463		0.49		0.027
		[0.240]*		[0.246]**		[0.268]
T^{output}	-0.011	-0.016	0.003	-0.016	-0.02	0.006
	[0.015]	[0.015]	[0.018]	[0.016]	[0.015]	[0.018]
$T^{output} \times D_{exp}$		0.014		0.012	0.02	0.001
		[0.021]		[0.021]	[0.022]	[0.032]
$T^{output} \times D_{fs}$		0.057		0.043		-0.04
		[0.066]		[0.068]		[0.077]
S_{imp}		-0.018		-0.024	-0.047	-0.059
		[0.023]		[0.024]	[0.032]	[0.030]*
D_{exp}		-0.002		-0.002	-0.002	-0.001
		[0.002]		[0.002]	[0.003]	[0.003]
D_{fs}	0	-0.03	-0.007	-0.029		-0.007
	[0.013]	[0.016]*	[0.014]	[0.016]*		[0.020]
In (K/Q)	0.002	0.002	0.003	0.006	0.004	0.006
	[0.000]***	[0.000]***	[0.005]	[0.004]	[0.004]	[0.004]
$S_{foreign\ capital}$	0.005	0.006	0.005	0.006	0.005	0.006
	[0.003]**	[0.003]**	[0.003]	[0.003]**	[0.003]*	[0.003]*
$R_{machinery/total}$	-0.001	-0.001	0.299	-0.003	0	-0.009
	[0.003]	[0.003]	[0.181]*	[0.004]	[0.004]	[0.005]*
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Plants	25,667	25,667	25,667	25,667	23,480	19,542.00
Observation	95,828	95,828	95,828	95,828	87,124	67,897.00
AR^2			0	0	0	0
AR1			0	0	0	0
AR2			0	0	0	0
Hansen			0.376	0.597	0.703	0
Instruments			31	32	29	36

Notes: "***", "**", "*" indicate statistically significant at 1 percent, 5 percent, or 10 percent level, respectively.

5. Concluding Remarks

This paper addresses the topic of globalization and skill premium (i.e. the gap in wage and the extent of skilled workers hired by a firm) using the plant-level data of Indonesia manufacturing. It asks the question of how the greater trade and investment openness, as a result of trade and investment liberalization in the 1990s and early 2000s, affect the skill premium and intensity within firms, the mechanisms at work, and which theories can explain the relationship between the liberalizations and skill premium.

The descriptive analysis shows a declining pattern in the relative wages while there is a slightly increasing trend in relative employment. As a result, there is rather declining trend in the share of skilled workers in wages. In addition, the analysis suggests that the trend in relative wage and demand for skilled workers are different between foreign-owned plants and plants with higher importing share on one hand and other plants on the other hand. The relative wages for skilled workers in foreign-owned plants, which were much higher than other plants, have been declined faster than that for other plants. Furthermore, the patterns of relative demand for skilled workers in foreign-owned and importing plants are more or less flat while other plants increased slightly relative demand for skilled workers.

The econometric results point to several key points. First, they confirmed the earlier study by Amiti & Cameron (2012) that finds the impact of tariff cut on relative wage between skilled and unskilled workers. This is consistent with trade theory which suggests that trade liberalization decreases relative demand for skilled labor in a less-skilled worker abundant economy because domestic production of relatively skill-intensive intermediate inputs is replaced by imports. Second, the results, at the same time, also show that the input tariff cut leads to lower skill intensity (i.e., lower share of skill workers in total wages bill) in foreign-owned plants or plants with higher share of imported material to output. This is also consistent with the trade theory. Third, the results also suggests that the input tariff cut leads to higher skill intensity in local plants or non-importing plants or plants with lower share of imported material to output. One of the possible interpretations of this result is that local plants or not-importing plants responded to the increasing competitive pressure from foreign-owned or importing plants, which could improve efficiency by importing intermediate inputs,

by increasing employing a relatively large number of skilled workers. The decrease in the relative wages for skilled workers enabled the plants to respond so.

All in all, this study (temporarily) concludes that globalization indeed create a pressure to narrow the gap in the wage difference between skilled and unskilled workers and the difference in wage skill premium among plants in Indonesian manufacturing.

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Appendix

Table A1. Relative wage of skilled workers to unskilled workers

		1990-93	1994-96	1997-99	2000-02	2003-05	2006-08
15	Food products and beverages	2.22	1.96	2.06	1.89	1.81	1.76
16	Tobacco	3.36	3.06	3.74	2.78	2.71	2.30
17	Textiles	2.47	2.18	2.23	1.99	1.97	1.77
18	Wearing apparel	2.36	2.23	2.16	1.86	1.77	1.69
19	Tanning and dressing of leather	2.80	2.44	2.39	2.12	2.00	1.74
20	Wood and products of wood	2.20	2.07	2.19	2.05	1.96	2.06
21	Paper and paper products	2.67	2.35	2.52	2.07	1.88	1.91
22	Publishing and printing	1.98	1.90	1.84	1.65	1.57	1.53
23	Coal/refined petroleum products	1.98	1.62	1.97	2.26	1.58	1.79
24	Chemicals and chemi. products	2.57	2.25	2.48	2.17	2.05	2.01
25	Rubber and plastics products	2.44	2.12	2.25	1.94	1.90	1.92
26	Non-metallic mineral products	2.16	1.91	2.03	1.95	2.05	1.91
27	Basic metals	2.69	2.30	2.68	2.47	2.31	2.08
28	Fabricated metal products	2.56	2.31	2.51	2.03	1.95	1.95
29	Machinery and equipment	2.06	1.89	2.06	1.97	2.08	2.02
30	Office/computing machinery	2.47	3.62	3.55	2.79	3.24	1.92
31	Electrical machinery	2.71	2.44	2.80	2.42	2.46	2.20
32	Radio/television/communication	3.08	2.85	3.10	2.82	2.66	2.47
33	Precision/optical instruments	2.30	2.50	2.46	1.95	2.03	1.92
34	Motor vehicles and trailers	2.25	2.24	2.73	2.34	2.34	2.24
35	Other transport equipment	1.98	1.85	2.00	1.92	1.70	1.72
36	Furniture	2.70	2.17	2.29	1.92	1.84	1.86
	Total manufacturing	2.39	2.13	2.26	1.99	1.93	1.86

Table A2.Share of skilled workers in total employment (percent)

		1990-93	1994-96	1997-99	2000-02	2003-05	2006-08
15	Food products and beverages	19.6	21.3	20.6	19.7	20.0	21.6
16	Tobacco	8.7	10.3	9.2	10.0	12.0	11.3
17	Textiles	12.4	13.1	13.6	14.1	13.8	14.0
18	Wearing apparel	10.7	11.5	11.4	11.5	12.1	12.6
19	Tanning and dressing of leather	12.0	12.8	13.4	14.5	15.5	14.9
20	Wood and products of wood	16.4	16.8	15.1	15.4	15.4	16.0
21	Paper and paper products	18.3	19.6	19.7	19.7	20.5	20.7
22	Publishing and printing	22.3	22.9	23.5	24.1	23.9	25.3
23	Coal/refined petroleum products	29.3	34.4	28.7	28.0	28.8	29.7
24	Chemicals and chemi. products	29.6	30.7	29.1	29.4	31.2	33.3
25	Rubber and plastics products	18.3	19.3	18.5	18.3	17.8	18.9
26	Non-metallic mineral products	13.9	16.3	17.1	16.0	15.6	16.1
27	Basic metals	24.0	24.6	23.7	22.6	23.5	23.7
28	Fabricated metal products	17.6	17.5	18.6	19.1	19.2	20.3
29	Machinery and equipment	18.3	18.6	21.3	22.4	23.0	23.0
30	Office/computing machinery	22.8	16.7	26.2	41.4	21.6	17.1
31	Electrical machinery	21.0	21.0	22.8	23.1	21.4	21.8
32	Radio/television/communication	17.3	15.7	18.3	17.7	15.1	16.2
33	Precision/optical instruments	18.9	16.7	18.5	24.0	20.3	19.3
34	Motor vehicles and trailers	20.6	20.8	21.7	21.6	20.8	20.0
35	Other transport equipment	18.6	18.6	19.8	19.4	19.9	20.3
36	Furniture	12.6	13.9	13.4	13.7	14.5	15.6
	Total manufacturing	16.9	17.9	17.8	17.6	17.9	18.7

Table A3. Share of skilled workers in total wage (percent)

		1990-93	1994-96	1997-99	2000-02	2003-05	2006-08
15	Food products and beverages	28.2	27.9	27.3	25.0	24.9	26.0
16	Tobacco	18.6	19.5	18.8	16.3	18.3	16.4
17	Textiles	21.6	20.7	21.2	20.4	19.9	18.8
18	Wearing apparel	18.7	18.4	17.6	16.0	16.1	16.1
19	Tanning and dressing of leather	23.4	21.4	21.5	21.5	21.9	19.8
20	Wood and products of wood	24.5	24.0	22.5	22.0	21.1	22.7
21	Paper and paper products	30.9	30.5	30.7	28.1	27.8	28.7
22	Publishing and printing	30.9	30.6	30.0	29.3	29.0	29.8
23	Coal/refined petroleum products	38.5	40.2	35.3	35.9	33.3	34.6
24	Chemicals and chemi. products	42.6	41.0	40.4	38.8	39.9	41.9
25	Rubber and plastics products	28.6	27.5	27.2	25.0	24.3	25.7
26	Non-metallic mineral products	21.0	21.3	23.1	21.3	20.7	21.1
27	Basic metals	37.1	35.4	36.5	33.8	32.7	32.9
28	Fabricated metal products	29.3	27.2	28.9	27.0	26.6	27.8
29	Machinery and equipment	26.5	25.6	29.0	30.0	31.0	31.3
30	Office/computing machinery	32.1	28.3	37.6	45.5	41.3	21.5
31	Electrical machinery	34.9	33.0	34.8	32.8	31.2	30.9
32	Radio/television/communication	31.0	26.9	31.1	28.8	25.1	25.7
33	Precision/optical instruments	30.5	26.3	27.9	31.2	27.6	26.2
34	Motor vehicles and trailers	30.6	30.9	33.4	31.5	30.9	29.7
35	Other transport equipment	25.6	24.4	26.7	25.9	25.4	25.2
36	Furniture	22.8	21.2	20.7	19.2	19.9	21.2
	Total manufacturing	26.2	25.6	25.6	23.9	23.8	24.3

CHAPTER 4

Impact of Trade Liberalization on Wage Skill Premium in Philippine Manufacturing

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The paper aims to examine how trade liberalization affect wage premium at the firm level. Using effective protection rate as trade proxy, the paper assumes that in the face of increasing competition, an import-substituting firm may decide to remain at the low value added stage of the production process which requires relatively less skilled workers and suggests a decline in the wage premium. On the other hand, a firm may move away from the product whose protection rate has fallen and shift and expand toward a higher value added activity. This would require relatively more skilled workers suggesting an increase in the wage premium. The main findings of the paper show that: First, trade liberalization lowers the wage premium. A firm responds to import competition by shifting to the manufacture of products with lower value added and importing intermediate inputs rather than producing these within the plant. Second, using ASEAN tariff rates as trade proxy, the same results are obtained, however, when ASEAN tariff is interacted with skill intensity, the results show that tariff reduction on skill intensive products is associated with rising wage skill premium. Third, firm characteristics such as skill intensity, firm size, and capital labor ratio matter in assessing the impact of trade reform on the wage premium. Lastly, exports are associated with increasing wage premium at the firm level the higher their skill intensity. In the literature, greater openness is associated with skill biased technological change with export-oriented and technology intensive activities as channels.

Keywords: wage skill premium, trade liberalization, Philippine manufacturing, labor market

JEL Classification: F16

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1. Introduction

Since the 1980s, the Philippines has made considerable progress in opening-up the manufacturing industry by removing tariff and non-tariff barriers. Despite the market-oriented reforms, the growth of the manufacturing industry has been slow. Average manufacturing growth was 0.9 percent in the 1980s, 2.5 percent in the 1990s, and 3.5 percent in the early 20s. Average manufacturing share to total industrial output remained unchanged during the same periods; it accounted for 28 percent of total output in the 1970s, 26 percent in the 1980s, and 24 percent in the 1990s. In terms of employment generation, the manufacturing industry failed in creating enough employment to absorb new entrants to the labor force as its share to total employment dropped from 11.3 percent in the mid-1970s to 9.7 percent in the 2001-2003 period. The industry's total factor productivity growth was negative from 1996 to 2006.

Trade liberalization and integration into the global economy offers opportunities for creating output and employment. Trade liberalization leads to a reallocation of factors of production (labor and capital) within and between firms and sectors. This is the source of the efficiency improvements that underpin the gains from trade. According to the Hecksher-Ohlin model, countries will export goods that use intensively those factors that are relatively abundant at home and import goods that use intensively those factors that are relatively scarce. Trade will increase the demand for the abundant factors, assuming that exports will expand, and will reduce the demand for scarce factors as import-competing sectors contract. In developing countries where unskilled labor is abundant and skilled labor is scarce, trade will increase unskilled labor wages and lower skilled wages, thus, narrowing wage inequality.

In the real word, many of the simplifying assumptions of the model do not hold. Countries do not use exactly the same technology, and transportation costs and non-tariff barriers are present. Many industries operate under conditions of imperfect competition and non-constant returns to scale. The empirical literature indicates that in general, trade liberalization leads to relatively large increases in skill premiums due to the increased demand for skilled workers (Hoekman & Winters 2005 and Goldberg

& Pavcnik 2004). In Mexico, Cragg & Epelbaum (1996) reported a skill premium increase of about 68% between 1987 and 1993. In Columbia; Attanasio, *et al.* (2004) found a 20% increase between 1990 and 1998. Studies indicated that the demand for skilled workers particularly in developing countries may have increased due to the increase in returns to particular occupations that are associated with a higher educational level; shift of skill intensive intermediate goods production from developed to developing countries; skill-biased technological change (SBTC): and compositional changes and quality upgrading of firms and products produced by developing countries.

Despite substantial trade liberalization in the last two decades, the growth of manufacturing has been sluggish and services has become the main driver of growth and employment in the country. Wage premiums declined in industry as education intensity increased suggesting an oversupply of skilled labor relative to the sector's skill needs (World Bank, 2010). With trade liberalization as a major economic reform carried out in the country, it is important to ask whether it has contributed to the decline in the wage skill premium. Using firm level data, the paper aims to analyze the impact of trade liberalization on wage skill premium in the Philippine manufacturing industry. Trade indicators such as output tariffs, input tariffs, and effective protection rates are used in the analysis.

The paper is divided into five parts, after the introduction, section two will provide a brief review of the trade and employment literature. Section three will discuss the trade and employment policies affecting the manufacturing industry along with a review of its performance and contribution to employment. Section four will present the empirical framework and analysis of major findings. Section five will summarize the results and policy implications of the paper.

2. Review of the Trade and Employment Literature Review

2.1. Overview of the Trade and Employment Literature: Rising Skill Premium and Wage Inequality between Skilled and Unskilled Workers

The trade and employment literature focuses on the channels emphasized by the workhorse model of trade, the Hecksher-Ohlin (H-O) model and the Stolper-Samuelson model. A simple version of the model with 2 countries, 2 goods and 2 factors of production predicts that countries should specialize in the production and export of goods that use more intensively their relatively abundant factor and import those goods that use intensively those factors that are relatively scarce. The Stolper-Samuelson model suggests that trade liberalization will increase the demand for and returns to the abundant factor in each of the two countries. If the two factors are skilled and unskilled labor, trade reform in the unskilled abundant country should lead to a decrease in wage inequality between skilled and unskilled labor as the demand for unskilled workers rises. The opposite happens in the skilled labor abundant country.

The Heckscher-Ohlin model suggests that trade liberalization would lead to a redistribution of employment away from import-substituting sectors towards export-oriented sectors under the assumptions of homogeneous firms and products and inter-industry specialization and trade. In many developing countries, however, empirical work has consistently documented a lack of major labor reallocation across sectors despite substantial trade liberalization episodes in these countries from the 1980s to the 1990s (Goldberg & Pavcnik, 2004).

New studies using micro-level data provide evidence of substantial output reallocation following trade reforms from less productive towards more productive firms within an industry leading to an increase in aggregate productivity. Faced with increased import competition, less efficient firms in the industry are forced to downsize, improve efficiency or exit while efficient firms expand their market shares. Overall total factor productivity increases more in industries that liberalized more (Hoekman & Winters, 2005).

It is important to note that 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. As Melitz (2002) points out, 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.

One of the robust stylized facts on the trade and employment literature is the **significant increase in skill premium and wage inequality between skilled and unskilled workers (**Hoekman & Winters 2005 and Goldberg & Pavcnik 2004). While the Hecksher-Ohlin model would predict that trade liberalization could induce a decline in skill premium and wage inequality; empirical studies show relatively large increases in skill premiums over a short period of time. The increase in skill premium is driven by increased demand for skilled workers. Studies indicate that the demand for skilled workers particularly in developing countries may have increased due to the following:

2.1.1. Increase in returns to particular occupations that are associated with a higher educational level

In the case of pre NAFTA Mexico, Cragg & Epelbaum (1996) find strong support for this hypothesis especially in the occupational premia of professionals and administrators. The authors attributed the increase to the rapid changes introduce in the economy by reforms that increased the demand for individuals who could implement these reforms. Although in Columbia, Attanasio, *et al.* (2004) found that occupational returns remained relatively stable during the period 1986-1998. Although there is a spike in the returns to managers and other professionals in 1992, a year after a dramatic trade and labor reform, this was short-lived and cannot explain the increase in skill premium in the late 1980s and 1990s.

2.1.2. Shift of skill intensive intermediate goods production from developed to developing countries

It is important to point out that trade takes place not only in final goods but also in intermediate goods. As Feenstra & Hanson (1996, 2003) indicated, the increase in global production sharing or outsourcing can partly account for the increased demand for skilled labor in both developed and developing countries. The production of final goods requires the use of intermediate inputs that differ in their skill intensities. Trade

and investment liberalization shift the production of some of these intermediate goods from developed to developing countries. While these products would be characterized as unskilled labor intensive from a developed country's perspective, they appear as skilled labor intensive from the point of view of developing countries. Hence, the average skill intensity increases in both the developed and developing countries, inducing an increase in the skill premium in both places.

2.1.3. Skill-biased technological change (SBTC)

Most of the existing evidence favors the SBTC view as responsible for the rising skill premium. Based on studies using different methodologies (inspired by the H-O model); Lawrence and Slaughter (1993), Sachs & Shatz (1994), Robbins (1996), Desjonqueres, *et al.* (1999) and others find that trade has little explanatory effect on changes in labor demand and relative wages across industries. Freeman & Katz (1991), Katz & Murphy (1992), Revenga (1992), Bernard & Jensen (1995) and Berman, *et al.* (1994) conclude that SBTC explains a large part of the changes in employment and relative wages based on the finding of a strong positive association between R&D expenditures and a rise in the relative return to skilled labor.

Note however, that although the evidence is in favor of SBTC, this does not necessarily imply that trade policy did not indirectly contribute to changes in the wage distribution especially if technological change was itself an endogenous response to more openness (Goldberg & Pavcnik, 2004). Recent theoretical papers have explored channels through which trade openness may have induced or at least contributed to SBTC. Wood's (1995) defensive innovation hypothesis states that intensified competition from abroad may induce firms to engage in R&D or take advantage of existing new technologies that they may have had little incentive to adopt prior to liberalization. The same argument was put forward by Thoenig & Verdier (2003). Acemoglu (2003) develops an endogenous technological change model and argues that in the case of developing countries this technological change may take the form of increased imports of machines, office equipment, and other capital goods that are complementary to skilled labor.

Trade liberalization affects the demand for skilled labor by reducing the prices of the relevant capital goods and hence increasing their imports. In the model developed by Aghion, *et al.* (2003), firms' response to trade liberalization depends on how close

they are to the technology frontier. Firms that are sufficiently close can survive or deter entry of competitors by innovating while those that are far from the frontier may not be able to fight external entry. The authors also emphasize the role of domestic institutions, labor market restrictions in particular, and their interactions with technology adoption for the impact of trade policy on wage inequality. Another explanation focuses on the increased exports from developing countries following trade reforms. Empirical evidence from the US suggests that exporting is a skill-intensive activity (Bernard & Jensen, 1997) and to the extent that this is true for developing countries, an increase in exports will increase the relative demand for skilled labor. In Mexico, Harrison & Hanson (1999) finds a positive association between a firm's exporting status and the relative employment of white collar workers during a period of trade liberalization. Based on regressions relating the change in the share of skilled workers by sector to the change in tariff protection during the 1984-1998 period; Attanasio, *et al.*(2004) show that the increase in demand for skilled workers was largest in those sectors that experienced the largest tariff cuts (textiles and apparel). This provides some support for the theory that SBTC was itself an endogenous response to trade liberalization.

2.1.4. Compositional changes and quality upgrading of firms and products produced by developing countries

One puzzling finding in studies on trade liberalization studies in developing countries is the lack of labor reallocation across sectors which is the complete opposite of trade and productivity studies that are based on micro-level data. These studies find major resource reallocation across firms after trade liberalization with resources moving from less productive to more productive firms within the same industry which leads to increases in aggregate industry productivity. Recent work focus on compositional change in response to trade reform that may induce reallocation of both capital and labor towards "higher quality" firms. Trade openness induces a quality upgrading of firms where quality can mean either firm productivity or product quality. This higher quality firms employ a higher proportion of skilled workers so that aggregate demand for skilled workers increases relative to unskilled workers. In response to trade reforms, firms in import-competing sectors try to avoid competition

from cheaper countries by differentiating themselves. Trade can also shift resources from non-exporters to exporters and there is sufficient evidence that exporters tend to be more productive than non-exporters.

Using Indonesian manufacturing data and assuming firm heterogeneity, trade in final and intermediate goods as well as firm-specific wages; Amiti & Davis (2011) shows that the impact of a tariff change on wages depends on the globalization mode of the firm at which a worker is employed. A decline in output tariffs reduces wages of workers that sell only in the domestic market, but increases wages of workers at firms that export. Meanwhile, a decline in input tariffs increases the wages of workers at firms using imported inputs, but reduces the wages of workers at firms that do not import inputs.

In another paper, Amiti & Cameron (2011) analyzed the wage skill premium impact of tariff reduction on intermediate and final goods within firms in Indonesia. The analysis relied on firm-level census data on manufacturing covering firms employing 20 or more workers during the period 1991-2000. Their findings show a strong link between input tariffs and wage skill premium; their results indicate that tariff reduction on inputs reduces the wage skill premium within firms. However, in terms of tariff reduction on final goods, no similar significant impact on the wage skill premium was observed within firms.

2.2. Philippine Trade and Employment Studies

In the Philippines, similar studies that examine the relationship between trade and employment are still relatively few. Lanzona (2001) tested the Samuelson-Stolper theory and the findings showed that liberalization led to an increase in the incomes of all resource owners, although the increase in returns to unskilled labor had been lower than the other factors. Lanzona also found moderate increases in wage inequality. In another paper, Orbeta (2002) indicated that increases in the propensity to export shifts the demand for labor upward and increases in export propensity increase the proportion of low-skilled production workers.

Meanwhile, Hasan & Chen (2003) showed that wage inequality in the manufacturing sector declined over the period 1988-1997 despite large reductions in tariff rates in less skill intensive manufacturing industries and tariff reductions had an

insignificant impact on both employment and average hours of work among full-time workers across industries. Their results also showed that tariff reductions were associated with declines in industry wage premiums in capital-intensive industries and these declines seemed to be largest for skilled workers.

Hasan & Jandoc (2010) found little evidence that trade liberalization had an important role to play in increasing wage inequality in the Philippines. The authors concluded that there is little evidence that trade liberalization had an important role to play in increasing wage inequality in the Philippines. The bulk of the trade-induced increases in inequality are due to employment reallocation effects of trade as employment shifted to more protected sectors. Based on the decomposition of changes in the entire wage distribution from 1994 to 2000, they showed that the trade-induced effects on industry wage premia, industry-specific skill premia, and employment reallocation accounted for slightly less than 17% of the total increase (in the Gini coefficient).

3. Trade and Employment Policies and Performance of the Manufacturing Industry

3.1. Trade Policy Reforms

After more than three decades of protectionism and import substitution from the 1950s up to the 1970s, the government started to liberalize the trade regime by removing tariff and non-tariff barriers in the 1980s. In 1982, the country's first tariff reform program (TRP 1) substantially reduced the average nominal tariff and the high rate of effective protection that characterized our industrial structure. TRP I also reduced the number of regulated products with the removal of import restrictions on 1,332 product lines between 1986 and 1989.

In 1991, the second phase of the tariff reform program (TRP II) further narrowed down the tariff range with the majority of tariff lines falling within the three to 30 percent tariff range. It also allowed the tariffication of quantitative restrictions for 153 agricultural products and tariff realignment for 48 commodities. As such, the number

of regulated products declined to about three percent in 1996 and by 1998, most quantitative restrictions were removed except those for rice.

In 1995, the government initiated the third round of tariff reform (TRP III) as a first major step in its plan to adopt a uniform five percent tariff by 2005. This further narrowed down the tariff range for industrial products to within three and ten percent range. In June 1999, Executive Order 63 was issued to increase the tariff rates on textiles, garments, petrochemicals, pulp and paper, and pocket lighters and at the same time, froze tariff rates at their 2000 levels.

In 2001, another legislation (TRP IV) was passed to adjust the tariff structure towards a uniform tariff rate of 5 percent by the year 2004. However, this was not implemented, instead, in October and December 2003, the government issued Executive Orders 241 and 264 which modified the tariff structure to protect selected industries. These Executive Orders restructured tariffs such that the rates on products that were not locally produced were made as low as possible while the tariff rates on products that were locally produced were adjusted upward. Since 2004, no major unilateral tariff changes have been made; mostly the tariff reductions carried out were those covered by the ASEAN Free Trade Area-Common Effective Preferential Tariff (AFTA-CEPT) scheme.

4. Tariff and Protection Structure

Table 1 presents the tariff rates from 1996 to 2004 for the country's major economic sectors. Note that since 2004, no major most favored nation (MFN) tariff changes have been implemented. The tariff changes pursued were mainly those arising from the ASEAN Free Trade Agreement.

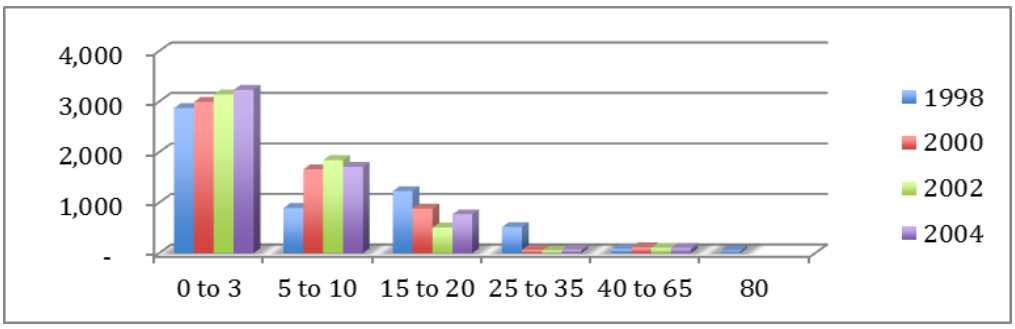
Table 1: MFN Tariff Structure

	Implementation of Major Tariff Policy Changes							
Major Sectors	1996	1998	1999	2000	2001	2002	2003	2004
All Industries	25,5	11,32	10,25	8,47	8,28	6,45	6,6	6,82
CV	1,02	0,96	0,91	0,99	1,04	1,17	1,06	1,07
Agriculture	29	15,9	13,2	11,5	12,3	10,4	10,4	11,3
CV	0,81	1,07	1,14	1,3	1,23	1,31	1,22	1,17
Fishing & forestry	22	9,4	8,9	6,7	6,7	5,8	5,7	6
	0,95	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
CV		0,42	0,41	0,24	0,23	0,38	0,4	0,48
Manufacturing	28	11,38	10,35	8,5	8,28	6,39	6,57	6,76
CV	0,97	0,93	0,88	0,95	1	1,13	1,03	1,03

Note: CV coefficient of variation (ratio of SD to mean).
Source: Aldaba (2005)

It is evident from the data that the country's overall level of tariff rates are already low. As of 2004, the average tariff rate for all industries is 6.82 percent. Manufacturing rates are almost the same as the total industry average with an average tariff rate of 6.76 percent. In terms of frequency distribution, Figure 1 shows that in 2004, more than 50% of the total number 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 5 to 10% tariff range fell but those in the 15 to 20% range increased.

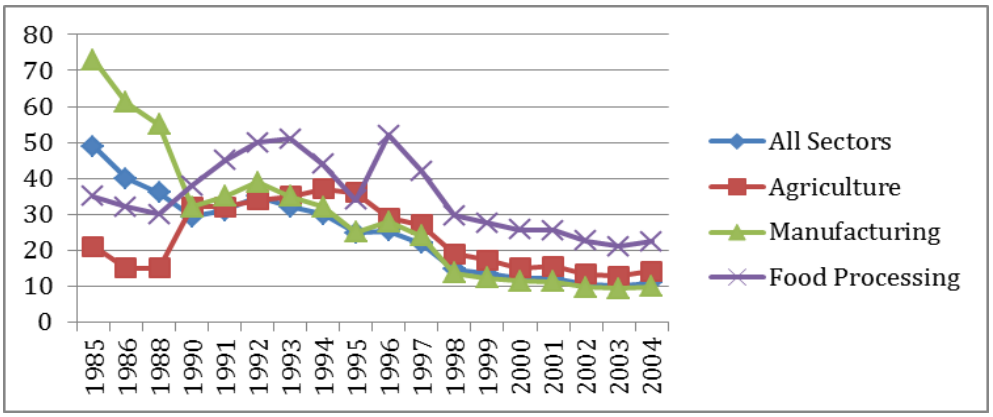
Figure 1: Frequency Distribution of Tariff Rates



Source: Aldaba (2005).

Compared to tariff rates, effective protection rates (EPRs)[1] 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%, to 15% in 1998 and to 10.9% in 2004. For manufacturing, EPR fell from 73% in 1985 to 55% in 1988 and to 28% in 1996. This further declined to 11.4% in 2000 to about 10% in 2004.

Figure 2: Effective Protection Rates (1985-2004)



Source: Medalla, E (1990), Tan, E. (1995), Manasan, R. & V. Pineda (1999), and Aldaba (2005)

5. Overall Economic Performance

Table 2 presents the average growth rates of the economy from the 1970s to the 2000s. While the industry sector was the best performer in terms of average annual growth rate in the 1970s, the services sector has become the most important sector in the succeeding decades. Both agriculture and industry, manufacturing in particular,

[1] 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. EPRs measure the net protection received by domestic producers from the protection of their outputs and the penalty from the protection of their inputs. However, as Francois & Reinert (1997) cited, EPRs are partial equilibrium rather than equilibrium measure. It assumes that there is no change in technology in shifting between actual and world prices. It assumes that there is perfect substitutability between domestic and foreign goods, whereas most modern trade models assume imperfect substitutability or the so-called "Armington assumption".

experienced sluggish growth in the 1980s and 1990s; modest gains were registered in the current period. In contrast, the average growth rate of the services sector increased particularly in the last two decades as its average growth rate went up from 3.6% in the 1990s to 5.8% in the 2000s.

Table 2: Average Growth Rates by Sector (in %, at constant 1985 prices)

Year	1971-80	1981-90	1991-00	2001-10
Gross Domestic Product	5,7	1,7	3	4,7
1. Agriculture, Fishery, Forestry	3,9	1,1	1,8	3
2. Industry Sector	7,6	0,3	3	4,2
Manufacturing	5,9	0,9	2,5	4,1
3. Service Sector	5,2	3,3	3,6	5,8

Source of basic data: National Accounts of the Philippines, National Statistical Coordination Board

*: figure refers to combined finance and trade sectors

Table 3 shows that the average share of manufacturing value added increased from 28% in the 1970s, this declined to 26% in the 1980s, to around 24 percent in the 1990s and 23.7% in the 2000s. It is also evident from the table that the Philippine economy's output structure is characterized by a large services sector. The services sector's share continued to increase from an average of 37 percent during the 1970s to 40.4 percent in the 1980s, 42.4 percent in the 1990s and to 48 percent in the most recent period.

Table 3: Value Added Structure by Major Economic Sector

Year	1971-80	1981-90	1991-00	2001-10
Agriculture, Fishery,Forestry	25,6	23,9	20,8	18,9
Industry Sector	38,3	38	34,1	33,1
Manufacturing	28,2	26,3	24,3	23,7
Service Sector	36,6	40,4	42,4	48

Source of basic data: National Accounts of the Philippines, National Statistical Coordination Board

*: figure refers to combined finance and trade sectors

6. Productivity

Table 4 shows total factor productivity (TFP)[2] growth figures for manufacturing which 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%. On the whole, the manufacturing sector's aggregate productivity declined by 3.4% from 1996 to 2006.

Table 4: TFP Growth from 1996 to 2006

Sector	TFP	Sector	TFP
Food, beverages, & tobacco	-1,44	Non-metallic products	-0,65
Textile	2,35	Basic metal & fabricated metal products	1,32
Garments	-0,99	Machinery & equipment, motor vehicles & other transport	-0,86
Leather	9,54	Furniture	1,86
Wood, paper, & publishing	-5,39	Other manufacturing	2,87
Coke, petroleum, chemicals & rubber	-4,76	All Manufacturing	-3,37

Source: Aldaba (2010)

Herrin & Pernia (2003) attributed the deterioration in the country's productivity to the failure of firms to invest in state-of-the-art technology and implement best practice, the lack of investments in human capital, and the relatively quick expansion of employment in low productivity services sector.

[2] Total factor productivity was estimated using the methodology of Levinsohn and Petrin (2001).

7. Employment

In terms of employment contribution, the manufacturing sector has failed in creating enough employment to absorb new entrants to the labor force as well as those who move out of the agricultural sector. As Table 5 shows, its share dropped from 11 percent in the mid-1970s to 9 percent in the 2000-2009 period. The services sector has become the largest provider of employment in the most recent period.

Table 5: Structure of Employment (in percent)

Major Sector	1975-78	1980-89	1990-99	2000-09
Agriculture, Fishery and Forestry	52,83	49,6	43,16	36,58
Industry	15,23	14,49	15,98	15,2
Manufacturing	11,29	9,93	10,01	9,24
Services	31,87	35,9	40,94	48,21

Source: Yearbook of Labor Statistics (1980-2000) and Current Labor Statistics (2001-2002), Bureau of Labor and Employment Statistics, Department of Labor and Employment and Employed Persons by Major Industry Group, National Statistics Office Labor Force Survey (1970, 1975-1976, 1977-1978, 2003-2009).

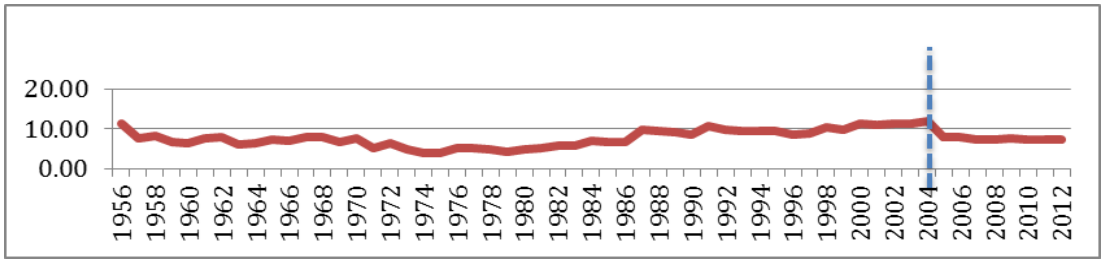
Table 6 and Figure 3 presents the average unemployment and underemployment rates from the 1970s to present. Unemployment increased steadily from an average of 4.9% in the 1970s to 7% in the 1980s, 9.8% in the 1990s and 11% during the early 2000s. Underemployment rate was high and was more than double the unemployment rate up to the 1990s. It declined from 26% in the 1980s to 21% in the 1990s and to 17% in the early 2000s. Note that due to the change in the definition of unemployment in 2005, there has been a big drop in the unemployment rate and an increase in the underemployment rate for the period 2005-2010.

Table 6: Labor Market Indicators

Year	Unemployment Rate	Underemployment Rate	GDP growth rate
1971-75	4,86	21	4,8
1981-90	7,43	25,74	5,7
1991-00	9,75	21,39	1,7
2001-04	11,43	17,2	3
2005-10	7,57	20,14	4,7
2011	7,2	18,8	3,7
2012	7,4	19,4	6,6

Source: Yearbook of Labor Statistics. BLES-DOLE. The rates for 2011 & 2012 are from Labor Force Survey of NSO. Notes: (1) Starting April 2005, unemployed persons include all persons 15 years old & over & are reported as (i) without work & currently available for work & seeking work & (ii) without work & currently available for work but not seeking for work due to the following reasons: tired/believed no work available; awaiting results of previous job application; bad weather; & waiting for rehire/job recall. (2) Prior to 1976, working age population covered 10 years old and over, and from 1976 onwards, 15 years and above.

Figure 3: Philippine Unemployment Rate



Note: Starting April 2005, NSO changed the definition of unemployment (see above).
Source: Yearbook of Labor Statistics. BLES-DOLE. The rates for 2011 & 2012 are from Labor Force Survey of NSO.

8. Wage Premium Trends

Table 7 presents the relative wages of skilled to unskilled workers using the Occupational Wages Survey of the Bureau of Labor Statistics. The Survey covers average monthly wage rates of time-rate workers on full-time basis employed in non-agricultural establishments employing 20 or more workers. These are based on basic pay referring to pay for normal/regular working time before deductions for employees contributions and withholding taxes and excluding overtime, night shift differential and other premium pay. Skilled workers include production supervisors, general foremen, engineers, quality inspectors, accounting and bookeeping clerks, production

clerks and related workers. Unskilled refers to other workers excluding janitors, messengers, and freight. On the average, the data show a general downward trend between 2004 and 2010 except for certain sectors such as wood, wood products ex. furniture; rubber and plastic products; and motor vehicles, trailers, and semi-trailers.

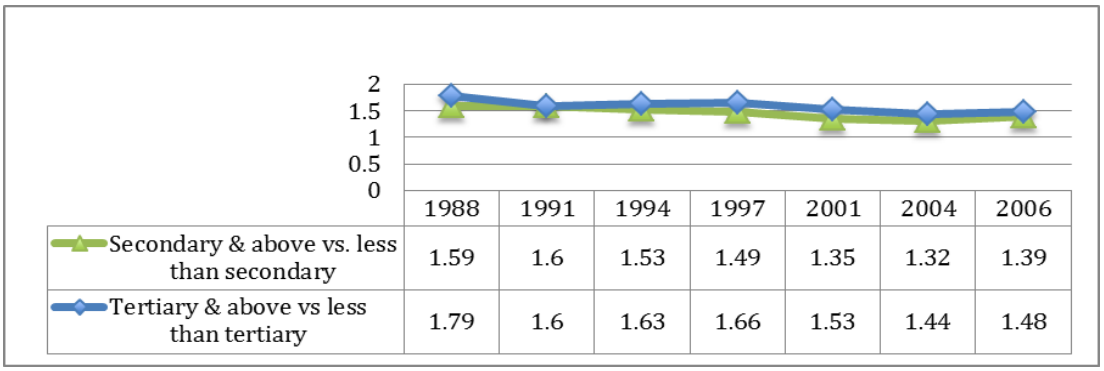
Table 7: Relative Wages of Skilled and Unskilled Workers

Sector	2004	2006	2008	2010
Food Products and Beverages	1,69	1,55	1,37	1,61
Manufacture of Textiles	1,33	1,23	1,22	1,17
Manufacture of Wearing Apparel	1,36	1,25	1,06	1,19
Tanning and Dressing of Leather; Luggage, Handbags and Footwear	1,2	1,16	1,14	1,14
Wood, Wood Products except Furniture	1,28	1,29	1,25	1,34
Paper and Paper Products	1,76	1,48	1,5	1,31
Publishing and Printing	1,51	1,36	1,27	1,36
Coke, Refined Petroleum and Other Fuel		3,14	1,71	2,2
Chemicals and Chemical Products	2,08	1,73	1,88	1,97
Rubber Products	1,37	1,74	1,44	1,74
Plastic Products	1,27	1,25	1,28	1,46
Other Non-Metallic Mineral Products	1,93	1,58	2,06	1,79
Basic Metals	1,37	1,23	1,29	1,26
Fabricated Metal Products, except Machinery and Equipment	1,21	1,36	1,25	1,1
Machinery and Equipment, n.e.c.	1,47	1,15	1,56	1,29
Electrical Machinery and Apparatus, n.e.c.	1,7	1,64	1,8	1,29
Radio, Television and Communication Equipment and Apparatus	1,55	1,31	1,52	1,35
Motor Vehicles, Trailers and Semi-Trailers	1,88	1,37	1,6	1,92
Building and Repairing of Ships and Boats	1,98	1,46	1,18	1,31
Manufacture and Repair of Furniture	1,25	1,3	1,23	1,19
Average	1,54	1,48	1,43	1,45

Source: Bureau of Labor Statistics Occupational Labor Survey.

In the manufacturing industry, the share of the workforce with higher education increased dramatically between 1988 and 2006. The share with some secondary education and above went up from 0.5951 in 1988 to 0.6901 in 1994 to 0.745 in 2001. This further increased to 0.7548 in 2004 and to 0.7779 in 2006. In the light of increasing skill shares, wage premium for the employed with secondary and above vs. those with less than secondary declined from 1.59 in 1988 to 1.39 in 2006. Wage premiums for the employed with tertiary and above vs. less than tertiary also dropped from 1.79 in 1988 to 1.48 in 2006 (see Figure 4). Figure 5 shows the declining trend in wage premiums in the various manufacturing sub-sectors.

Figure 4: Skill Wage Premium in Manufacturing



	1988	1991	1994	1997	2001	2004	2006
Secondary & above vs. less than secondary	1.59	1.6	1.53	1.49	1.35	1.32	1.39
Tertiary & above vs less than tertiary	1.79	1.6	1.63	1.66	1.53	1.44	1.48

Source of basic data: Skills wage premiums are calculated as ratio of hourly pay of each skill group relative to comparator skill group. World Bank 2010. Philippine Skills Report.

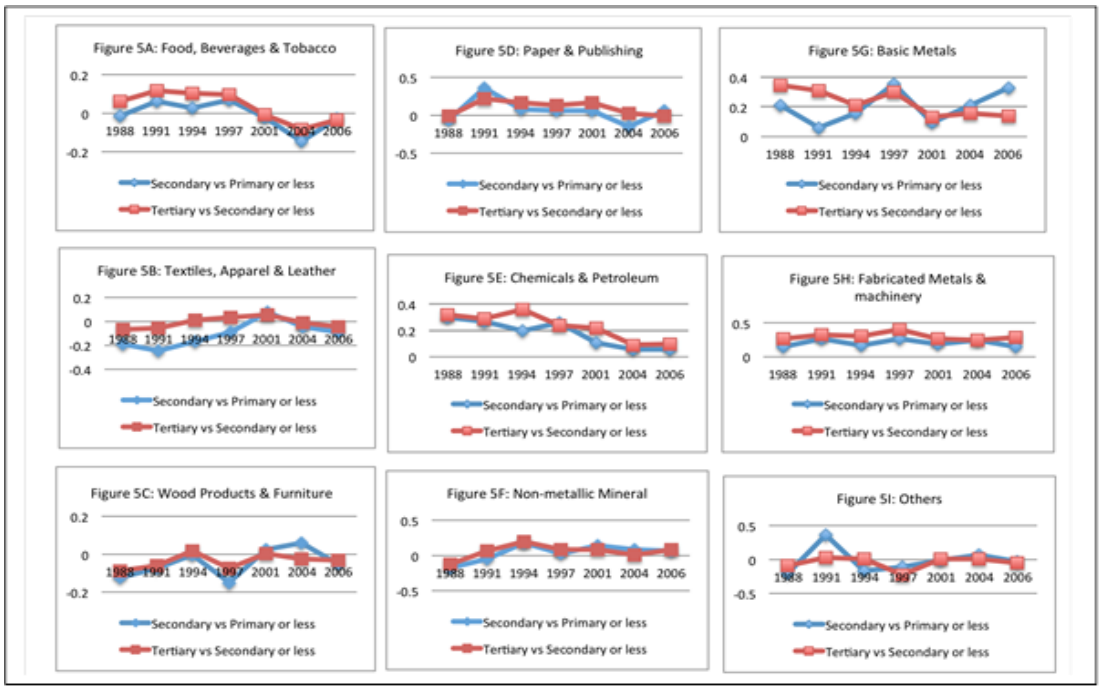
9. Labor Market Policies

Labor regulations in the Philippines are characterized by minimum wages and stringent protection laws especially on workers dismissal. Since the 1950s, wage boards (consisting of members appointed by the President) have governed the determination of wages in the country. Prior to 1989, minimum wages were set at the national level. Thereafter, these have been set at the regional level through the issuance in 1989 of Republic Act (RA) 6727 or the Wage Rationalization Act. This shifted wage setting from a national to a regional system of wage determination and assigned the function of minimum wage setting to the Regional Tripartite Wages and

Productivity Boards (RTWPBs) to take into account the differences in living standards and economic development across regions. It aimed to rationalize minimum wages, promote productivity as well as to reduce labor market rigidities in response to liberalization and other market-oriented reforms being carried out in the country.

The Labor Code requires employers to justify termination for authorized causes such as redundancy, installation of labor-saving devices, and other similar measures. The Labor Code also mandates employers to regularize probationary employees after their 6th month of service. Regularized employees have the right to full benefits and security of tenure, and can only be removed under just or authorized causes. Other workers may be terminated after their contracts have expired. However, due to their complexities, many of the regulations are not effectively implemented as indicated by the low compliance and enforcement rates. Less than 25 percent of workers comprising mostly formal wage and salaried workers are *de facto* covered and protected by labor regulations. The informal sector and informal workers in the formal sector are largely left out and are not protected from job and income losses (World Bank PDR 2012).

Figure 5: Wage Premium in Manufacturing Sub-sectors[3]



Source: World Bank ,2010. Philippine Skills Report.

10. Methodology and Analysis of Results

10.1. Estimation Methodology

To examine the impact of trade on the wage skill premium, the framework draws from the Amiti & Cameron (2011) study. The following reduced form equation will be estimated:

$$WS_{it} = \beta_0 X_{it} + \beta_1 Trade_{jt} + \beta_2 Industry + \beta_3 Time + \mu_{it}$$

where *i* indexes firms, *j* industry, and *t* year. The μ_{it} are error terms. The dependent variable, *WS*, is the log of the wage skill premium for firm *i* at time *t*. It is measured by the ratio of the average wage of skilled or nonproduction workers to the average wage of unskilled or production workers. The explanatory variables include trade

[3] Estimates are based on log hourly wage regressions controlling for individual attributes, 16 regions, 34 industries & 5 occupations. Industry premiums are deviations from employment-weighted average industry wage premium (World Bank 2010. Philippine Skills Report).

policy proxies and a vector of firm-level controls denoted by *X* such as export share, capital intensity, number of workers (to control for size) and skill share (to control for skill intensity). *Industry and time dummies* are also included in the analysis. *TRADE* is the trade policy variable proxied by the effective protection rate (EPR) in sector *j*.

Effective protection rates (EPR) or rates of protection of value added are more meaningful than actual tariff rates since it is value added rather than the value of the product that is contributed by the domestic activity being protected. EPRs measure the net protection received by domestic producers from the protection of their outputs and the penalty from the protection of their inputs. The EPR formula is given by

$EPR = (V-V^*)/ V^*$

where V is the domestic value added per unit of the final good (including the tariffs on that good and on its inputs) and V^* is the value added under free trade. Value added per unit is defined as the gross value of output minus the cost of inputs used in production. Domestic value added is given by

$V = (1+ t_j) - \sum a_{ij} * (1+t_i)$

free trade value added is the same, except that in this case tariffs do not exist (the value of t is zero)

$V^* = 1- \sum a_{ij}$

where

a_{ij}: technical coefficient derived from the 1994 and 2000 input-output table indicating the amount of input from sector i needed to produce a unit of output j

tj : tariff on output from sector j

ti : tariff on input from sector i.

EPR increases (decreases) under the following conditions: (i) the larger (smaller) the tariff on the output; (ii) the smaller (larger) the tariffs on the inputs and; (iii) the lower (higher) the world value added. With tariff reduction on both inputs and output, competition from foreign goods increases. As tariffs on both the inputs that the firm uses and the output that it produces are reduced, the level of effective protection rate declines; the decline can be offset depending on the size of the world value added of the firm's activity. The lower the world value added, the higher the EPR. Faced with some small positive protection, an import-substituting firm may decide to remain at the low value added stage of the production process and given the reduction on tariffs on its inputs, the firm would import these intermediate inputs rather than manufacture these within the plant. The low value added activity in which the firm is engaged in

would require relatively less skilled workers. This suggests a decline in the wage premium within the firm and a positive coefficient on EPR.

On the other hand, the firm may decide to move away from the domestic market and production of import substitutes whose protection rate has fallen and shift and expand towards a higher value added stage of the production process and export. This would require relatively more skilled workers suggesting an increase in the wage premium within the firm. Thus, a negative coefficient on EPR is expected.

The other trade policy variables used are MFN and ASEAN tariff rates. Following Amiti & Cameron (2011) input and output tariffs are calculated separately. MFN and ASEAN tariff rates are average tariffs at the two-digit level classification code. Tariff rates were linked to the manufacturing data by converting HS and AHTN Codes into their corresponding two-digit industry codes. MFN output rates are obtained from the Philippine Tariff Commission while the ASEAN rates are from the ASEAN Secretariat database. MFN input tariff rates are weighted averages based on the technical coefficients obtained from the Input-Output table of the Philippines.

The firm-level characteristics are measured as follows:

KL is capital intensity measured as the ratio of the book value of assets to total workers.

SKILL INTENSITY is the ratio of wages of nonproduction workers to total wages

EXPORT is the ratio of exports to total revenue.

LNWORKERS is the log of number of workers

11. Data

In linking trade liberalization and wage inequality, the paper will use the firm level panel data created in the first ERIA Micro Data Project. The panel dataset was based on the Annual Survey of Establishments and Census of Establishments conducted by the National Statistics Office (NSO)[4]. The dataset consists of firm level information

[4] The National Statistics Office provided assistance in building the panel dataset.

on sales revenues, export, employment, compensation, physical capital, and production costs including the cost of domestic outsourcing.

The firm-level panel dataset covers four years: 1996, 1997, 1998, and 2000. The year 2000 is a census years while the remaining six years are survey years. The panel dataset is unbalanced and covers all firms with two or more overlapping years during the period 1996-2000. Firms with missing, zero or negative values for any of the variables listed above as well as firms with duplicates were dropped. These are mostly firms with less than 10 workers.

The dataset has export information for the years 1996, 1998, and 2000. For the years 1996 to 2000, compensation by type of workers is also available. This enables us to differentiate between wages and salaries received by skilled and unskilled workers. Skilled workers are defined as managers and other office and administrative workers while unskilled workers refer to production and other workers. Domestic outsourcing is measured by the cost of industrial services done by other firms. This is defined as contract or commission work done by others on materials owned and controlled by the firm. The summary statistics are presented in Table 8.

Table 8: Summary Statistics

Variable	N	Mean	Std. Dev.
EPR	9481	0,1936065	0,2444629
MFN output tariff	9481	0,1694335	0,0986249
ASEAN tariff	9427	0,1109581	0,0592453
MFN input tariff	9481	0,1396643	0,0969018
KL	9481	176307	978528,5
Export share	9475	0,1860599	0,3687404
Skillint	8943	0,1868895	0,1370246
Ratio Skilled-unskilled workers	8041	0,661974	1,419953
Ratio Skilled-unskilled wages	7541	1,049153	2,137425
Employment	9481	283,4903	613,065
Lnworkers	9481	4,732057	1,323537
LnWS	7535	0,5081771	0,5467905

Between 1996 and 2000, the overall declining trend in effective protection along with MFN and ASEAN tariff rates is evident in Table 9. The table shows rising capital intensity during the same years. LnWS (log of the wage skill premium measured by

the ratio of the average wage of skilled or nonproduction workers to the average wage of unskilled or production workers) also increased between 1996 and 2000. Increases in export ratio are also observed.

Table 9: Mean Values for 1996, 1997, 1998 and 2000

Variable	1996	1997	1998	2000
EPR	0,208446	0,18964	0,217849	0,153088
MFN output tariff	0,214108	0,187993	0,150031	0,110985
ASEAN tariff	0,138768	0,121553	0,103311	0,071621
MFN input tariff	0,179051	0,154957	0,120401	0,091885
KL	145506,2	139726,2	192869,8	243333,3
LNWS	0,485142	0,487143	0,517172	0,550841
Export	0,214526	ND	0,280447	0,282356

12. Results

In analyzing the impact of trade liberalization on wage inequality; firm heterogeneity and output and input tariffs are taken into account. The model to be tested is given by the following:

$$LNWS_{it} = \beta_0 TRADE_{jt} + \beta_1 EXPORT_{ijt} + \beta_2 Skillint_{ijt} + \beta_3 TRADE_{jt} * Skillint_{ijt} + \beta_4 EXPORT_{jt} * Skillint_{ijt} + \beta_5 LNWorkers_{ijt} + \beta_6 KL_{ijt} + \mu_{it}$$

where *i* indexes firms, *j* industry, and *t* year. *LNWS*, is the log of the wage skill premium for firm *i* at time *t.* It is measured by the ratio of the average wage of skilled or nonproduction workers to the average wage of unskilled or production workers. *TRADE* is a trade policy proxy measured by MFN input and output tariffs, ASEAN rates, and effective protection rates. *EXPORT* is export share, *KL* is capital intensity, *LNWorkers* is a control for size measured by the number of workers and *Skillint* is a control for skill intensity measured by skill share. The trade variables (MFN Output tariff, ASEAN tariff, and EPR) as well as Exports are interacted with Skill intensity.

12.1. Trade liberalization and skill intensity

Two estimation techniques are used, fixed effects (FE) and random effects (RE) methods. Table 10A presents the results using MFN tariffs as trade variables. Table 10B summarizes the results using ASEAN tariff rates as trade proxy variable while Table 10C presents the results with EPR as trade variable.

Using MFN tariffs as trade policy variable, Table 10A shows that based on FE estimates (1A and 1B), firm characteristics like skill intensity, size (Ln workers), and capital intensity (KL) are highly significant and positively correlated with the wage skill premium. Based on the FE results, the coefficients on MFN output and MFN input tariffs are not statistically significant. The coefficient on export share is positive but not statistically significant.

Table 10A: MFN Tariffs

lndiff	FE (1A)	FE (1B)	RE (2A)	RE (2B)
Output tariff	-0,182	0,04	0.25***	0.308***
	-0,18	-0,2	-0,096	(0.106)
Input tariff	0,017	0,039	-0.57***	-0.459***
	-0,19	-0,19	-0,108	(0.129)
Export share	0,025	0,012	0.095***	0.08***
	-0,017	-0,02	(0.01)	(0.016)
Skill intensity	2.190***	2.212***	1.79***	1.86***
	-0,137	-0,137	(0.076)	(0.077)
Ln workers	0.140***	0.143***	.0777***	.074***
	-0,03	-0,03	(.007)	(0.007)
KL	1.44e-08***	1.36e-08***	-2.67e-09	-2,19E-09
	-3,65E-09	-3,58E-09	(7.55e-09)	-6,69E-09
Year	N	Y	N	Y
Industry	N	Y	N	Y
Obs	7530	7530	7530	7530
R2	0,165	0,17	0,15	0,156

Note: *significant at 10%, **significant at 5%, ***significant at 1%. Robust standard errors in parentheses.

Compared with the FE model where the trade and export regressors were not significant, the RE results show that these variables have highly significant effects on the wage premium. Capital intensity which is highly significant in the FE model is insignificant in the RE model. As might be expected from the different results

generated by the RE technique, the Hausman test's null hypothesis that the RE estimator is consistent is soundly rejected.

Using ASEAN tariff as trade variable, Table 10B shows the same general results as those obtained using MFN tariffs as trade variable. The coefficients on ASEAN output tariff and input are not statistically significant. The coefficient on export share while positive is not significant. Firm characteristics such as skill intensity, size, and capital intensity are strongly significant and are positively associated with wage skill premium. The RE results generated are different from the FE results. Based on the Hausman test, the RE estimator is rejected.

Table 10B: ASEAN Tariffs

lndiff	FE (1A)	FE (1B)	RE (2A)	RE (2B)
ASEAN Output tariff	-0,002 -0,002	0,001 -0,002	-0,002 -0,002	0.003** (0.002)
Input tariff	-0,06 -0,154	0,048 -0,17	-0.06 (0.154)	- 0.335*** .117131
Export share	0,024 -0,017	0,013 -0,02	0.024 (0.017)	0.084*** (0.016)
Skill intensity	2.188*** -0,137	2.207*** -0,137	2.188*** (0.137)	1.85*** (0.077)
Ln workers	0.140*** -0,03	0.143*** -0,03	0.14*** (0.03)	.073*** (0.007)
KL	1.45e-08*** -3,65E-09	1.37e-08*** -3,60E-09	1,45E-08 -3,65E-09	-2.24e-09 (6.67e-09)
Year	N	Y	N	Y
Industry	N	Y	N	Y
Obs	7493	7493	7493	7493
R2	0,16	0,17	0,15	0,156

Note: *significant at 10%, **significant at 5%, ***significant at 1%. Robust standard errors in parentheses.

Table 10C presents the results using the effective protection rate on the firm's output as trade policy variable. EPR nets out the effect of protection by taking into account tariffs on both intermediate inputs and final output. The FE results show that trade liberalization is associated with lower wage skill premium as indicated by the positive and significant coefficient on EPR (in both models 1A and 1B). The coefficient on Export share is positive but not significant. The coefficients on skill

intensity, Ln workers, and KL are positive and highly significant. The RE technique produces different results and based on the Hausman test, the RE estimator is rejected.

Table 10C: EPR

lndiff	FE (1A)	FE (1B)	RE (2A)	RE (2B)
EPR	0.041**	0.052***	0.027*	0.048***
	-0,017	-0,02	-0,015	(0.017)
Export share	0,024	0,011	0.102*** (0.01)	0.0817***
	-0,017	-0,02		(0.016)
Skill intensity	2.189***	2.210***	1.79*** (0.077)	1.854***
	-0,137	-0,137		(0.077)
Ln workers	0.139***	0.14***	0.077***	0.073***
	-0,03	-0,03	(0.007)	(0.007)
KL	1.47e-08***	1.36e-08***	-2,29E-09	-2.43e-09
	-3,68E-09	-3,58E-09	-7,35E-09	(6.65e-09)
Year	N	Y	N	Y
Industry	N	Y	N	Y
Obs	7530	7530	7530	7530
R2	0,165	0,174	0,16	0,16

Note: *significant at 10%, **significant at 5%, ***significant at 1%. Robust standard errors in parentheses.

12.2. Interacting skill intensity with trade and export variables

Interaction terms are added to the model by interacting skill intensity with trade variables and exports. The results are presented in Tables 11A (using MFN tariffs as trade variable), 11B (ASEAN tariffs), and 11C(EPR). The FE results show that the coefficient on Export share interacted with skill intensity is positive and significant. The coefficient on the interaction between output tariff and skill intensity is positive while the coefficient on input tariff and skill intensity is negative but both are not statistically significant. Skill intensity, capital intensity and size remain highly significant. The RE estimator is rejected by the Hausman test.

Table 11A: MFN Tariff Rates

lndiff	FE (1A)	FE (1B)	RE (2A)	RE (2B)
Output tariff	-0,246 -0,3	-0,032 -0,3	-0.018 (0.178)	0.034 (0.185)
Input tariff	0,213 -0,3	0,238 -0,3	-0.244 (0.181)	-0.114 (0.19)
Export share	-0,014 -0,027	-0,028 -0,029	0.009 (.022)	0.002 (0.02)
Skill intensity	2.228*** -0,2	2.236*** -0,2	1.68*** (0.137)	1.77*** (.136)
Output tariff*Skill intensity	0,39 -1,56	0,477 -1,55	1.572 (0.97)	1.55 (0.967)
Input tariff*Skill intensity	-1,161 -1,4	-1,187 -1,4	-1.865** (0.876)	-1.97** (0.869)
Export*Skill intensity	0.25* -0,145	0.266* -0,145	0.54*** (0.12)	.514*** (0.12)
Ln workers	0.141*** -0,03	0.143*** -0,029	.080*** (.007)	0.075*** (0.007)
KL	1.44e-08*** -3,64E-09	1.36e-08*** -3,57E-09	-2,81E-09 -7,90E-09	-2.39e-09 (7.03e-09)
Year	N	Y	N	Y
Industry	N	Y	N	Y
Obs	7530	7530	7530	7530
R2	0,166	0,17	0,15	0,157

Note: *significant at 10%, **significant at 5%, ***significant at 1%. Robust standard errors in parentheses.

Table 11B summarizes the results based on ASEAN tariff rates as trade policy variable. It is important to note that in Model 2B (which includes year and industry dummy variables), the coefficient on the ASEAN tariff rate is positive and significant at 5% level. When this is interacted with skill intensity, the coefficient turns negative and highly significant indicating that tariff reduction on skill intensive products is associated with rising wage skill premium. The coefficient on the interaction term Export*Skill intensity is positive and significant at 5% level. The coefficients remain positive and highly significant for skill intensity, size and capital intensity. The RE estimator is rejected by the Hausman test.

Table 11B: ASEAN Tariff Rates

lndiff	FE (1A)	FE (1B)	RE (2A)	RE (2B)
Output tariff	0,003 -0,003	0.01** -0,004	0.003 (0.002)	0.004 (0.003)
Input tariff	-0,032 -0,23	0,077 -0,242	-0.337** (0.147)	-0.162 (0.164)
Export share	-0,016 -0,027	-0,027 -0,029	0.008 (0.02)	0.002 (0.02)
Skill intensity	2.446*** -0,2	2.455*** -0,22	1.81*** (0.149)	1.892*** (0.147)
Output tariff*Skill intensity	-0.03* -0,017	-0.029*** -0,017	-0.004 (0.013)	-0.002 (0.013)
Input tariff*Skill intensity	-0,086 -1,07	-0,082 -1,058	-0.776 (0.730)	-0.955 (0.72)
Export*Skill intensity	0.269* -0,14	0.277** -0,14	0.551*** (0.12)	.517*** (0.12)
Ln workers	0.140*** -0,03	0.143*** -0,03	0.079*** (0.007)	0.075*** (0.007)
KL	1.39e-08*** -3,59E-09	1.31e-08** -3,53E-09	-3.34e-09 (7.97e-09)	-2.85e-09 (7.07e-09)
Year	N	Y	N	Y
Industry	N	Y	N	Y
Obs	7493	7493	7493	7493
R2	0,19	0,175	0,15	0,157

Note: *significant at 10%, **significant at 5%, ***significant at 1%. Robust standard errors in parentheses.

Table 11C indicates that with EPR as trade policy variable, the results show a positive and significant coefficient (at 5% level based on Model 1B results which include year and sector dummies). This implies that a reduction in protection is associated with a decline in the wage premium of firms that produce using low value added process requiring relatively less skilled workers. Interacting Export with Skill intensity shows a positive and significant coefficient at the 5% level. This indicates that an increase in the export of skill intensive products is associated with a rising wage premium of firms that respond to the reduction in protection by reallocating its resources towards high value added production processes that require relatively more skilled workers.

Table 11C: EPR

lndiff	FE (1A)	FE (1B)	RE (2A)	RE (2B)
EPR	0.096*	0.117**	0,038	0.075**
	-0,06	-0,06	-0,0383	-0,039
Export share	-0,018	-0,033	0,009	-0,006
	-0,027	-0,029	-0,022	-0,02
Skill intensity	2.177***	2.2***	1.673***	1.76***
	-0,147	-0,146	(.088)	-0,09
EPR*Skill intensity	-0,255	-0,297	-0,048	-0.128
	-0,2	-0,216	-0,16	(0.159)
Export*Skill intensity	0.272*	0.284**	0.58***	0.55***
	-0,145	-0,145	-0,12	(0.119)
Ln workers	0.14***	0.144***	0.078***	0.075***
	-0,03	-0,03	(0.007)	(0.007)
KL	1.48e-08***	1.37e-08***	-2.42e-09	-2,61E-09
	-3,64E-09	-3,54E-09	(7.69e-09)	-6,99E-09
Year	N	Y	N	Y
Industry	N	Y	N	Y
Obs	7530	7530	7530	7530
R2	0,167	0,175	0,155	0,161

Note: *significant at 10%, **significant at 5%, ***significant at 1%. Robust standard errors in parentheses.

The above tends to show that the relationship between trade liberalization and wage skill premium seems to be driven by the firm's response to foreign competition arising from the decline in protection. A firms can continue to produce import-substitutes for the domestic market and move toward low value added processes that require relatively less skilled labor or they can engage in high value added stage of the production process for the export market that would require relatively more skilled workers.

The regression results show a positive and significant coefficient on EPR which implies that due to foreign competition, firms shifted to the manufacture of low value added products for the domestic market that requires relatively less skilled workers and where foreign competition is less intense. On the other hand, interacting Export share with Skill intensity yields a positive and statistically significant coefficient indicating that the export of relatively more skill intensive products is associated with higher wage premium. In the literature, greater openness is associated with skill biased

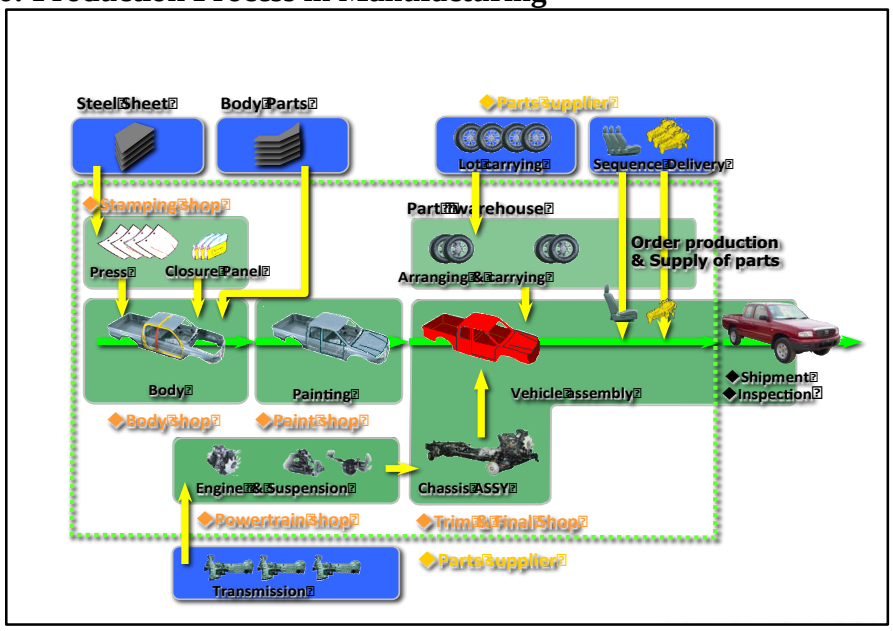
technological change with export-oriented and technology intensive activities as channels.

It is also important to note that the ASEAN tariff results tend to show the same with the significant positive coefficient on the ASEAN tariff. This implies that a reduction in ASEAN tariff rate is associated with a lower wage premium. However, when ASEAN tariff is interacted with skill intensity, the coefficient turns negative indicating that tariff reduction on skill intensive products is associated with rising wage skill premium. The impact of trade liberalization on the wage premium is affected by the stage where the firm is in the value chain process.

As output tariffs are reduced, competition in import-competing industries intensifies but at the same time, tariffs on intermediate inputs in the production of the final products that firms manufacture also fall. As firms import skill intensive inputs and expand their less-skill intensive production process, the relative demand for skilled workers falls leading to a reduction in the wage skill premium.

For instance, firms engaged in the assembly process do not produce intermediate parts or products within the plant as these are mostly imported from abroad. In the case of high-tech vehicle manufacturing, the production process would cover multiple activities such as stamping shop, powertrain shop, trim and final shop, body shop, paint shop, assembly, and shipment and inspection (see Figure 6).

Figure 6: Production Process in Manufacturing



Source: Auto Alliance Thailand.

In the Philippines, vehicle manufacturing is basically assembly with only welding, painting, trimming, and inspection being carried out within the assembly plants. CKD (completely knocked down) packs are imported with a few small parts sourced domestically. The linkage between the automotive assembly sector and local parts and components has remained weak with the domestic parts sector accounting for only 10 to 15 percent of the total number of parts and components required by local motor vehicle assemblers. Box 1 illustrates the experience of a typical company which used to enjoy substantial protection from imports.

Box 1: Liberalization and the Need to Upgrade

This auto parts firm is a manufacturer of brake discs and owns a foundry shop (the only one in the Philippines accredited by Japan). It has CNC machines and automatic second-hand equipment. From the 1980s till the mid 1990s, it was manufacturing brake discs for Mitsubishi, Toyota, and Honda. After liberalization, the three companies started to pull out. Toyota wanted a 20% reduction in its price, which it could not meet given its volume of operations. It tried export, but a buyer from France wanted a 15% reduction in its price for 1.5 million pieces annually. A buyer from Japan wanted it to fulfill major requirements such as upgrading of its existing equipment. Its grinding and finishing operations were not acceptable. To reduce its cost, the firm has downsized its labor force and outsourced its machining process. Toyota wanted the firm top do only the finishing of brake discs which would be imported from its affiliate in Thailand. Mitsubishi asked it to do the finishing of its bearing retainers.

In the case of Indonesia, Amiti & Cameron (2011) differentiated the impact of input and output tariffs on the wage premium. They pointed out that the mechanism affecting the wage skill premium differs for reducing tariff on inputs from reducing tariff on outputs. Interacting input tariffs with imports of intermediate goods, their results show that a reduction in input tariffs reduces the wage skill premium within firms that import their intermediate inputs. However, changes in output tariffs have no significant effect on the wage skill premium within firms. They noted that this evidence is contrary to the current emerging view in the literature that trade liberalization increase the wage skill premium. They argued that Indonesia has a very high share of unskilled labor and is a very low skill economy rather than a middle income country. With its comparative advantage is in low-skill labor intensive activities, unskilled labor is likely to benefit relatively more than skilled labor following trade liberalization.

13. Summary and Policy Implications

Since the 1980s, the Philippines has made considerable progress in opening-up the economy and currently, the trade regime is substantially more open, particularly in the manufacturing industry. Despite the market-oriented reforms, the impact on the overall growth and employment of the manufacturing industry has been limited. In terms of performance, manufacturing growth remained sluggish in the past two decades and its contribution declined substantially. This is the opposite of the performance of the manufacturing industry in ASEAN countries such as Indonesia, Thailand, Malaysia, and China whose contribution experienced rising trends.

In terms of export performance, the country's export base has become less diversified as manufactured exports became largely concentrated in three product groups. These consisted of electronics, garments and textile, and machinery and transport equipment which together accounted for around 76% of total exports in 2008. These goods are considerably dependent on imported inputs and have weak backward and/or upward linkages with the rest of the manufacturing industry.

One of the major stylized facts in the empirical trade and employment literature indicates relatively large increases in skill premiums driven by increased demand for skilled workers in both developed and developing countries (Hoekman & Winters 2005; Goldberg & Pavcnik 2004). In the Philippines, however, wage premiums in manufacturing declined as education intensity increased indicating an oversupply. In understanding these seemingly perverse effects of trade liberalization in the country, firm characteristics are crucial. In particular, how are wage premiums affected by firm export activities, skill intensity, capital intensity, firm size and the interaction between trade policy and skill as well as between export and skill intensity.

As such, the present study is a departure from the H-O model. In contrast to the H-O model that relies on the representative firm assumption, the study assumes firm heterogeneity within an industry with firms using different technologies, having different skill requirements and market orientation. The main findings of the paper are given by the following:

First, using effective protection rates as trade variable, trade liberalization lowers the wage premium as firms respond to import competition by shifting to the

manufacture of products with lower value added and importing intermediate inputs rather than producing these within the plant. Lower value added processes require relatively less skilled workers thus reducing the wage skill premium within the firm.

Second, based on ASEAN tariff rates as trade proxy variable, the same results are obtained as shown by the significant positive coefficient on the ASEAN tariff. A reduction in ASEAN tariff rate tends to be associated with a lower wage premium within the firm. However, when ASEAN tariff is interacted with skill intensity, the coefficient turns negative indicating that tariff reduction on skill intensive products is associated with rising wage skill premium.

Third, exports are associated with increasing wage premium at the firm level the higher their skill intensity. This suggests that firm exports of high value added products which require more skilled labor is an important factor in increasing the wage premium.

Fourth, firm characteristics matter in assessing the impact of trade reform on the wage premium. Increases in skill intensity, firm size, and capital labor ratio are associated with rising wage premium at the firm level.

The above results suggest the need to transform and upgrade manufacturing and shift toward more diversified and sophisticated export products. The process of structural transformation and diversification would require climbing the industrial ladder, moving into higher value added sectors as sources of production advance. With the caveat of endogeneity, the case of the Philippines shows that on the overall, tariff reduction is correlated with a decline in wage skill premium within firms in the manufacturing industry. Openness and trade liberalization has led to increases in import competition which seemed to have lowered wage skill premium as domestic firms shifted their manufacturing process towards low value added activities requiring relatively less skill intensity production.

Technological upgrading is an important channel to drive the demand for skilled labor and skill intensive manufacturing processes. Further upgrading of education levels, promoting productivity growth, increasing technological capability and providing incentives for further labor reallocation towards high productivity processes will also be required. These reforms would allow the country to deepen its participation in global and regional production networks and strengthen its competitive

position to take advantage of the opportunities arising from increasing globalization, openness and liberalized markets.

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CHAPTER 5

Trade, Technology, Foreign Firms and Wage Gap: Case of Vietnam Manufacturing Firms

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In this study we explore the effects of trade and technology on the impact of wage gap in the Vietnamese manufacturing industries using the enterprise level data. We explore the impact of skill-biased technological change on the wage differential between the skilled and unskilled workers. The results indicate that firms experienced neutral technological change affecting both skilled and unskilled in a neutral fashion. However, trade tends to have skilled-biased effects in terms of increasing the returns of skilled workers relative to unskilled workers. This has implications for Vietnam in terms of increasing skills and human capital of workers and reducing any job mismatch that might emanate from the economic restructuring of the economy. The importance of domestic capacity building and linkages will be crucial to increase the technological development and innovation capabilities of domestic economy. In particular, the next phase of development for Vietnam will be based on how well they are able to harness the development of local human capital and domestic enterprises.

Keywords: Wage inequality, Technological Change, Trade
JEL Classification: J23; J31; L24.

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1. Introduction

The growing amount of recent research in the area of international economics has associated the phenomenon of widening wage differentials between skilled and unskilled workers in developed countries due to technological changes and globalization. The recent studies highlights that the rising wage differentials in most developed countries are mainly due to technological advances and skill-biased technological change that increased the demand for skilled workers (Autor, *et al*., 1998; Acemoglu & Autor, 2011; Card & DiNardo, 2002). However, Card & DiNardo (2002) highlights that the key issue for the skill-biased technology change is that it failed to explain wage inequality due to gender and racial wage gaps and the age gradient in the returns to education.

In contrast, with the prevalence of globalization and trade activities, Feenstra & Hanson (1996, 1999) highlights that we can observe widening wage differentials occur when production stages shift to higher value-added activities due to competition in the global markets. Several empirical studies examined a relationship between trade (outsourcing) and wage inequality using information on a wide range of industries in various economies such as Anderton & Brenton (1999) for the United Kingdom (UK), Geishecker (2002) for Germany, Chongvilaivan & Thangavelu (2012) for Thailand, and Hsieh & Woo (2005) for Hong Kong. These studies produce rather consistent evidence that points to trade and international outsourcing – the uses of parts and components imports that allow firms to specialise their core-competent activities, to enhance cost efficiency, and to maintain competitiveness in the globalised market – as a key catalyst of mounting wage inequality. This development is attributed to advancement of information and communication technology and closer trade ties to the international market that have led to substantial surges in outsourcing of less skill-intensive activities to developing countries in which unskilled workers are relatively abundant.

The objective of this study is to examine the impact of trade and technology on the wage gap of skilled and unskilled workers for the Vietnamese manufacturing firm level data. In particular, we will examine the skill-biased technological changes induced by globalization that increases the demand for skilled workers relative to the unskilled workers. In addition, we also examine the impact of trade on the wage gap

of skilled and unskilled. It is expected that the impact of imports is likely to have a different impact on the demand of skilled and unskilled workers as compared to exports. In particular, if technology is embodied in imported intermediate inputs such as machines and equipments, than the impact on skilled workers is expected to be greater than the unskilled workers. In this study, we examined the impact of capital investment, imported intermediate inputs and exports on the wage gap of the skilled and unskilled workers.

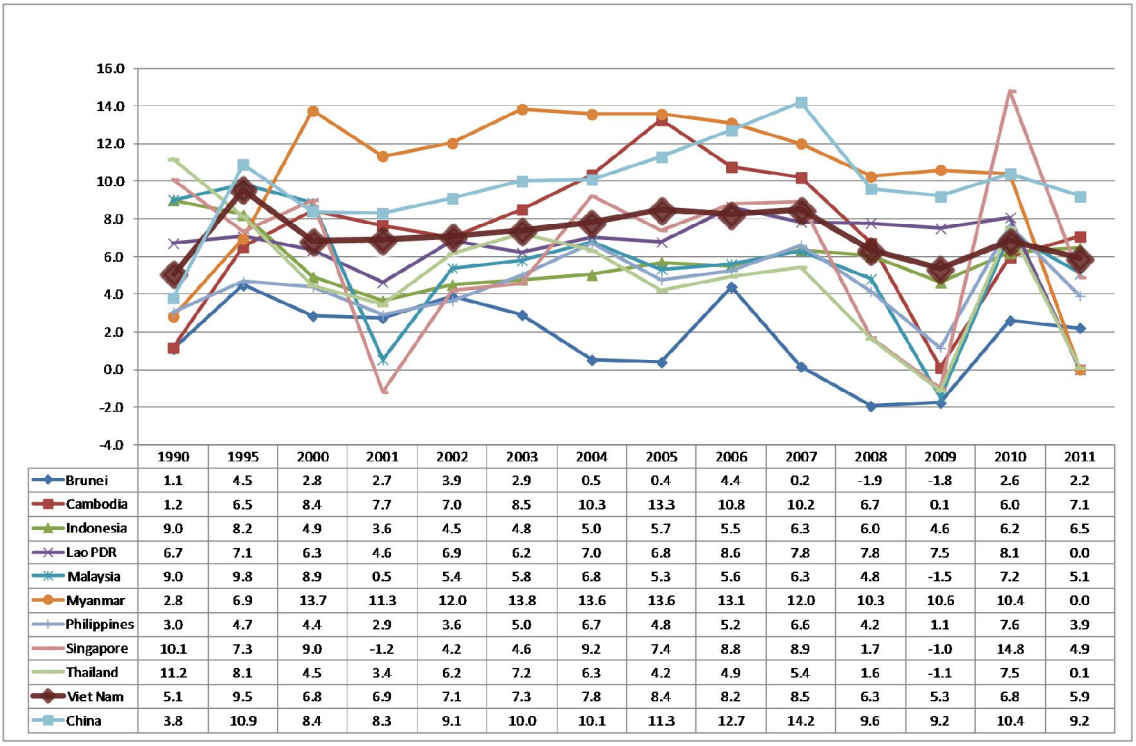
The organisation of paper is as follows. Section 2 depicts the recent trends and developments in Vietnam. Section 3 develops the empirical methodology based on the translog cost function approach. Section 4 presents and discusses the empirical results. Section 5 concludes.

2. Overview of Globalization and Vietnamese Manufacturing Industry

The key to strong growth of the Vietnamese economy is the liberalization policy of the government to increase the competitiveness of the domestic economy by opening it to foreign competition and investment. Since its economic liberalization, the government has put in market friendly policy to attract foreign activities in the domestic economy. In 2007, Vietnam joined the WTO and hence increasing its participation in the global economy.

The role of the government is also emerging as an important factor for economic stability of the Vietnamese economy. The pro-business approach of the government tends to attract significant foreign direct investment activities in the economy. Current economic policies were triggered by a series of reform in the 1980s known as *doi moi* (new thought). The government is now more receptive to the involvement of foreign governments in its domestic economy, especially in the key sectors such as the IT sector.

Figure 1: Real Growth Rate of GDP of Vietnam and Selected Asian Countries



	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Brunei	1.1	4.5	2.8	2.7	3.9	2.9	0.5	0.4	4.4	0.2	-1.9	-1.8	2.6	2.2
Cambodia	1.2	6.5	8.4	7.7	7.0	8.5	10.3	13.3	10.8	10.2	6.7	0.1	6.0	7.1
Indonesia	9.0	8.2	4.9	3.6	4.5	4.8	5.0	5.7	5.5	6.3	6.0	4.6	6.2	6.5
Lao PDR	6.7	7.1	6.3	4.6	6.9	6.2	7.0	6.8	8.6	7.8	7.8	7.5	8.1	0.0
Malaysia	9.0	9.8	8.9	0.5	5.4	5.8	6.8	5.3	5.6	6.3	4.8	-1.5	7.2	5.1
Myanmar	2.8	6.9	13.7	11.3	12.0	13.8	13.6	13.6	13.1	12.0	10.3	10.6	10.4	0.0
Philippines	3.0	4.7	4.4	2.9	3.6	5.0	6.7	4.8	5.2	6.6	4.2	1.1	7.6	3.9
Singapore	10.1	7.3	9.0	-1.2	4.2	4.6	9.2	7.4	8.8	8.9	1.7	-1.0	14.8	4.9
Thailand	11.2	8.1	4.5	3.4	6.2	7.2	6.3	4.2	4.9	5.4	1.6	-1.1	7.5	0.1
Viet Nam	5.1	9.5	6.8	6.9	7.1	7.3	7.8	8.4	8.2	8.5	6.3	5.3	6.8	5.9
China	3.8	10.9	8.4	8.3	9.1	10.0	10.1	11.3	12.7	14.2	9.6	9.2	10.4	9.2

Source: ADB, Macroeconomic Indicators.

Recent evidence also indicates that the Vietnamese government is liberalizing key sectors such as IT sector for foreign investment and export competitiveness. The deregulation is taking the form of restructuring state-owned enterprise into private enterprises and increasing foreign ownership in domestic industries. In terms of infrastructure, the government has devoted resources into building Vietnam's most modern industrial parks.

The effects of liberalization of the Vietnamese economy are reflected in terms of real GDP growth at Figure 1. Vietnam tends to have experienced an average real growth of around 7.1% from 2000-2011, which is much higher than the ASEAN 5 countries and it is only surpassed by recently liberalized economies of Cambodia and Myanmar. The real growth rate peaked before the Global Financial Crisis at 8.4 in 2006. However, we do observe a downward trend in real GDP after the Global Financial crisis in 2008, where the average growth rate is 5.9% from 2008-2011.

The growth of the Vietnamese economy also reflects the rising importance of manufacturing for the domestic economy. Table 1 clearly shows the rising of share of

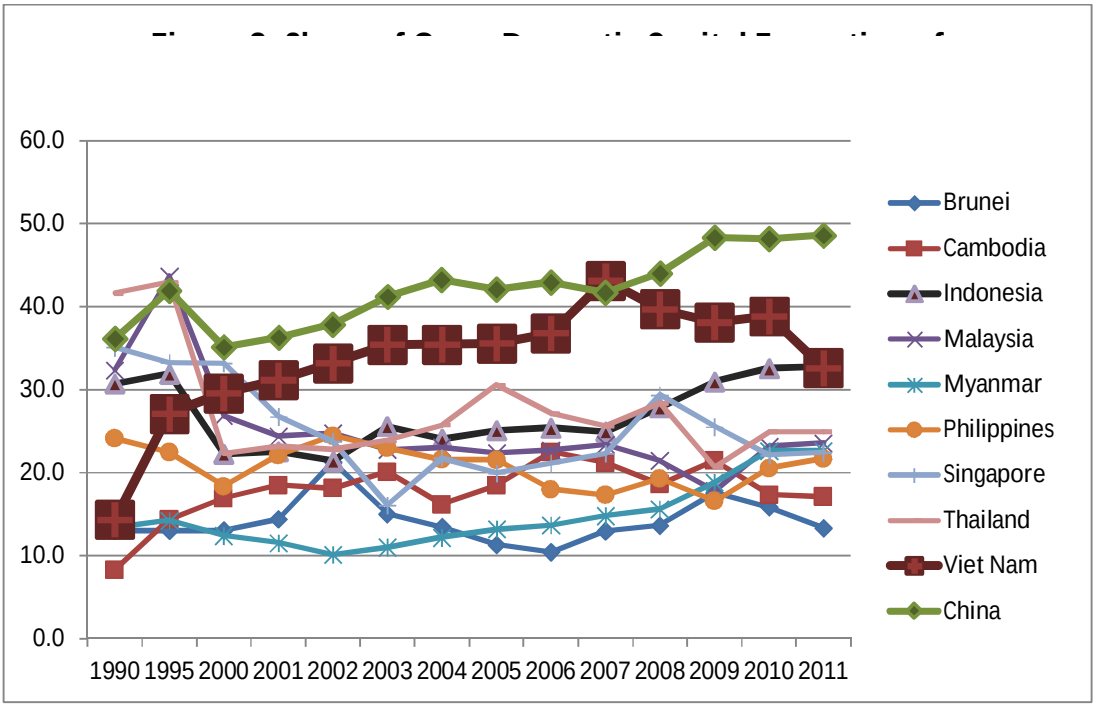
manufacturing with concurrent declining share of the agricultural sector. The share of manufacturing to GDP ratio rising from 22% in 1990 to over 40% in 2011, and concurrently, we observed the agricultural sector declining to 22 percent in 2011 from over 39 percent in 1990. In contrast, the share of services sector to GDP remaining steady at 38 percent from 1990 to 2001. We also observe similar trends for Cambodia, Indonesia, Lao PDR, and Myanmar. In particular, Cambodia, Lao PDR and Myanmar also experienced strong and double digit increase in the share of manufacturing to GDP ratio from 1990 to 2011 with concurrent decline in the agricultural sector.

Table 1: Share of Key Sectors to GDP Ratio for Vietnam and Selected Asian Countries

	Agriculture			Manufacturing			Services		
	1990	**2000**	**2011**	**1990**	**2000**	**2011**	**1990**	**2000**	**2011**
Brunei	1.0	1.0	0.6	61.6	71.6	71.7	37.5	35.3	27.7
Cambodia	56.5	37.9	36.7	11.3	26.4	23.5	32.2	39.1	39.8
Indonesia	19.4	15.6	14.7	39.1	46.5	47.2	41.5	38.5	38.1
Lao PDR	61.2	48.5	30.3	14.5	23.5	27.7	24.3	32.4	42.0
Malaysia	15.0	8.3	12.0	41.5	46.9	40.7	43.5	44.9	47.3
Myanmar	57.3	57.2	36.4	10.5	17.5	26.0	32.2	33.1	37.6
Philippines	21.9	14.0	12.8	34.5	33.8	31.5	43.6	51.6	55.7
Singapore	0.3	0.1	0.0	31.9	31.6	26.6	67.8	65.4	73.4
Thailand	10.0	8.5	10.9	37.2	38.8	40.1	52.8	54.6	49.0
Viet Nam	38.7	24.5	22.0	22.7	41.0	40.3	38.6	38.7	37.7
China	27.1	15.1	10.1	41.3	47.4	46.8	31.5	39.0	43.1

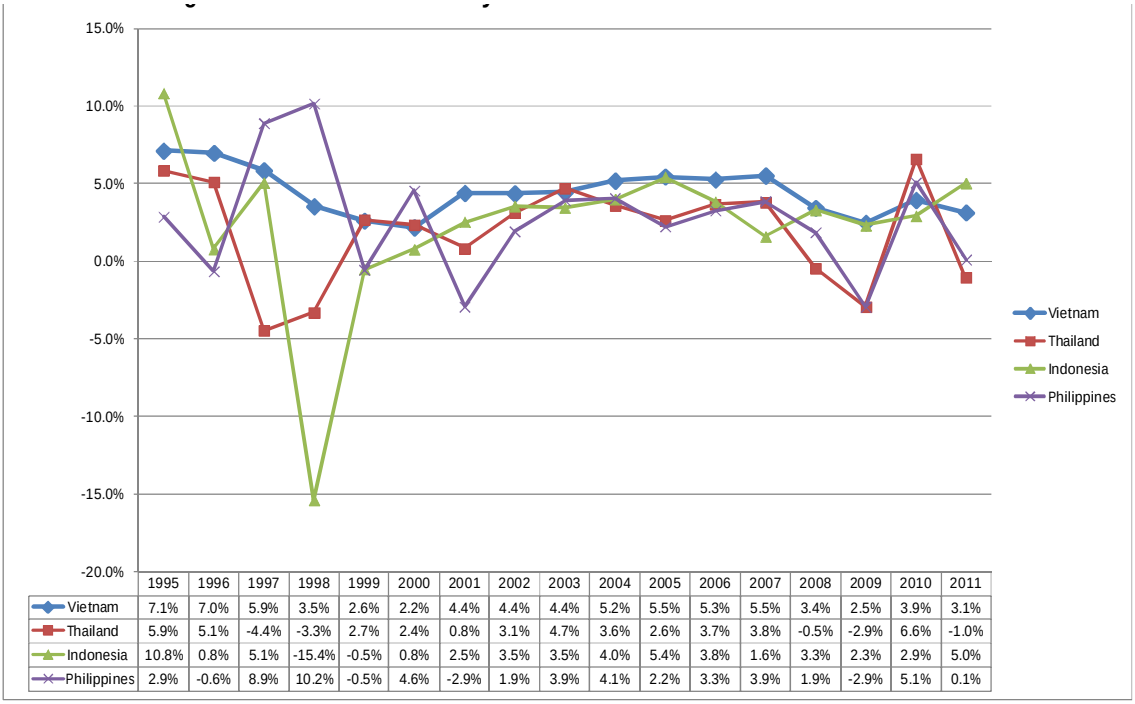
Source: ADB.

Figure 2: Share of Gross Domestic Capital Formation of Vietnam and Selected Asian Countries



Source: ADB.

Figure 3: Labour Productivity of Vietnam and Selected Asian Countries



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Vietnam	7.1%	7.0%	5.9%	3.5%	2.6%	2.2%	4.4%	4.4%	4.4%	5.2%	5.5%	5.3%	5.5%	3.4%	2.5%	3.9%	3.1%
Thailand	5.9%	5.1%	-4.4%	-3.3%	2.7%	2.4%	0.8%	3.1%	4.7%	3.6%	2.6%	3.7%	3.8%	-0.5%	-2.9%	6.6%	-1.0%
Indonesia	10.8%	0.8%	5.1%	-15.4%	-0.5%	0.8%	2.5%	3.5%	3.5%	4.0%	5.4%	3.8%	1.6%	3.3%	2.3%	2.9%	5.0%
Philippines	2.9%	-0.6%	8.9%	10.2%	-0.5%	4.6%	-2.9%	1.9%	3.9%	4.1%	2.2%	3.3%	3.9%	1.9%	-2.9%	5.1%	0.1%

Source: Statistics from ADB.

A recent study by the World Bank (Vietnam Development Report, 2012) reports the importance of declining labour productivity growth for Vietnam and its impact on sustaining the economic growth momentum in the region. The trend of labour productivity for Vietnam and selected ASEAN countries are given at Figure 3. The labour productivity is fairly stable for Vietnam but is showing a downward trend after the Global Financial Crisis. The average labour productivity is around 4.9 percent from 2000-2007 and it declined to nearly 3.2 percent in 2008-2011. Although the decline in labour productivity in the post-crisis period is of a concern, as compared to other selected ASEAN countries, the productivity for Vietnam is quite stable and shows similar trend as other ASEAN countries.

The more important consideration other than productivity growth is the distribution of growth in the economy. Together with the declining labour productivity, as of greater concern is the widening income (wage) gap between the top 20 percentile income earners with lower 20th percentile income earners (see Table 2). The income gap between the high income earners as compared to the low income earners has widened over the years. We also noted the widening income gap across most selected

Asian countries except for Indonesia, Malaysia and Philippines. The widening income (wage) gap might be driven by technological innovation and trade as the economy transits to higher value-added activities, thus increasing the demand for more skilled workers.

Table 2a: The Income Gap in Vietnam and Selected ASEAN Countries

	Income Ratio of Highest 20% to Lowest 20%	
	1995	**Latest year**
China	5.0	9.6 (2005)
Cambodia	5.8 (1994)	6.1 (2008)
Indonesia	5.0 (1996)	5.1 (2005)
Lao PDR	5.4 (1997)	5.9 (2008)
Malaysia	12.0	11.3 (2009)
Philippines	8.3 (1994)	8.3 (2009)
Thailand	8.1 (1996)	7.1 (2009)
Viet Nam	5.6 (1993)	5.9 (2008)

Source: ADB.

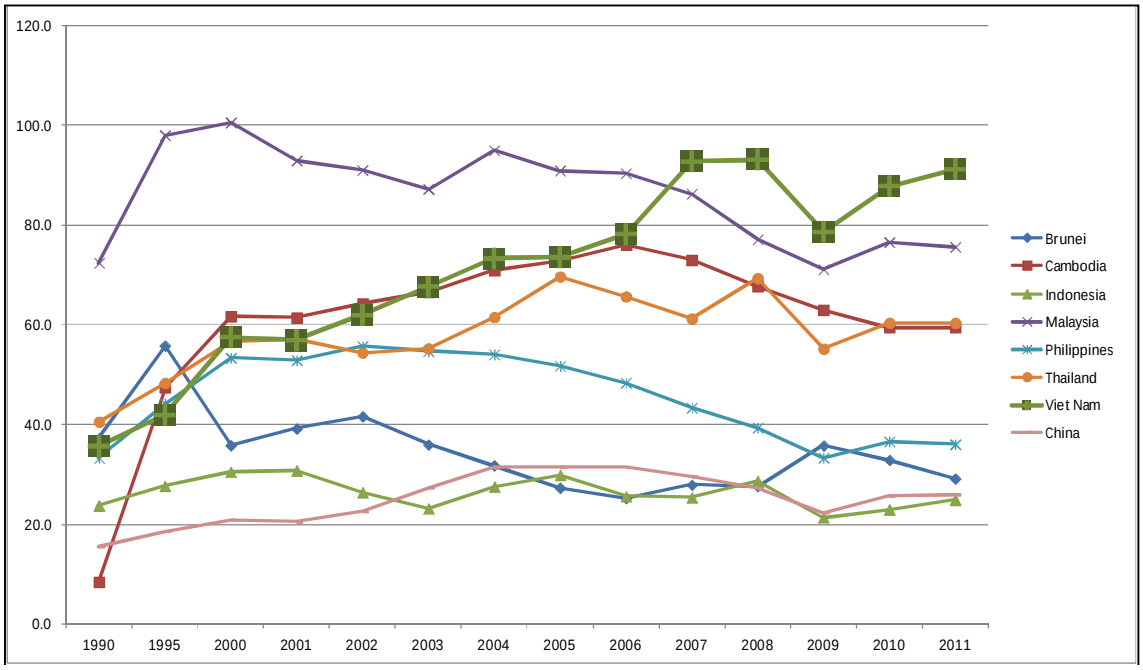
It is important to highlight that the economic liberalization of Vietnam is mainly driven by the growth in global trade. The share of export to GDP increased to 87 percent in 2011 from 26 percent in 1990. The impact of openness is also observed with the rising share of imports to GDP, whereby it increased from 36 percent in 1990 to nearly 91 percent in 2011. The rising trend of the imports suggests that Vietnamese and foreign firms might be increasing their outsourcing activities in the domestic economy.

Table 2b: Share of Exports and Imports to GDP Ratio for Vietnam and Selected Asian Countries

	Exports			Imports		
	1990	**2000**	**2011**	**1990**	**2000**	**2011**
Brunei	61.8	67.4	81.3	37.3	35.8	29.1
Cambodia	2.4	49.9	54.1	8.4	61.7	59.5
Indonesia	25.3	41.0	26.3	23.7	30.5	24.9
Malaysia	74.5	119.8	91.6	72.4	100.6	75.7
Myanmar	1.9	0.5	0.1	3.6	0.6	0.1
Philippines	27.5	51.4	31.0	33.3	53.4	36.0
Singapore	177.4	192.3	209.0	167.4	179.5	182.3
Thailand	33.1	65.0	66.7	40.6	56.6	60.4
Viet Nam	26.4	55.0	87.0	35.7	57.5	91.2
China	19.0	23.3	28.6	15.6	20.9	26.0

Source: ADB.

Figure 4: Share of Imports to GDP Ratio for Vietnam and Selected Asian Countries



Source: ADB.

The rising share of imports to GDP ratio clearly indicates that the Vietnamese economic liberalization has reduced the barriers to trade in terms of import tariffs and tax on capital goods. The effects of this liberalization are the rising share of imports

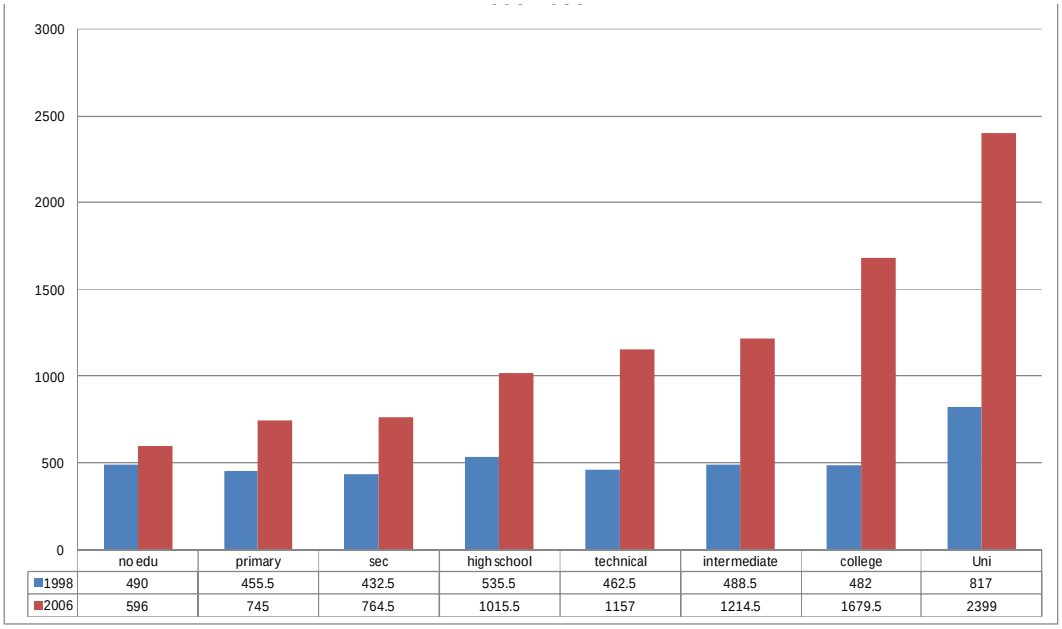
to GDP, where domestic firms are likely to outsource some of their key services and other activities to the global production value-chain. The rising share of imports and hence outsourcing is given at Figure 2, where the share of imports increased from 36 percent in 1990 to nearly 91 percent in 2011.

2.1. Impact of Trade on Wage Gap

Vietnam also has strong labour force and human capital. The wages in Vietnam is much lower than that of India and the recent investment in education is increasing the share of skilled workers. Increasingly the Vietnamese workforce is improving their skills in technical and science education, thereby increasing the incentive for the firms to adopt new technologies. Further, recent evidence indicates that Vietnamese workers are educated in English, thus enabling Vietnam to absorb and diffuse new technologies faster.

Vietnam has an educated and young labour force. The young population less than aged 25 years old consist of nearly 60 percent of the population. It also has very high literacy rate of nearly 97 percent. Primary education focuses on mathematics and the sciences, and cultivates the interest of the students in technology fields. Annually, about 20,000 Vietnamese graduate as technical engineers. Another key characteristic of the Vietnamese labour force is the low turnover, which helps to create strong clientele and customer relationships. The nominal wages of workers by educational attainment from 1998 to 2006 is given at Figure 5. It is clear that wages of the educated workers have increased significantly for the Vietnamese workers, where the tertiary and higher educated workers experienced nearly average annual wage increase of 16% from 1998 to 2006. In contrast, the annual average wages of primary and secondary and high school is increasing at 5% and 6.5% from 1998 to 2006. This clearly indicates that the demand for skilled and educated workers is rising over the years and the wage gap between the skilled and unskilled workers are widening.

Figure 5: Nominal Wages of Workers by Educational Attainment at Vietnam: 1998-2006.



	no edu	primary	sec	high school	technical	intermediate	college	Uni
1998	490	455.5	432.5	535.5	462.5	488.5	482	817
2006	596	745	764.5	1015.5	1157	1214.5	1679.5	2399

Source: Nguyen Thi Lan Huong (2008).

The plots of share of skilled and unskilled workers compensation against fixed capital, export and imports of material imports are given below. The negative impact of fixed capital on share of unskilled workers compensation as compared to skilled workers compensation is clear at Figures 6 and 7. This suggests a technological change that is biased towards skilled workers from capital investment.

Figure 6: Share of Unskilled Compensation to Fixed Capital

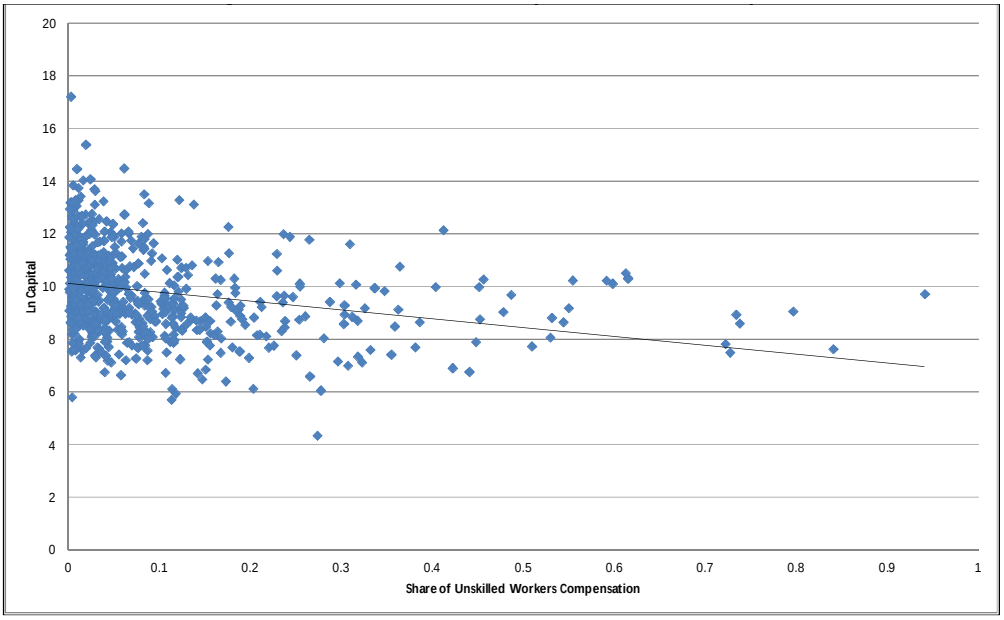
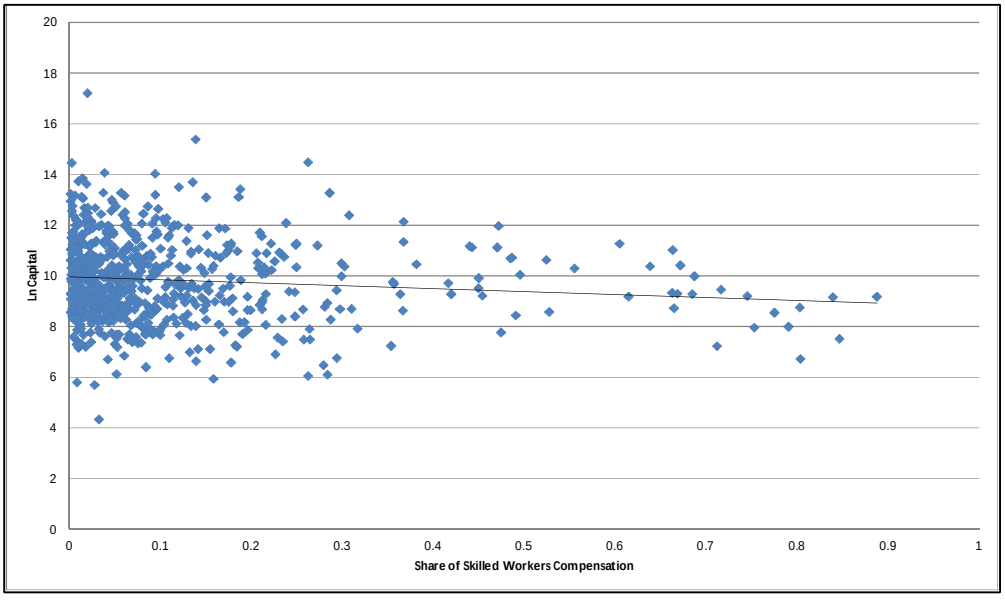


Figure 7: Share of Skilled Workers Compensation to Fixed Capital



Figures 8 and 9 show the relationship between export and compensation share of skilled and unskilled workers. It is clear that trade activities are more in favour of skilled workers as compared to unskilled workers. This indicates that Vietnam is becoming more competitive in the trade of capital intensive goods away from labour intensive goods that reduce the wage share of unskilled workers.

Figure 8: Share of Skilled Workers Compensation to Export

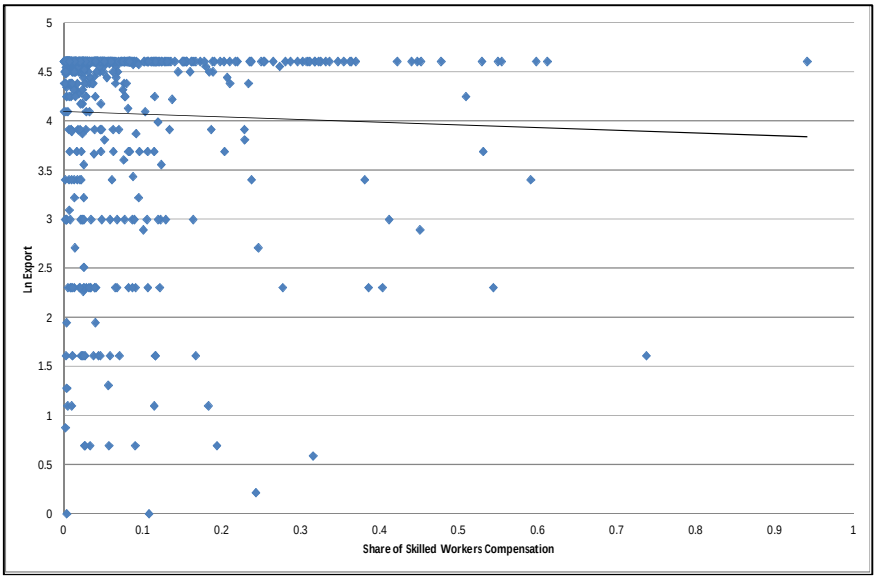
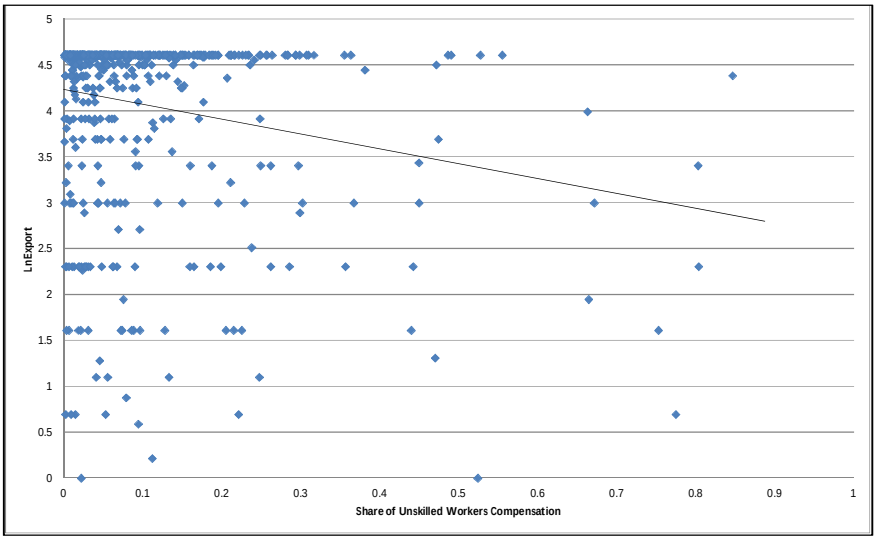


Figure 9: Shared of Unskilled Workers Compensation to Export



Both the share of skilled and unskilled compensation tends to rise with imports of intermediate inputs. However, the correlation between share of skilled workers and import of intermediate inputs is 1.34 as compared to only 0.6 for unskilled labour. This indicates that the importing activities of firms increase the compensation share of skilled workers relative to unskilled workers. This impact is likely to be driven by skilled biased technological change especially if technology is embodied in the imports of machines and equipments.

Figure 10: Share of Unskilled Workers Compensation and Imports of Material Inputs (Log) in Vietnamese Firms

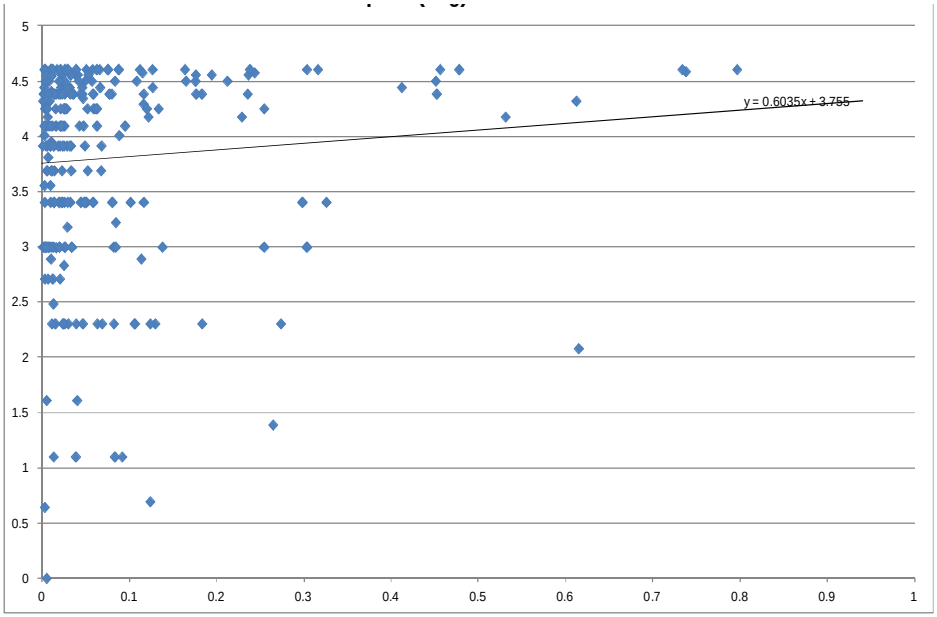
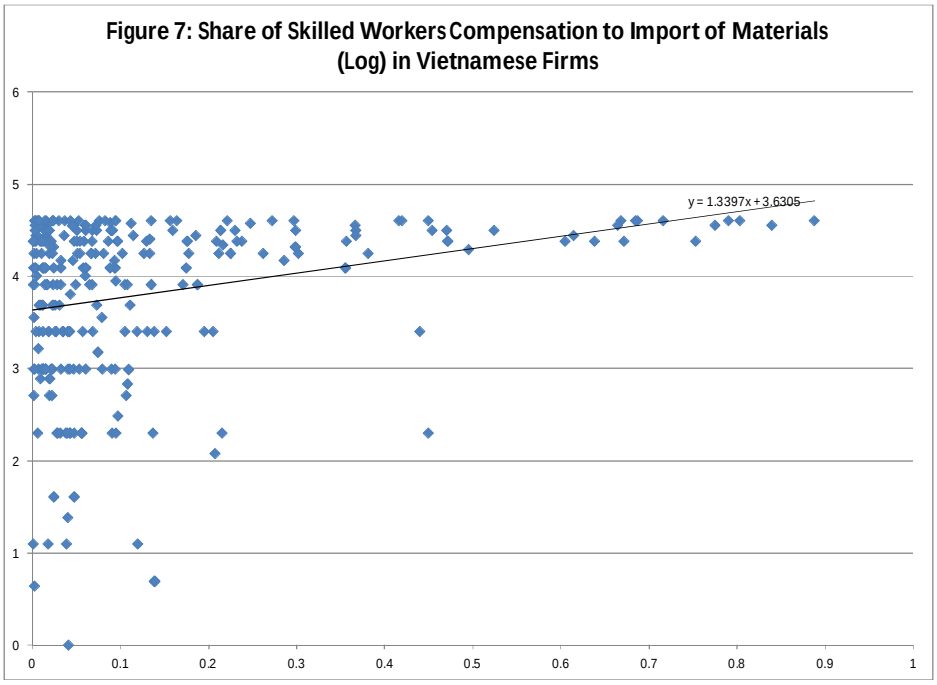


Figure 11: Share of Skilled Workers Compensation to Import of Materials (Log) in Vietnamese Firms



3. Empirical Model

We will explore the skilled-biased effects of outsourcing using the cost function (short-run cost function with capital as fixed input). We derived the relative demands for skilled and unskilled labour by differentiating the cost function (Translog) with respect to factor prices of skilled ($\ln W_{Hi}$) and unskilled wages ($\ln W_{Li}$). To empirically investigate the economic impacts of outsourcing on the relative demands for skilled and unskilled workers, it is important to estimate a cost function that is sufficiently flexible to show the effects of outsourcing on the firms' labor demands. Following Morrison & Siegel (2001), our model is based on a non-homothetic variable cost function specification incorporating the quasi-fixed capital, and *external shift* factors.[1]

[1] Despite these three variable factors, our framework, unlike Morrison and Siegel (2001), is based on the non-homothetic translog cost function rather than the Generalized Leontief cost function.

For a given industry *i*, where *i* = 1,…, *N*, the short-run (dual) cost function can be expressed in an implicit form as:

$$G_i = G(\mathbf{w}_i, K_i, Y_i, \mathbf{T}_i) \tag{1}$$

where $\mathbf{w}_i$ is a vector of variable input prices, including unskilled workers, skilled workers, and raw materials; K_i is quasi-fixed capital stock; Y_i is output; and $\mathbf{T}_i$ is a vector of external trade and technological factors, including the indexes of material and service outsourcing. Therefore, the short-run total cost function is equal to $C_i = G(\mathbf{w}_i, K_i, Y_i, \mathbf{T}_i) + w_K K_i$, where w_K is the price of capital stock.

Following Berman, *et al*. (1994), by assuming that capital is a quasi-fixed factor, we will employ the non-homothetic translog functional form of a variable cost function. By assuming symmetry such that $\gamma_{ij} = \gamma_{ji}$, $\phi_{ij} = \phi_{ji}$, and $\delta_{ij} = \delta_{ji}$ and temporarily dropping the time and industry subscripts, the cost function is given as:

$$\begin{aligned}
\ln G = {} & \alpha_0 + \alpha_L \ln(w_L) + \alpha_H \ln(w_H) + \alpha_M \ln(w_M) + \gamma_{HL} \ln w_H \ln w_L + \gamma_{HM} \ln w_H \ln w_M \\
& + \gamma_{LM} \ln w_L \ln w_M + \frac{1}{2}\gamma_{HH} (\ln w_H)^2 + \frac{1}{2}\gamma_{LL} (\ln w_L)^2 + \frac{1}{2}\gamma_{MM} (\ln w_M)^2 + \beta_K \ln K \\
& + \phi_{LK} \ln w_L \ln K + \phi_{HK} \ln w_H \ln K + \phi_{MK} \ln w_M \ln K + \frac{1}{2}\delta_{KK} (\ln K)^2 + \beta_Y \ln Y \\
& + \phi_{LY} \ln w_L \ln Y + \phi_{HY} \ln w_H \ln Y + \phi_{MY} \ln w_M \ln Y + \delta_{KY} \ln K \ln Y + \frac{1}{2}\delta_{YY} (\ln Y)^2 \\
& + \beta_o \ln O + \phi_{Lo} \ln w_L \ln O + \phi_{Ho} \ln w_H \ln O + \phi_{Mo} \ln w_M \ln O + \delta_{Ko} \ln K \ln O \\
& + \delta_{Yo} \ln Y \ln O + \frac{1}{2}\delta_{oo} (\ln O)^2 + \beta_T \ln T + \phi_{LT} \ln w_L \ln T + \phi_{HT} \ln w_H \ln T \\
& + \phi_{MT} \ln w_M \ln T + \delta_{KT} \ln K \ln T + \delta_{YT} \ln Y \ln T + \delta_{oT} \ln O \ln T + \frac{1}{2}\delta_{TT} (\ln T)^2
\end{aligned} \tag{2}$$

where *O* is the indexes of outsourcing, and *T* is the index of technological progress. For a well defined cost function, it must satisfy the condition of linear homogeneity in

variable factor prices. This implies that we have to impose the following parameter restrictions on equation (3).

$$\alpha_L + \alpha_H + \alpha_M = 1 \qquad (3)$$

$$\gamma_{HL} + \gamma_{HH} + \gamma_{HM} = \gamma_{LL} + \gamma_{LH} + \gamma_{LM} = \gamma_{ML} + \gamma_{MH} + \gamma_{MM} = \phi_{Lj} + \phi_{Hj} + \phi_{Mj} = 0 \qquad (4)$$

where $j = K, Y, O,$ and T .

By employing Sheppard's Lemma and logarithmically differentiating the equation (3) with respect to variable input prices, we can show that $S_k \equiv w_k k / C \equiv \partial \ln C / \partial \ln w_k$, where k = L, H, and M. Furthermore, the adding-up condition requires that the summation of three factor shares must be equal to unity ($S_L + S_H + S_M = 1$), and therefore only two equations are linearly independent. Hence, we choose to drop the material share equation and estimate the followings:

$$S_L = \alpha_L + \gamma_{LL} \ln w_L + \gamma_{HL} \ln w_H + \gamma_{ML} \ln w_M + \phi_{LK} \ln K + \phi_{LY} \ln Y + \phi_{Lo} \ln O + \phi_{LT} \ln T \qquad (5)$$

$$S_H = \alpha_H + \gamma_{HH} \ln w_H + \gamma_{HL} \ln w_L + \gamma_{HM} \ln w_M + \phi_{HK} \ln K + \phi_{HY} \ln Y + \phi_{Ho} \ln O + \phi_{HT} \ln T \qquad (6)$$

The share equations of (5) and (6) can be deemed as a composite representation of the demands for unskilled and skilled labor, respectively. To estimate these share equations empirically, one must specify a stochastic framework. Typically, a random disturbance term u_K is added to each share equation and assumed to be multivariate normally distributed with a mean vector zero, $E(\mathbf{u}) = 0$, and a constant variance matrix, $Var(\mathbf{u}) = \Omega$. Furthermore, our econometric model specifications also include the time-specific (μ_t) and industry-specific (λ_i) dummies. These time- and industry-specific effects are meant to capture persistent industrial differences and overall technological progress affecting the industries. Accordingly, our fully specified econometric model is given as follows:

$$S_{Lit} = \alpha_L + \gamma_{LL} \ln w_{Lit} + \gamma_{HL} \ln w_{Hit} + \gamma_{ML} \ln w_{Mit} + \phi_{LK} \ln K_{it} + \phi_{LY} \ln Y_{it} + \phi_{Lo} \ln O_{it}$$

$$+\phi_{LT}\ln T_{it}+\mu_t+\lambda_i+u_{Lit} \tag{5A}$$

$$S_{Hit}=\alpha_H+\gamma_{HH}\ln w_{Hit}+\gamma_{HL}\ln w_{Lit}+\gamma_{HM}\ln w_{Mit}+\phi_{HK}\ln K_{it}+\phi_{HY}\ln Y_{it}+\phi_{Ho}\ln O_{it}$$

$$+\phi_{LT}\ln T_{it}+\mu_t+\lambda_i+u_{Hit} \tag{6B}$$

One attractive feature of the non-homothetic translog functional form of the dual cost equation (2) is that it does not impose any restrictions on the elasticities of substitution between two variable inputs in priori. It may also be interesting to investigate the impacts of outsourcing on substitution among unskilled labor, skilled labor, and raw materials.

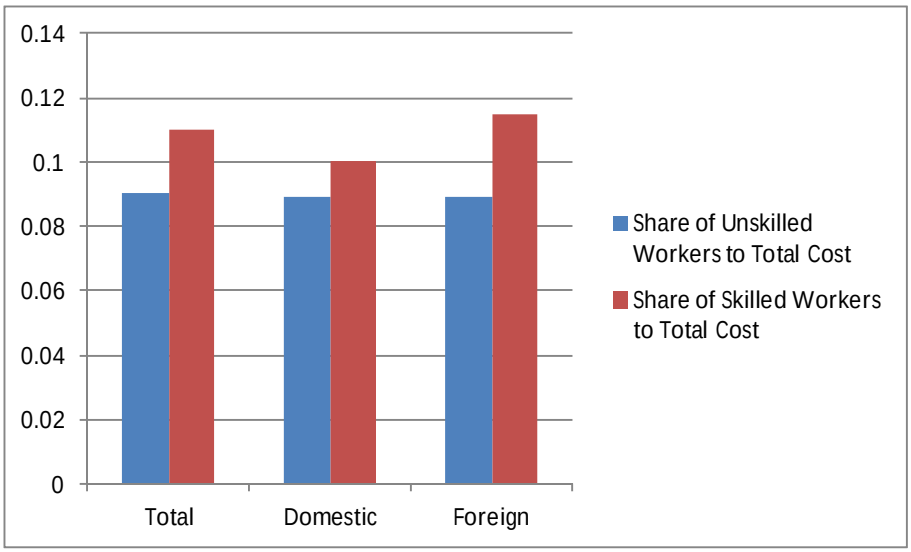
In the above analysis we have three variable inputs: skilled, unskilled and material inputs. For the adding-up condition to hold, the summation of shares of the factor inputs should add to unity. To account for the adding-up condition, we dropped the share of material inputs and estimated only the labour share equations given above. We introduced dummies for technology adoption, number of branches and foreign ownership, respectively. They take the value of unity if a firm adopts new technology, has at least one branch, and is foreign-owned; and nil otherwise.

The data for the estimation is from *Annual Statistical Censuses & Surveys: Enterprises,* gathered by General Statistics Office of Vietnam. It provides firm-level information on foreign ownership and production characteristics, like the number of workers, gross revenue, working capital, materials, profits, level of export and import. However, the survey does not provide any information on the wages of workers by occupation. We also obtained wage data from the *World Bank Business Survey* at the occupational level to derive the wages for the skilled and unskilled workers. Since wage data is only available for 2006, we are only able to implement the model for 2006. As with other studies (Amiti & Wei, 2009: Chongvilaivan & Thangavelu, 2012), we define the imports of intermediate inputs as:

$$OM_i=\sum_j \frac{imported\ \ intermediate\ \ input\ \ j\ \ by\ \ industry\ \ i}{total\ \ intermediate\ \ inputs\ \ used\ \ by\ \ industry\ \ i}.$$

The skilled labour share (S_H) is measured by the ratio of the non-production wage bill to total cost as in Feenstra & Hanson (1996 and 1999). Likewise, production workers represent unskilled labour. By definition, non-production workers are those who are engaged in factory supervision, executives, financing, legal, professional and technical services, whereas production workers are those who are engaged in assembling, packaging, inspecting, repair and maintenance. Therefore, non-production and production workers are conventionally acknowledged as promising candidates of proxies for skilled and unskilled workers, respectively. Since wage data by occupation is not available in the survey, we derived the occupation wage data by industry from the *World Bank Business Survey*. This information is matched to workers at the industry to derive the weighted wages for the skilled (w_H) and unskilled (w_L). Furthermore, capital stock (K) is measured by the values of land, building and construction, and machinery and equipment at the end of each consecutive year, whereas total output (Y) is proxied by the total sales of goods produced.

Figure 12: Share of Unskilled and Skilled Labour in Vietnamese Manufacturing Sector



The share of skilled and unskilled compensation to total cost is given at Figure 9. As expected the share of skilled compensation to total cost is much higher for both domestic and foreign firms relative to the share of the unskilled compensation. We also observed that the share of skilled compensation is much higher for the foreign firms as compared to local firms suggesting that allowing more foreign firms tends to push the wages of skilled workers higher. It is likely that the foreign workers work with more advance technology that complements the skilled workers and hence increase the demand and wages for skilled workers.

Two issues should be highlighted. First, since we have three variable factors of production, it follows that the summation of the three factor shares must be unity; that is, the adding-up condition must be satisfied: $\sum_k S_k = S_H + S_L + S_M = 1$. This condition requires us to drop one out of three equations from the system estimation to make it linearly independent. In doing so, we choose to drop the material share equation and estimate only the labour share equations. In light of this, we employ the two-step Iterative Seemingly Unrelated Regression (ISUR) to estimate the labour share equations (5A and 6A). The major advantage of ISUR is that the ISUR estimates are invariant to the choices of factor share equations dropped.

4. Empirical Results

Table 3 portrays the ISUR estimates of (5A and 6A) with the perturbed specifications. We also undertook 3SLS-SURE estimation to address any endogeniety issues in the estimation. The results for the 3SLS-SURE are given at Table 4. We find that our estimates are robust with respect to the inclusion of the trade and technology variables for ISUR and 3SLS-SURE.

Table 3: Impact of Technology and Trade on Skilled and Unskilled Labour in Vietnamese Firms (ISUR).

	Share of Skilled Wages			**Share of Unskilled Wages**		
	1	2	3	1	2	3
Log(Skilled wages/Price of Materials)	0.006 (0.008)	0.011 (0.007)	-0.011 (0.013)	0.004 (0.007)	-0.0004 (0.007)	0.012 (0.011)
Log(Unskilled wages/Price of Materials)	0.004 (0.007)	-0.0004 (0.007)	0.012 (0.011)	0.011 (0.007)	0.0149** (0.007)	0.001 (0.012)
Log of Material Imports	-	-	0.037** (0.010)	-	-	0.009 (0.008)
Log(Capital)	0.199*** (0.046)	0.2004*** (0.043)	0.189** (0.073)	0.201*** (0.040)	0.151*** (0.041)	0.192** (0.053)
Log of Export	-	0.112** (0.039)	-	-	-0.139*** (0.037)	-
Adopted Technology Dummy	0.007 (0.107)	0.010 (0.009)	0.024 (0.020)	-0.0008 (0.009)	-0.0009 (0.009)	-0.009 (0.014)
Branches Dummy	-0.033* (0.017)	0.002 (0.015)	-0.051* (0.027)	0.0029 (0.015)	-0.010 (0.015)	-0.0007 (0.020)
Foreign Owned	-0.0001 (0.002)	-0.0004 (0.002)	-0.0003 (0.002)	-0.001 (0.001)	-0.0012 (0.0023)	-0.0008 (0.002)
Constant	-0.696 (0.051)	-0.070 (0.044)	-0.181** (0.087)	-0.117** (0.044)	-0.1222** (0.042)	-0.156** (0.063)
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	623	535	535	623	535	535
R-Square	0.074	0.089	0.118	0.116	0.166	0.121

Notes: * 10 percent level of statistical significance, ** 5 percent level of statistical significance, *** 1 percent level of statistical significance. The parenthesis indicates standard errors.

Source: Authors' compilation.

Table 4: Impact of Technology and Trade on Skilled and Unskilled Labour in Vietnamese Firms (3SLS- SURE).

	Share of Skilled Wages			Share of Unskilled Wages		
	1	2	3	1	2	3
Log(Skilled wages/Price of Materials)	0.005 (0.007)	0.014 (0.008)	-0.012 (0.013)	0.004 (0.008)	-0.0002 (0.007)	0.012 (0.012)
Log(Unskilled wages/Price of Materials)	0.004 (0.007)	-0.0002 (0.007)	0.012 (0.011)	0.011 (0.008)	0.0143** (0.007)	0.004 (0.013)
Log of Material Imports	-	-	0.012** (0.012)	-	-	0.008 (0.007)
Log(Capital)	0.176*** (0.048)	0.198*** (0.044)	0.167** (0.074)	0.200*** (0.042)	0.150*** (0.042)	0.190** (0.054)
Log of Export	-	0.115** (0.040)	-	-	-0.138*** (0.038)	-
Adopted Technology Dummy	0.007 (0.018)	0.010 (0.009)	0.024 (0.020)	-0.0008 (0.009)	-0.0009 (0.010)	-0.008 (0.015)
Branches Dummy	-0.034* (0.018)	0.002 (0.016)	-0.055* (0.028)	0.0029 (0.015)	-0.010 (0.015)	-0.0005 (0.020)
Foreign Owned	-0.0001 (0.003)	-0.0004 (0.002)	-0.0003 (0.002)	-0.001 (0.001)	-0.0011 (0.002)	-0.0008 (0.002)
Constant	-0.047 (0.053)	-0.067 (0.044)	-0.151** (0.088)	-0.116** (0.045)	-0.119** (0.049)	-0.153** (0.065)
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	623	535	535	623	535	535
R-Square	0.070	0.094	0.112	0.120	0.167	0.117

Notes: * 10 percent level of statistical significance, ** 5 percent level of statistical significance, *** 1 percent level of statistical significance. The parenthesis indicates standard errors.

Source: Authors' compilation.

We observed very interesting results from Tables 3 and 4. The results are robust and consistent for both ISUR and 3SLS-SURE. We observe technological changes in the Vietnamese firms (statistically significant) and it tends to be neutral in terms of increasing both the skilled and unskilled wage shares. This suggests that technological changes are neutral and it is not the key factor for the widening wage gap observed in the Vietnamese economy. Nevertheless, this result is not surprising as capital accumulation like automated machineries; computers and equipments typically require skilled workers to work with. As the Vietnamese firms are moving towards industrialization through high-tech capital investment, one would expect the

complimentary effect whereby building up capital escalates the demand for skilled workers and thus wage inequality between skilled and unskilled workers.

The results based on trade variables of export and import is very interesting. The import of intermediate inputs increase the skilled wage share and it is statistically significant. In contrast, the impact of import of intermediate inputs is not statistically significance. This is intuitive as technology is embodied in imports of machines and equipments that complements and increase the returns for skilled workers. This complementary effects increase the demand for skilled workers.

The impact of export on wage share of skilled and unskilled workers indicates that it increase the demand for skilled workers relative to unskilled workers. The coefficient of export is positive and statistically significant for the wage share of skilled workers. The results clearly indicates that trade tend to increase the returns for skilled workers as both import and export tend to have positive impact on wage share of skilled workers.

The Vietnamese firms with branches tend to employ less skilled workers than do those without branches. The coefficient of the branches dummy is negative and statistically significant at the 5 percent level. This evidence may be explained by the fact that skill-intensive activities like research and development (R&D) and product design are typically subject to knowledge spillovers, and therefore the Vietnamese firms strategically retain them within a single location.

Lastly, we find only weak evidence that foreign-owned firms tend to employ more skilled workers than local firms. Even though the coefficients of the foreign ownership dummy are positive and negative in the skilled and unskilled share equations respectively, both are statistically insignificant.

5. Policy Conclusion

In this study we explore impact of trade and in particular the effects of international activities among Vietnamese firms. The results indicate that firms that adopt new technologies and restructure their organization are likely to move part of their activities to more value-added and skill based. This restructuring activities

increase the wage gap between the skilled and unskilled workers due to the increase in demand for skilled workers.

We also observe that firms that are part of the production networks and value-chain are likely to undertake more restructuring and international activities. As Vietnam liberalises and integrates with the ASEAN community, we should expect more international activities among Vietnamese firms.

The implications of economic liberalisation to foreign investment and competition are that it is likely to increase restructuring activities in the domestic firms. It is clear from our results that trade related activities are skill-biased towards the skilled workers, thereby increasing their demand and wages. Thus, we are likely to see a more widening wage gap between skilled and unskilled workers in the Vietnamese economy. This has implications for Vietnam in terms of increasing skills and human capital of workers and reducing any job mismatch that might emanate from the economic restructuring in the economy.

Several key challenges still exist in Vietnam. Firstly, there is still rent-seeking in the Vietnamese economy and this is likely to create inefficiencies in the economy. The importance of transparency and protection of property rights are important for conducting business in the country. Thus, the flow of foreign investment is slow-moving, and there are concerns that the government's economic reform has been sluggish.

The other challenge for Vietnam is the inadequate investment in public infrastructure such as IT and telecommunications. The IT and telecommunication industry is heavily regulated by the government, and there are restrictions on foreign ownership. Greater economic liberalisation of this sector is expected to increase the competitive and efficiency of the domestic sector.

There are several important policy implications from the study. If the manufacturing activities in Vietnam are moving to more capital- and technology-intensive activities, the impact of globalization will have important implications on the rising wage inequality and also on the skilled developments in the economy.

Our results indicate that there are negative effects on unskilled workers, and thus the government has an important role in managing the negative effects without sacrificing the positive effects from trade and globalization. This clearly reflects

domestic human capital development as a key component of growth in an open economy to globalisation. The training and upgrading of skills programmes will be crucial to move unskilled workers to more productive sectors in the economy. The improvement and upgrading of the education and innovation systems in Vietnam's economy will be important factors to augment the potential benefits of globalization. The government should focus on retraining of the unskilled workers as they are displaced from technological changes and globalization. As new jobs are created from structural changes, it is important to train and move workers to the competitive industries. Thus, the government could consider policies to continuing education such as Industrial Education for working population to upgrade their skills and remain relevant in the labour market.

The importance of domestic capacity building and linkages will be crucial to increase the technological development and innovation capabilities of domestic economy. In particular, the next phase of development for Vietnam will be based on how well they are able to harness the development of local human capital and domestic enterprises.

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CHAPTER 6

Global Production Sharing and Wage Premium: Evidence from Thai Manufacturing*

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The paper examines wage premium across firms with emphasis on the effect of global production sharing, using firm level data of Thai Manufacturing as the case study. Our results show the effect of engaging into the global production network on the wage skill premium varies across firms, depending on the extent to which firms actively engage. The more active the firm, the larger the benefit expected from the network. For active firms there are a wide range of activities, far beyond simple assemble and unskilled-intensive activities, to be participated. This reduces the risk to be trapped in the production network. The key policy inference is there is benefit from globalization through global production sharing but is not automatic. The role of government should emphasize adequate and qualified skilled workers in order to facilitate the participation of indigenous firms in the network.

Keywords: Skill Premium, Wage differential, Global Production Sharing, Thai Manufacturing
JEL: JEL: F14, F16, O14, O53

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1. Issues

International trade-wage nexus remains the ongoing debate in the context of economic globalization. Even though the theoretical postulation from the standard neo-classical trade theory highlights potential favorable impact on income distribution as a result of proper resource allocation in line with the country's comparative advantage and hence narrowing a wage gap between unskilled and skilled workers (henceforth referred to the wage premium), empirical results remain mixed at best. Such a favorable impact is found only in some cases such as Mishra and Kumar (2005) of India, Bigsten & Durevall (2006) for Kenya, Amiti & Cameron (2012) for Indonesia. There are a number of empirical evidence (e.g. Currie & Harrison, 1997; Hanson & Harrison, 1999; Galiani & Sanguinetti, 2003; Attansaio, *et al*. 2004; Goldberg & Pavcnik, 2007) where wage premium is persistent. This raises concerns about the impact of globalization on income inequality.

While the earlier explanation of the persistence of wage premium was on imperfection of resource reallocation[3] and the protection structure[4], it is far from satisfactory (Goldberg & Pavcnik, 2007). The recent explanation is shifted toward the role of firm heterogeneity. In particular, the recent study by Amiti & Davis (2011) lays down theoretical ground connecting wages paid, firm performance and trade policy. That is, firms with different performance would pay different wage and their performance is related to whether and how firms are globally integrated, i.e. export final goods and import intermediates. This is to a certain extent related to policy stance toward trade liberalization.

On par, global production sharing is highlighted as a main cause of the persistence of wage premium in developed countries (Feenstra & Hanson, 1996, 1997, 1999, and 2003).

[3]See details in Revenga (1997), Hanson & Harrison (1999), Feliciano (2001), Attanasio, *et al*. (2004), Currie & Harrison (1997), Topalova (2004) and Wacziarg & Seddon (2004). Noticeably the results are largely based on Latin American experience.

[4] It was the unskilled labor-intensive sectors like that were protected the most prior to trade reform. When trade liberalization takes place, inflated demand for unskilled workers as a result of protection is diminished. Hence, the wage premium would increase. See Hanson &Harrison (1999) and Robertson (2000; 2004) for Mexico; Currie & Harrison (1997) for Morocco; Attanasio, *et al*. (2004) for Colombia.

The global production sharing is referred to a circumstance where the whole production processes are divided into separated stages and economically allocated in many locations according to competitiveness. Given the fact that developed countries are relatively endowed by skilled labor as opposed to developing ones, this would positively affect the relative demand for workers in the former. Empirical studies in this area is lopsided, most of which examine the impact on developed countries. The effect on developing countries is both theoretically and empirically unknown. In theory this could either narrow or widen the wage premium in developing countries. As postulated in the standard HO theory, activities located in developing countries as a result of global production sharing would be unskilled-labor intensive so that participating to the global production sharing would raise demand for unskilled workers and narrow the wage premium. On the other hand, despite being regarded as unskilled-labor intensive in the context of developed countries, activities could be skilled-labor intensive in the developing countries. In other words, developing and developed countries could face different cones of production. Therefore, global production sharing could induce more demand for skilled workers as opposed to that for unskilled ones in both developing and developed countries simultaneously. The impact on developing countries' labor market is immense policy relevant as there is growing concern in developing countries' policymakers that participating in the global production sharing could make their enterprises to be trapped in low-skilled or low quality workers and retard technological advancement.

To the best of our knowledge so far, the role of firm heterogeneity and global production sharing are yet brought under the common framework. Besides, research on wage premium persistence has so far paid less attention on East Asia relative to developed countries or Latin-American developing countries. Against this backdrop, this study aims to examine the determinants of the wage premium by using plant level data of Thai manufacturing as the case study. This study is distinct from previous studies by incorporating the effect of global production network along with trade liberalization in determining the wage premium. Three alternative measures of global production network are used to ensure the robustness of our results while carefully controlling for firm and industry specific factors.

Thailand is the excellent case study for the issue in hand for at least two reasons. First, Thailand has been long engaged into the global production network by

multinational enterprises. This would have impact on the relative demand for unskilled and skilled workers as well as the wage skill premium in the country. Secondly, despite substantial progress in trade liberalization observed in the past two decades, many remain to be done. The tariff peak remains unchanged, suggesting protection varies across sectors. Such protection pattern across sectors is partly influenced by tariff escalation structure, the key policy implication of import substitution industrialization ideology. Tariff on finished products are still higher than that on intermediate products. Thus, further liberalization on both input and output would still have some implication on allocation of skilled and unskilled labor.

The rest of the paper is organized as follows. Section 2 presents analytical framework of determinants of the wage skill premium. The brief discussion of the wage skill premium in Thailand is presented in Section 3. Section 4 discusses the empirical model while data and variable measurements are in Section 5. Section 6 discusses our empirical results. Last section presents conclusions and policy inferences.

2. Analytical Framework

This section lays down analytical framework illustrating the effect of global production sharing and the wage premium. The standard neo-classical trade model postulates that opening up to the international trade would lead to specialization across countries according to their comparative advantage. For developing countries whose comparative advantage is determined by abundance of unskilled workers, opening up to international trade would raise price of unskilled worker-intensive goods due to export opportunity. In contrast, these countries would experience a decline in price of the skilled-labor intensive products as a result of import surge. Changes in the relative price would affect the relative demand for skilled and unskilled worker. Therefore, it is expected that wage premium between skilled and unskilled workers would decline. This would generate a favorable effect on income equality.

Such theoretical postulation is not always supported empirically. In some cases, the gap was even widened (Goldberg & Pavcnik, 2007; Davis & Mishra, 2007). Earlier

explanations of the persistence of wage premium emphasize fiction in labor market that constrains resource reallocation and the structure of protection. Nonetheless, they could not be satisfactory in explaining the persistence of wage premium observed. For example, imperfect labor mobility could be at best the short-run phenomenon and be less important over time. It is unlikely to be different across firms. Interestingly, the premium is also observed not only at the economy-wide level, but also within industries and within firms (Pavcnik, *et al.* 2004; Verhoogen, 2008).

The research direction is shifted toward firm heterogeneity. Pioneered by Melitz (2003), the firm heterogeneity literature raises possibility that firms in a given industry can have different productivity and so behave noticeably different, including wage paid to their workers. The link between firm heterogeneity is explicitly pronounced in the general equilibrium framework developed by Amiti & Davis (2011).[5] While the model workhorse is based on Melitz (2003) where firms' productivity is not unique, Amiti & Davis (2011) add two additional features into the general equilibrium model. The first feature is the fair-wage constraint to create link between wages paid and firm performance. In the fair-wage constraint, workers employed in the high productivity firms tend to receive higher wages. The second feature in Amiti & Davis (2011: 5) is firms' productivity and modes where firms are globally integrated, i.e. export final goods, import intermediates, or both. The key theoretical proposition in Amiti & Davis (2011) is wage paid by firms exporting final goods, importing intermediates and doing both is higher than those without the direct link to the global.

Another branch of literature focuses the effect of participating in global production sharing. As mentioned above, global production sharing refers to a circumstance where the whole production processes are divided into separated stages and economically allocated in many locations according to competitiveness. There are three phases in the global spread of production sharing (Athukorala, forthcoming). It begins with two-way exchange between home and host country where parts and component assembly/testing in the host country to be incorporated in final assembly in the home country. The next phase is component assembly networks encompassing many host countries whereas R&D, final assembly and head-quarter functions are still in the home country. The final

[5] This study also conducts empirical analysis, using Indonesian manufacturing

phase is the full-fledged production networks involving component production/assembly/tenting and final assembly encompassing host countries. In the last phase, R&D and head-quarter functions only perform predominantly in the home country. This would affect the relative demand for skilled and unskilled workers in countries participating in the global production sharing.

The effect of relative worker demand in the developing countries is ambiguous. On the one hand, relatively unskilled-labor intensive activities would be located in developing countries according to their comparative advantage. When specialization in global production network continues, the wage gap between unskilled and skilled workers would be narrow down. Nonetheless, the discussion above is under the implicit assumption that there is a single production cone where there would not be any factor intensity reversal and firms in developed and developing countries are facing the same factor endowment vector. In reality, a number of studies point such an assumption is rather restrictive (Leamer & Levinsohn, 1995; Feenstra, 2004; Leamer, *et al*., 2005; Kiyota, 2012). For example, consider the footwear industry. While much of the footwear in the world is produced in developing countries, the US retains a small number of plants, e.g. New Balance has a plant in Norridegewock, Maine. Operation there is full with computerized equipment. This is a far cry from the plants in Asia and China in particular which using traditional production technology and rely heavily on workers. Therefore, for any given activity, it can be regarded as unskilled in the North but skilled labor intensive in the South. Unskilled labor intensive activities outsourced by firms in developed countries might require relative skillful workers in developing countries to perform.[6] Therefore, it is possible that demand for skilled to unskilled workers increases in both developing and developed countries simultaneously so that the wage gap is persistently observed.

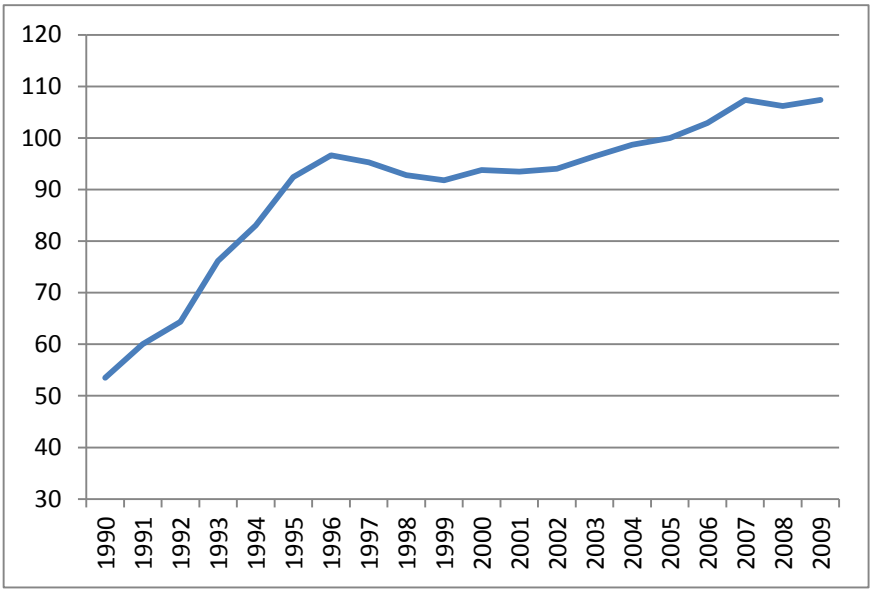
[6] See the similar evidence in Isaacsan (2011: Chapter 41), the conversation between US President Barak Obama and Apple Inc. CEO Steve Job. Particularly, Apple had 700,000 factory workers employed in China, he said, and that was because it needed 30,000 engineers on-site to support those workers. "You can't find that many in America to hire", These factory engineers did not have to be PhDs or geniuses; they simply needed to have basic engineering skills for manufacturing". Such factory engineers are unlikely to be unskilled workers in China as well.

3. Wage Premium in Thai Manufacturing

Wages in Thailand are largely determined by the market as The Thai labour force is largely non-unionized. Domestic and foreign investors have been able to carry on their business activities without any fear of labour problems. This is a result of the abolition of the Labour Act of 1956. Establishing labour unions, as well as any form of labour movement, was prohibited until 1978, when the Labour Act was amended to allow firms to set up labour unions under the auspices of the Labour Relations Law. Nevertheless, there has not been any threat of labour unions in Thai manufacturing. In addition, despite the presence of minimum wage regulations since 1973, their impact on actual wage behaviour has been low in Thailand (Kohpaiboon, 2006).

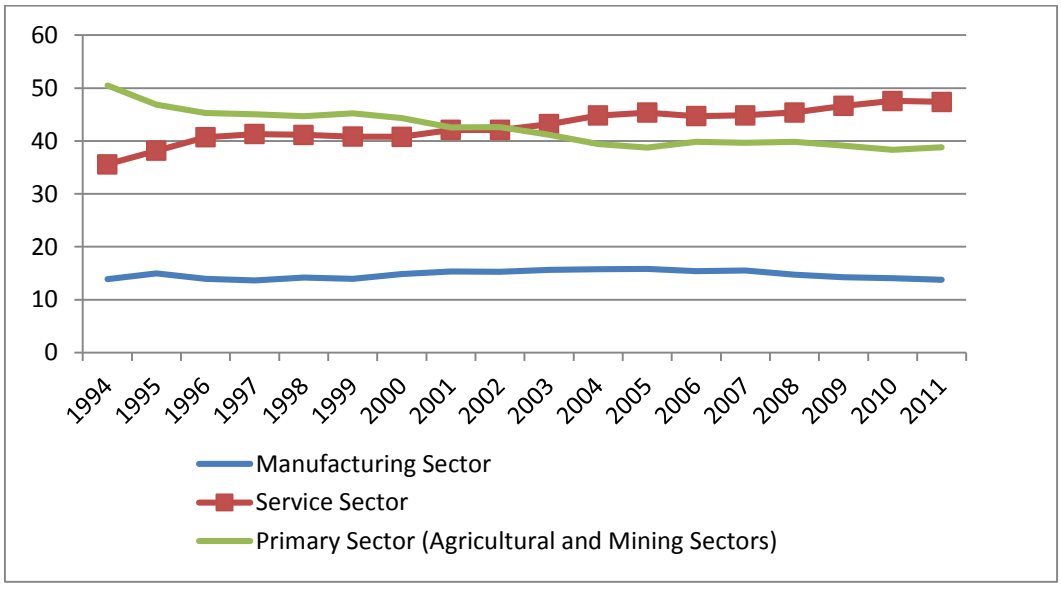
Figure 1 illustrates (real) wage pattern in Thailand between 1990 and 2009. Real wage in Thailand grew at the relatively rapid rate between 1990 and 1996, the pre-crisis era. The annual growth rate was 10.4 per cent during this period. As a result, Thai baht experienced real appreciation, deteriorating international competitiveness and eventually causing the economy to be succumbed to the crisis in 1997/98. When the economy experienced the 1997/98 crisis, real wage dropped. Not until 2000, real wage has grown noticeably. From 2002 and 2009, the real wage grew at 1.7 per cent and showed a noticeably upward trend.

Figure 1: Wage Pattern in Thailand between 1990 and 2009



The upward trend of real wage in Thailand was associated with the low and declining unemployment rate by developing country standard. In 2011, unemployment rate in Thailand was 0.7 per cent. Such a rate was much lower than the neighbors in Southeast Asia, e.g. Malaysia (3 per cent), Indonesia (6.6 per cent), Vietnam (2.0 per cent). This rather suggests the tightening labor market condition in Thailand.[7] Interestingly, patterns of employment share by sectors (i.e. agriculture, manufacturing and service) suggest labor tightening in manufacturing sector is getting more serious. Employment share in the manufacturing sector slighted changed in a small range between 13.6 and 15.8 per cent during the period 1994-2011. It was the service sector absorbing workers from the primary sector (agricultural and mining). In 2011, the employment share of service sector was approaching 50 per cent, increasing from 35.6 per cent in 1994. By contrast, the share of primary sector dropped from 50.5 per cent in 1994 to 38.8 per cent in 2011 (Figure 2).

Figure 2: Employment Share in Thai Economy 1994-2011



Source: Key Indicator of Asia and the Pacific 2012, Asian Development Bank (ADB).

[7] Data for unemployment reported here are the latest available from Key Indicator of Asia and the Pacific 2012, Asian Development Bank (ADB).

Wage differentials across industries in Thailand are observed but limited. Its estimate of diary wage was concentrated in 300-600 baht in 2006. By contrast, wage tends to vary significantly across firms as postulated in the firm heterogeneity literature. Table 1 shows a simple regression in order to illustrate statistical relationship between wage and several firm characteristics such as size, whether firms import intermediates, whether firms export.[8] The observed pattern is larger plants and those engaged with international activities (either export or import) pay higher wage for production workers (henceforth referred to blue collar workers) than domestically-oriented ones within industries even after controlling for the skill share among production workers (Columns A and B in Table 1).

Table 1: Wage Across Firms in Thai Manufacturing in 2006

	Production Workers		Non-production workers	
	A	B	C	D
	Without Industry Dummies	With Industry Dummies	Without Industry Dummies	With Industry Dummies
Intercept	8,89	9,87	8,07	8,7
	-349,5	-24,1	-47,51	-13,6
Export share	0,001	0,002	0,002	0,002
	-6,27	-9,45	-8,07	-7,5
Import share	0,004	0,002	0,004	0,003
	-16,6	-10,2	-11,3	-9,73
Size (output)	0,11	0,09	0,051	0,054
	-75,6	-61,8	-17,6	-17,9
Skillshare	0,28	0,12		
	-22,1	-10,1		
Wage of production workers			0,24	0,19
			-15,8	-12
Ad-R^2	0,2574	0,41	0,09	0,1102

Source: Authors' Calculation.

[8] The regression does neither aim to estimate wage determination-Mincer-styleequation and nor infer the causality relationship of wage and other key firm-specific characteristics. It is mainly used for statistic discussion only.

When non-production workers (henceforth referred to white collar workers) are concerned, the similar regression exercise is applied. That is, wage of white collar workers is regressed with size, mode of engaging international activities, and wage of blue collars. The latter is introduced to see whether wage of non-production workers is generally higher than that of production workers. The results in Columns C and D in Table 1 are to a large extent similar to Columns A and B where large plants and those engaged with international activities (either export or import) pay higher wage than domestically-oriented ones within industries. In addition, non-production workers tend to receive higher wage than production workers. In other words, wage premium exists in Thai manufacturing.

Figure 3 presents the scatter plot illustrating difference in wage paid and types of employed workers across industries according to the extent to which they are engaged to global production sharing. The share of parts and component imports to total imports is used as a proxy for the extent to which industries are engaged to global production sharing.[9] In Figure 3a, there is to a certain extent positive relationship between the wage gap and the share of parts and component imports across industries. This suggests that the wage gap tends to be higher as industries are increasingly engaged into global production sharing. The same positive relationship is found between the share of production to total workers and the share of parts and components imports despite less clear (Figure 3b).

[9] See discussion of the use of parts and component import shares as a proxy for the extent to which industries are engaged to global production sharing.

Figure 3a: Ratio of Non-production to Production Wage

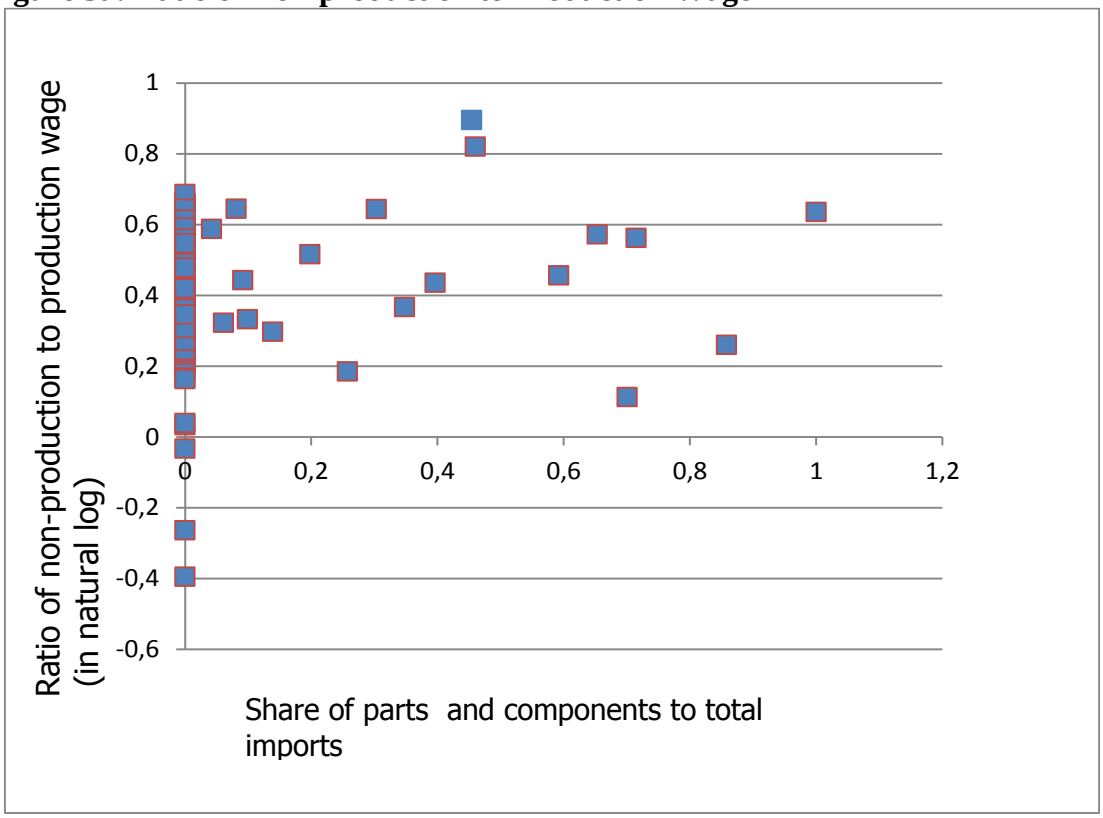
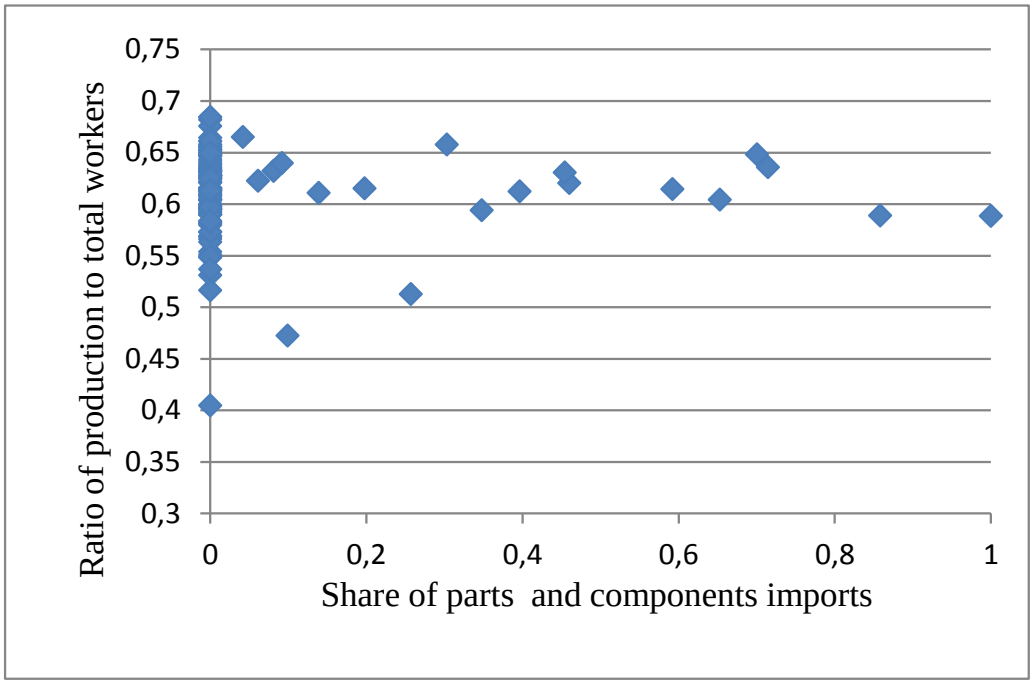


Figure 3b: Ratio of Production to Total Workers Across Industries



4. The Empirical Model

The empirical model employed in Amiti & Cameron (2012) is used as a point for departure. That is, the wage premium (*Ws/Wu*), the ratio of wage compensation of skilled worker to unskilled workers is a function of a set of firm specifics including size ($output_{i,j}$), export ($EX_{i,j}$) and import ($IM_{i,j}$) status, firms' ownership ($FOR_{i,j}$).[10] In addition, three additional firm-specific variables are introduced. They include the level of fixed asset stock capturing the degree of capital deepening at the plant level, the ratio of female to total worker to examine any possible gender bias, and the region which equals to 1 for Bangkok and Vicinity and 0 otherwise.

Since the definition of blue and white collar workers in micro dataset can vary from one to others, dataset-specific aspect in this regard must be taken into consideration. For Thailand's industrial census 2006, a number of blue collar workers employed at the plant are further disaggregated into skilled and unskilled blue workers. The former refer to supervisors who have long experience and are skillful to look over production lines so they should be regarded as white collars. Unfortunately, in the dataset, wage compensations paid to the operation workers are not separated and makes impossible to re-define more precise wage compensation of true white collar. Hence, to mitigate this problem, $skillshare_{i,j}$, the ratio of skilled to total operation worker, is introduced as one controlling firm-specific variable for the wage premium equation. The higher value of $skillshare_{i,j}$ implies that the denominator in the wage premium includes some belonging to actual skilled workers.

Similar to Amiti & Cameron (2012), input and output tariffs are separated in determining possible different effect of input and output trade liberalization on the wage premium in this paper. As argued in Amiti & Cameron (2012) when domestically-produced inputs are perfectly substitutes by imported ones and input production is more skilled worker intensive, cutting input tariffs encourages firms to import instead of buying locally-produced ones. This would reduce demand for skilled workers and, *certaris*

[10] Note that in Amiti & Cameron (2012) the model also includes government ownership perhaps due to the fact that state-owned firms seem to be relevant for Indonesia. By contrast, state-owned firms in the manufacturing sector in Thailand were rare so it is excluded in our model.

paribus, the wage premium would be narrower. The effect of output tariff would have the same effect, i.e. reduction in output tariff resulting in a decline in the wage skill premium. However, it is possible that reduction in output tariff would not have any significant impact because of the switching effect taking place when firms are to shift production between multiple products with different factor intensity. Otherwise, firms must continue in business due to presence of sunk and fixed cost in export business. Interaction terms these trade liberalization variables with the extent to which firms are engaged to the international business (export and import) are introduced. The positive sign is expected for these interaction terms on the wage skill premium.

As mentioned in Section 2, engaging into the global production sharing can have an implication on the wage skill premium. Ideally, to capture the effect of global production network $\left(GPN_j\right)$ on wage premium, details at firm level (e.g. whether firms are actually engaged to MNEs' production network, whether they import tailor-made raw materials for specific customers, etc.) are needed. Unfortunately, such details at the firm level are not available for Thai dataset.

In this study, therefore, three alternative proxies are used; First, the share of parts and component imports to total imports $\left(GPN1_j\right)$ is used to indicate the extent to which an industry is engaged into the production network. The higher the imported share, the more important the global production network on the industry. Parts list is a result of a careful disaggregation of trade data based on the Revision 3 of the Standard International Trade Classification (SITC, Rev 3) extracted from the United Nations trade data reporting system (UN Comtrade database).[11] It is important to note that the Comtrade database does not provide for the construction of data series covering the entire range of fragmentation-based trade. Parts list used here is from that developed in Athukorala & Kohpaiboon (2009).[12] To convert SITC to ISIC, the standard concordance is applied.

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[11] For details on the decomposition procedure, see Athukorala (2005). The list of parts and components is available on request.

[12] Using lists of parts in 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.[12] Additional lists of parts are included based on firm interview in Kohpaiboon (2009). Data on trade in parts are separately listed under the commodity classes of machinery and transport equipment (SITC7) and miscellaneous manufacturing (SITC8). Based on firm interview in Kohpaiboon (2009).

Second, the ratio of parts trade (the sum of imports and exports) to total goods trade is used $\left(GPN2_j\right)$. This is due to the fact that firms might be engaged into the global production network as parts suppliers, focusing on parts import might mislead to a certain extent. Using trade instead of import would mitigate such a problem as well as acts as the robustness check for GPN proxy.

Third, zero-one dummy variable $\left(GPN3_j\right)$is used. The dummy variable equals to one for industries in electronics, electrical appliances, and automotive [13] and zero otherwise., It is these three industries, in which global production network takes place intensively as suggested by previous empirical studies (Athukorala, forthcoming; Kohpaiboon & Jongwanich, 2013).

As argued in Kohpaiboon (2009) and Kohpaiboon & Jongwanich (2013) based on the firm-case study analysis in Thailand, benefits firms could gain from the network are not automatic, largely depending on how active firms participate. Some firms gain substantial benefits from the network and smoothly move up from relatively simple to more complicated activities. Simultaneously there are the others that are trapped to a relatively simple unskilled-worker intensive activity. This would have significant impact of relative demand for skilled and unskilled workers. To examine this argument, the interaction term between $GPNi_j$ and $skillshare_{i,j}$ is introduced. $skillshare_{i,j}$ is used as a proxy to measure how active the firm participates in the network. That is, the higher the number of employed skill blue collar workers, the more active the firm. The positive sign of the interaction term is expected. All in all, the overall impacts of engaging into the global production network also depend on the proportion of skilled and unskilled workers varying across firms.

The final departure from Amiti & Davis (2012) is to introduce two additional industry-specific factors instead of heavily relying on industry-specific dummy.[14] The first one is industrial concentration (CR_j). In general, industries with high barriers to entry are likely to be concentrated as it would be relatively more difficult for new entrants to

[13] It includes ISIC 2911, 2913, 2915, 2919, 2921, 2922, 2923, 2924, 2925, 2926, 3000,3110, 3120, 3220, 3230, 3311, 3312,3313, 3320, 3330, and 3410.

[14] When these two industry-specific variables are introduced into the model, zero-one industry dummies turn out be statistically insignificant.

involve. Such industries are often capital and/or skilled intensive. Hence, in the highly concentrated industry, demand for skilled workers would be higher and the wage premium is observed. On the other hand, the effect of industrial concentration could be negative. As argued in the firm heterogeneity literature, productivity could vary across firms in a given industry. Over the period, low productivity firms would be faded out so that the observed industrial concentration would be the outcome that only high productive firms are operating. This could occur in the unskilled-worker intensive industry where developing countries like Thailand gain international competitiveness. In this study, industrial concentration is measured by the sum of sale share of top-4 firms to total.

Theanother industry-specific variable is output growth ($GROWTH_j$) and its interaction with $skillshare_{i,j}$ to capture dynamics in labor movement. In general, in industries which experience rapid output expansion, there would be greater demand for inputs including labor. Arguably it would be relatively easier for firms in a rapid-expansion industry to hire unskilled workers relative to skilled ones so that the negative sign would be expected. To test this hypothesis, both output growth ($GROWTH_j$) and its interaction with $skillshare_{i,j}$. The hypothesis would hold if the coefficients associated with output growth ($GROWTH_j$) and its interaction with $skillshare_{i,j}$ are negative and positive, respectively. That is, while output growth tends to narrow the wage premium, the impact on wage premium is less for the relatively skilled worker intensity.

All in all, the empirical model employed in this study is as followed;

$$\begin{aligned}(W_s/W_u)_{i,j} = {} & \alpha_0 + \alpha_1 inputtariff_j + \alpha_2 input\_IM_{i,j} + \alpha_3 outputtariff_j + \alpha_4 output\_EX_{i,j} \\ & + \alpha_5 GPN_j + \alpha_6 GPN\_Skillshare_{i,j} + \alpha_7 SIZE_{i,j} + \alpha_8 EX_{i,j} + \alpha_9 IM_{i,j} \\ & + \alpha_{10} Capital_{i,j} + \alpha_{11} FOR_{i,j} + \alpha_{12} femaleratio_{i,j} + \alpha_{13} Skillshare_{i,j} + \alpha_{14} region_{i,j} \\ & + \alpha_{15} CR_j + \alpha_{16} Growth_j + \alpha_{17} Growth_j\_Skillshare_{i,j} + \varepsilon_{i,j}\end{aligned}$$

where

$(W_s/W_u)_{i,j}$ = the wage premium of firm *i* in industry *j*, measured by the ratio between

wage compensation per workers of non-operation to operation workers (in
natural logarithm)

$inputtariff_j$ (+) = Tariff on raw materials in industry j

$input\_IM_{i,j}$ (+) = Interaction term between input tariff and the share of raw material imports of firm i in industry j

$outputtariff_j$ (+) = Tariff on finished products in industry j

$output\_EX_{i,j}$ (+) = Interaction term between output tariff and export share of firm i in industry j

GPN_j (?) = Degree that industry *j* is engaged into the global production network[15]

$GPN\_skillshare_{i,j}$ (+) = Interaction term between degree that industry engaged into the global production network and labor skill share

$SIZE_{i,j}$ (+) = size of firm *i* in industry *j* measured by output (in natural logarithm)

$EX_{i,j}$ (+) = the share of exports of firm *i* in industry *j*;

$IM_{i,j}$ (+) = the share of raw material imports of firm *i* in industry *j*;

$FOR_{i,j}$ (+) = foreign ownership of firm *i* in industry *j*; (1 = foreign firms; 0otherwise)

$Capital_{i,j}$ (+) = Capital of firm i in industry j (in natural logarithm)

$female\_male_{i,j}$ (+) = The ratio of female to male workers

$Skillshare_{i,j}$ (-) = Ratio of skill operational workers to total operation workers of firm *i* in industry *j*

$region_{i,j}$ (-) = Location of firm i in industry j (1 = Bangkok and Vicinity; 0 otherwise)

CR_j (?) = Industrial concentration of industry *j*, measured by the share of top-4 output
plants to total plants in industry *j*.

$GROWTH_j$ (-) = (Real) Output growth of industry *j*

$\varepsilon_{i,j}$ = Disturbance terms of firm *i* in industry *j*

[15] See full discussion of the variable measurement in Section 3.

5. 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, when our key interest is the wage premium, panel data at firm level with a comprehensive information on wage compensation and workers at the disaggregate level, i.e. workers are properly classified by unskilled, skilled, scientists and office workers.

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 number, 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 survey return, presumably because plants belonging to the same firm filled the questionnaire using the same records. The procedure followed in dealing with this problem was to treat the records that report the same value of the eight key variables of interest in this study, are counted as one record. The eight variables are registered capital, number of male workers, number of female workers, sale value, 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 drops to 65,940 plants.[16] In addition, we delete establishments which had not responded to one or more the key questions such as sale value, output and which had provided seemingly unrealistic

[16] 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.

information such as negative output value or the initial capital stock of less than 5,000 baht (less than $200).[17]

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 of which 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). Hence, our analysis focuses on samples with more than 10 workers net of self-employed firms. Seven (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 remained establishment plants accounted for 75% of the Thailand's manufacturing gross output and 62% of manufacturing value added in 2006.

In the census, Thai firms are reluctant to share wage compensation information. This is especially true for non-operation workers (white collars). There are only 13,809 samples providing both wage compensation for operation and non-operation workers. Among them, there are 2,940 firms that report compensation per operation workers greater than and equal to that of non-operation workers. It seems unrealistic to observe such a pattern given the definition of non-operation workers used in the census and labor market situation in Thailand where most of office workers attain the undergraduate degree and receive higher wage than those in the production line. Hence, those samples are excluded and the final sample size drops to 10,706 firms.

Gross output and its corresponding price deflators are from National Economics and Social Development Board (NESDB). The annual growth rate is based on gross output at constant price (1988). Trade data are compiled from UN Comtrade and the standard concordance between ISIC and HS is used. Nominal rate of protection is fresh calculated in this study based on official data provided by Custom Duty, Ministry of Finance. *CR4*

[17] If we alter to 10,000 baht the number to be dropped increased to 1,289 samples (another 500 samples dropped).

is obtained from Kophaiboon & Ramstetter (2008) in which the concentration is measured at the more aggegrate level (e.g. many measured at the 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 high level of disaggregation.

Our tariff data is at the 6-digit HS code level. To calculate tariff on raw material, concordance between 6-digit HS code level and input-output table is developed. The weight of inputs in each product is calculated by using information from IO table. The formula to calculate input tariff is as follows:

$$inputtariff_i = \sum_{i=1}^{n} a_{ij} t_i$$

where t_i = nominal tariff on product i^{th}

$\sum_{i=1}^{n} a_{ij}$ = the sum of the shares of intermediate inputs (1, …, n) in the output value of product j^{th}

Since the data from the industrial census is based on the TSIC classification, concordance between input-output and TSIC classifications is developed to obtain the input and output tariff in each industry. Tables 2 and 3 provide a statistical summary as well as a correlation matrix of all relevant variables in this analysis.

Table 2: Statistic Summary of the Variables used in the Econometric Analysis

	# Obs	Mean	Standard Deviation	Min	Max
$(Ws/Wu)_{ij}$	10757	0,7	0,59	0	5,47
EX_{ij}	24865	9,34	25,15	0	100
IM_{ij}	24865	8,06	21,44	0	100
FOR_{ij}	21813	1,08	0,28	1	2
$SIZE_{ij}$	21813	15,83	3,65	0	25,16
$Skill\_share_{ij}$	21813	0,69	0,4	0	1
$GPN1_j$	21813	0,02	0,09	0	1
GPN2j	21813	0,02	0,08	0	1
GPN3j	21813	0,06	0,23	0	1
$Female\_share_{ij}$	23851	0,54	0,29	0	1
$Capital_{ij}$	24865	15,41	2,52	8,52	24,51
$region_{ij}$	24865	0,63	0,48	0	1
$inputtariff_j$	24865	0,04	0,02	0,002	0,11
$outputtariff_j$	24865	0,06	0,06	0	0,3
CRj	21730	0,53	0,16	0,02	1
GROWTHj	21730	0,06	0,07	-0,18	0,31

Source: Authors' Calculation

Table 3: Correlation Matrix of The Variables used in the Econometric Analysis

	$(Ws/Wu)_{ij}$	EX_{ij}	IM_{ij}	FOR_{ij}	$SIZE_{ij}$	$Skill\_share_{ij}$	$Female\_share_{ij}$	$Capital_{ij}$	$inputtariff_j$	$outputtariff_j$	$GPN1_j$	$GPN2j$	$GPN3j$	CRj	$GROWTHj$	$region_{ij}$
$(Ws/Wu)_{ij}$	1,00															
EX_{ij}	0,09	1,00														
IM_{ij}	0,08	0,33	1,00													
FOR_{ij}	0,05	0,32	0,32	1,00												
$SIZE_{ij}$	0,08	0,27	0,23	0,23	1,00											
$Skill\_share_{ij}$	-0,05	0,00	-0,01	0,01	-0,07	1,00										
$Female\_share_{ij}$	0,09	0,23	0,08	0,06	-0,02	-0,03	1,00									
$Capital_{ij}$	0,08	0,29	0,25	0,29	0,55	-0,08	-0,01	1,00								
$inputtariff_j$	0,00	0,06	0,06	0,10	0,12	-0,01	-0,11	0,09	1,00							
$outputtariff_j$	-0,02	0,01	0,05	0,05	0,04	0,03	-0,15	0,00	0,39	1,00						
$GPN1_j$	0,01	0,08	0,09	0,10	0,09	-0,01	0,02	0,05	0,22	0,08	1,00					
$GPN2j$	0,01	0,06	0,11	0,11	0,08	0,01	0,01	0,06	0,22	0,13	0,91	1,00				
$GPN3j$	-0,01	0,06	0,14	0,14	0,07	0,03	-0,08	0,07	0,38	0,15	0,04	0,06	1,00			
CRj	0,00	0,01	0,11	0,05	-0,02	0,06	0,04	-0,03	0,05	0,14	0,07	0,08	0,24	1,00		
$GROWTHj$	-0,05	-0,09	0,00	0,06	0,00	0,02	-0,23	0,03	0,15	0,22	0,08	0,16	0,17	-0,01	1,00	
$region_{ij}$	0,05	-0,02	0,10	0,06	0,10	0,02	0,04	0,04	-0,01	0,01	-0,01	0,04	0,08	0,14	0,07	

Source: Authors' Calculation.

6. Results

The equations are estimated using the ordinary least squares (OLS) method while paying attention to the possible presence of outliers as well as the performance in functional form. Cook's Distance is applied here to identify suspected outliers. Table 4 provides all the estimation results. In general, all equations in Table 4 perform well in the overall fitness (Wald/F-test). The results with and without the Cook's Distance detected outliers are not much different except minor changes in statistical significance. Three alternative proxies of global production network yielded basically comparable results. The following discussion focuses on the results based on the trade share of parts and components to total $(GPN1)$. This choice was made on the basis of the better performance on overall fit.

The intercept is positive and statistically significant in all cases, suggesting that the wage skill premium is persistent. Wage compensation paid for white collar workers is on average 38-43 per cent higher than that for blue collar ones, given the other controlling factors.

The coefficient on output tariff is positive and statistically significant. The wage premium is relatively high in firms operating under the high output tariff. This would reflect unfinished business in tariff restructuring in Thailand. Despite targeting 3 tariff rates (0-1, 5 and 10 per cent), there are more than one forth of tariff lines yet in the 3 rates structure. When we examine top 20 in terms of output, they are rather capital intensive where there would be more demand for skilled workers. This finding is in line with neo-classical trade model, opening up to the international trade would lead to specialization across countries according to their comparative advantage. A coefficient on the interaction term with export share is statistically insignificant. This would not be surprised. In an industry where firms already export, output tariff is quite low. They are not capital intensive as opposed to those subject to heavy tariff protection.

Table 4: Estimations of Three Alternatives of Global Production Sharing Measures

	GPN1				GPN2				GPN3			
	with outliers		without outliers		with outliers		without outliers		with outliers		without outliers	
	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat
Intercept	0.43***	7,02	0.33***	7,11	0.42***	7	0.32***	7,05	0.42***	6,84	0.32***	7,02
$inputtariff_{j}$	-0,18	-0,61	-0.36*	-1,54	-0,181	-0,61	-0.35*	-1,48	-0,140	-0,45	-0.38*	-1,57
$inputtariff_{j*}IMij$	0,02	1,37	0.02**	2,08	0.015*	1,34	0.015**	1,97	0.015*	1,39	0.02***	2,75
$outputtariff_{j}$	0.17**	1,62	0.17**	2,08	0.17*	1,6	0.16**	2	0.18*	1,62	0.16**	1,99
$outputtariff_{j*}EXij$	0,00	0,19	0,00	-0,46	0,001	0,18	-0,001	-0,48	0,001	0,19	-0,001	-0,22
GPNij	-0,09	-0,93	-0.10*	-1,52	-0,038	-0,32	-0.13*	-1,37	-0,047	-0,88	-0.10***	-3,31
*GPNij*Skill_shareij*	0.21**	1,59	0.23***	2,56	0,162	1,03	0.28***	2,32	0,066	1,04	0.10***	2,64
SIZEij	0.01***	3,8	0.01***	8,89	0.009***	3,8	0.015***	8,99	0.01***	3,86	0.015***	9,16
EXij	0.001***	3,22	0.001***	3,41	0.001***	3,23	0.001***	3,26	0.001***	3,22	0.001***	3,1
IMij	0,001	0,98	-0,00004	-0,1	0,001	0,98	0,000	-0,12	0,001	0,97	0,000	-0,44
FORij	0.025**	1,34	0,01	0,5	0.03*	1,34	0,010	0,68	0.026*	1,37	0,013	0,93
$Capital_{i,j}$	0.02***	5,9	0.02***	6,1	0.02***	5,9	0.015***	5,89	0.021***	5,87	0.015***	5,77
$Female\_share_{,j}$	0.06***	6,41	0.06***	9,35	0.06***	6,37	0.063***	9,09	0.062***	6,44	0.064***	9,3
Skill_share i,j	-0.12***	-5,32	-0.12***	-6,58	-0.1***	-5,22	-0.11***	-6,46	-0.12***	-5,26	-0.11***	-6,44
$region_{i,j}$	-0.12***	-6,18	-0.05***	-3,55	-0.1***	-6,2	-0.051***	-3,66	-0.12***	-6,18	-0.052***	-3,76
CRj	-0.07***	-2,07	-0.06***	-2,28	-0.07**	-2,09	-0.06**	-2,07	-0.07**	-1,96	-0.054*	-1,91
GROWTHj	-0.55***	-3,04	-0.65***	-5,04	-0.55***	-3,02	-0.64***	-4,83	-0.53***	-2,9	-0.61***	-4,69
*GROWTHj*Skill_share i,j*	0.41**	1,83	0.56**	3,45	0.4**	1,77	0.53***	3,21	0.39*	1,73	0.50***	3,09
# of Obs	10636		10085		10636		10113		10636		10098	
R2	0,0469		0,0504		0,0468		0,049		0,0467		0,0517	
F-stat	28.37(p=0)		37.55(p=0)		28.42(p=0)		36.33(p=0)		28.64(p=0)		38.5(p=0)	
RESET	1.68(p=0.1699)		2.17(p=0.0897)		1.63(p=0.1799)		2.22(p=0.0832)		2.16(p=0.0901)		3.04(p=0.028)	

Notes: t-stat is based on robusted standard error; *, **, and *** indicate the statistical significant level at 10,5 and 1 per cent, respectively.
Source: Authors' Calculation

Note that the interaction term between output tariff and export share ($output\_Ex_{i,j}$) is positive but statistically insignificant. This could be a result of a larger reduction of tariff in sectors with a high proportion of unskilled workers so that in those sectors, domestic prices are long approaching to world prices. Incentives for resource allocation between export and firms who sell their products only in domestic markets are not significantly different. The wage skill premium between these firms is statistical indifferent.

When input tariff is concerned, the positive sign is found only when the input tariff is interacted with import share. It indicates that input tariff would have effect only on firms who actually import intermediates from abroad. The positive sign suggests that as intermediates are capital/skilled labor intensive so that firms which import them demand skilled workers are less. Lower tariff encourages firms to import intermediates.

The coefficient associated with GPN1 is negative and statistical significance while the interaction term between GPN1 and the share of skilled workers ($GPN1\_skillshare_{i,j}$) is positive and significance. The negative sign on the network variable with the positive sign on the interaction term would suggests that it is not necessary for plants in the network would have greater demand for skilled workers. They can be at the unskilled-labor intensive segment. This could cause worrisome for policymakers for being trapped in the low-end segment. However, plants which put greater effort tend to move up and demand for more skilled workers. On average, when we use the mean value of skill share in Thailand, we find the small positive value of the wage skill premium as a result of engaging into the network. This raises attention to policymakers in supplying adequate skilled workers available to ensure the sustainable development while participating into the global network.

In line with the firm heterogeneity literature, firm-specifics have significant on the wage premium. All these variables but importer and foreign ownership are statistically significant at the 1% per cent or better and in line with the previous studies. The wage skill premium in firms engaged to the global economy is generally higher than that in those entirely domestically oriented. Interestingly, exporting firms have higher wage premium than importing ones. Such asymmetry would be due to the fact revealed in a

number of case studies[18] that there are extra activities for firms engaging international market. A number of extra activities tend to higher for exporting firms, including negotiating with customers, bargaining, and overcoming day-to-day problems in the production line, arranging delivery schedules, and after-sale services. Generally, firms must hire some professionals with sufficient foreign language ability and invest certain infrastructures (personal computer, internet, satellites, etc.). All of these incur fixed and sunk cost to firms. Such extra activities would be far less for imports as opposed to exports as some activities are shared by their suppliers aboard.

The statistical significance of the firm size variable ($Output_{i,j}$) suggests that the larger the firm, the greater the wage premium observed. The positive sign of capital ($Capital_{i,j}$) reflects firms with having the higher degree of capital deepening would need more skilled worker in order to harness benefits of their capital deepening. This would widen the wage skill premium. As expected, the wage skill premium tends to be higher for rural area. For skilled/higher educated workers, extra wage compensation is needed to work in rural areas. Unskilled workers working in Bangkok and vicinity face higher cost of living so that wage compensation must at least cover it.

We cannot find the difference between foreign and local firms in our analysis. This might be the fact that foreign investment policy in Thailand is long open since the early 1960s. Foreign and local firms interact with each other long for workers. The difference that supposed to have on wage premium disappears. This is especially true after controlling for capital and size in the equation.

The negative and statistically significance of $Skillshare_{i,j}$ is in line with our hypothesis. Due to the way data collected, wage compensation for operation workers partly cover that of skill workers so that the denominator in the wage premium is inflated.

The effect of industrial concentration on the wage premium is found negative and statistically significant at 1 per cent in all cases. The negative estimate suggests that the observed high industrial concentration is the outcome of firm dynamics where top firms are all highly productive. The highly concentrated industry tends to be relatively

[18] See more detail in Kohpaiboon (2006), Kohpaiboon, et al. (2012) and Kohpaiboon and Jongwanich (2012). Such evidence was revealed, based on experience of firms in processed food, garment, hard disk drive, automotive industries. The interview period is between 2004-2012 and the sample covers all firm sizes.

unskilled-worker intensive. Firms in the industry experiencing rapid output expansion (high output growth) tend to have greater demand for workers. To rapidly materialize a growing business opportunity, worker demands are geared toward unskilled ones, thereby narrowing the wage premium. Nonetheless, the positive coefficient associated between output growth and $Skillshare_{i,j}$ suggests that it would be more difficult for already high-skill intensity plants to rely on hiring unskilled workers in response to the output expansion.

7. Conclusion and Policy Inferences

This paper examines the determinants of the wage skill premium, with an emphasis on the effect of global production sharing, one facet of the ongoing globalization, by using firm level data of Thai Manufacturing as the case study. Our results show that the impacts of engaging into the global production network on the wage skill premium varies among firms and tends to be an increasing function of a number of skill operation workers. When we use the mean value of skill share in Thailand, it shows that participation into the network requires more skilled workers than unskilled ones and slightly widens the wage skill premium within firms.

In addition, output tariffs matter in determining the industry wage skill premium across firms in Thailand. The positive result of this variable is in line with neo-classical trade model, where opening up to the international trade would lead to specialization across countries according to their comparative advantage and reduction in the wage skill premium. Reduction in input tariff could help to reduce the wage skill premium but only for firms who import their intermediate input. Our findings also support the important role of firm- and industry-specific factors on the persistence of the wage skill premium.

Our study inference raises policy awareness on managing globalization. While being a part of the global production sharing can bring in various benefits including technology and chance to moving up to more skill intensive activities, it is irrefutable for presence of risk of being trapped in low-end activities. To avoid the trap, the policy focus should be on adequate and qualified skilled workers supply to allow firms to harness benefit from

the global production sharing. The more the skilled workers available, the less likely the firms to be trapped. In addition, it is needed for public information dissemination about pros and cons of being a part of global production sharing as well as systematic case studies of both indigenous winners and losers. This is to avoid misunderstanding and misallocation of resources. Our result is also in favor for continued trade liberalization due to presence of developmental impacts on income inequality.

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CHAPTER 7

Globalisation and the Income Risk of Australian Workers

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We study the relationship between one particular aspect of globalisation (international trade) and labour income risk using eleven waves of the annual Household Income and Dynamics in Australia (HILDA) Survey data over 2001-2011. Based on within-industry variation over three sub-periods of the data, we find some evidence for a positive correlation between import penetration and Australian workers' income risk across sectors. The positive correlation is stronger for the manufacturing industries than for the services industries when permanent income risk is considered. The evidence is, however, less clear for the case of transitory income risk.

Keywords: globalisation, import penetration, HILDA, income risk, Australia

JEL Classification: F16, F23, E24

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1. Introduction

The study in this report investigates the empirical relationship between globalisation and individual income risk faced by Australian workers as import competition increased. The aim of the study is to contribute to a better understanding of the effects of globalisation on domestic economic performance by considering a less frequently investigated channel through which globalisation may affect the welfare of domestic economy. While increased cross-border economic activities brought about by globalisation have many potential benefits such as improved allocational efficiency of resources, many have argued that they may also have some downsides. One particular downside that has increasingly received attention in the recent time is an increase in individual labour income risk. Globalisation may result in domestic workers facing higher economic uncertainty and income and therefore experiencing a reduction in their welfare even in the absence of lower average income. If such welfare reducing effect from increased income risk due to globalisation is significant and if it is not recognised during policy making then the resulting domestic policy response to globalisation may be suboptimal.

There is an extensive list of studies that look at how globalisation may be negatively associated with the incomes of workers in the domestic economies. However, most of these studies focus on the mean (or level) effects of globalisation. Thus, even if they have uncovered interesting and important findings on whether or not and how globalisation affects the level and distribution of incomes in the affected countries, they have been relatively silent with regards to how workers' income uncertainty may also increase as a result of globalisation. This is indeed rather disappointing because, as stressed by Menezes-Filho & Muendler (2011), "[a]t the

heart of welfare gains from trade is the expansion of consumption possibilities and the reallocation of production factors. Yet research to examine the impact of trade liberalization on workers' individual employment trajectories across employers over time is scant."

In theory, there are several reasons why changes in trade openness may affect individual labour income volatility. First, as a country opens its border, its import competing sectors become more exposed to the volatility of the international markets. Second, increased foreign competition may increase the demand elasticity of labour through the increased demand elasticity of products. In that case, shocks to labour demand would lead to a higher volatility in labour market outcomes. On the other hand, globalization may be associated with a lower level of individual income volatility if the international aggregation of shocks across countries resulted in a lower overall volatility. In other words, the link between globalization and individual income uncertainty is an empirical question waiting to be solved. Furthermore, because the relationship may vary from country to country, it is important to investigate the issue using individual micro data from many different countries.

This study applies a similar empirical methodology employed in of recent studies on Australian household longitudinal data.[2] Hence, the main focus of the study is on the link between the permanent component of labour income risk and the domestic economy's exposure to international competition. The focus on the permanent income risk is made because unlike the transitory income risk, workers would be less able in mitigating the shock and thus the potential welfare consequences of permanent income

[2] The labour income risk estimation part of the methodology follows those of earlier studies such as Carroll & Samwick (1997), Gourinchas & Parker (2002), and Meghir & Pistaferri (2004).

shocks are likely to be more significant. For example, workers may be able to reduce the impacts of transitory risks by smoothing their consumption overtime through savings or borrowings. In addition, there are public or private unemployment insurance schemes that, as in the case of consumption smoothing, reduce any transitory shocks to labour income risk.

To our knowledge, there is no existing study of the topic based on Australian data. The use of the Australian data to study the income risk – globalisation link allows us to make a number of important contributions to the literature. First, it provides us with the perspective of a small, open developed economy with less diversified export industry than the United States. With those characteristics, Australian workers may suffer more severe negative impacts of import competition in terms of increased income volatility. On the other hand, given that in Australia labour protection is (arguably) relatively strong, the negative impacts of globalisation on labour income volatility may be less severe. Second, the Australian data also allow us to investigate the differential effects between manufacturing and non-manufacturing sectors which may exist.

The findings of the study can provide important information for evaluating whether or not there is a need to better address the short-run adjustment to globalisation in order to minimize any associated welfare loss. There is strong evidence that globalisation can be associated with increased income inequality in both developed and developing countries. At the same time, increased globalisation can also be associated with domestic workers having to face higher economic uncertainty and volatility of their incomes and, therefore, a lower welfare even if there is no significant average income effect. If that is the case, the set of policies required to attenuate such

negative effects is likely to be different than the set of policies designed to attenuate the negative effects on income distribution. The rest of the report is structured as follows. Section 2 briefly reviews the literature on the link between international trade and labour income risk. Section 3 discusses the empirical methodology and the data. Section 4 presents the results. Section 5 concludes.

2. International Trade and Labour Income Risk

Economists generally agree that there is significant welfare benefit from international trade. However, many people are concerned with how increased trade from globalisation could negatively impact their job security (Felbermayr, *et al*. 2011). For example, many American workers fear that globalisation could worsen their prospects on the labour market (Scheve & Slaughter, 2001). To some extent such fear can rationalised (Felbemayr, *et al*. 2011). Those who lost their jobs because of trade liberalisation would need to spend some time actively searching before they could find new jobs. During this transition period, labour market reallocations increase the amount of frictions in the labour market resulting in even higher unemployment rate and longer transition time.

There is an extensive literature on the relationship between globalisation and income in the domestic economies. However, the main focus of the literature is on the mean income effects of globalisation rather than the effects on income volatility. Feenstra & Hanson (2002), Davidson & Matusz (2004), Goldberg & Pavcnik (2007), and Harrison (2007) provide a thorough survey of the literature and the summarised

research efforts have uncovered interesting and important findings on whether or not and how globalisation affects the level and distribution of incomes in the affected countries. They have been relatively silent with regards to whether or not and how workers' income uncertainty may also increase as a result of globalisation.

Recent studies such as Krishna & Senses (2009) and Krebs, *et al*. (2010) are particularly interesting because they investigated how globalisation may increase labour income risk. They argue that in theory there are a number of channels through which changes in trade openness may affect individual labour income volatility. First, as a country opens its border, its import competing sectors become more exposed to the volatility of the international markets. For example, responding to changes in international patterns of comparative advantage change, the domestic factors of productions in more open economies would need to reallocate across sectors and across firms further. If otherwise similar workers experience different outcomes of such reallocations, labour income uncertainty would increase (Fernandez & Rodrik, 1991).

Second, increased foreign competition may increase the demand elasticity of labour through the increased demand elasticity of products. In that case, shocks to labour demand would lead to a higher volatility in labour market outcomes (Rodrik, 1997; 1998; Traca, 2005). There are several studies which have tested for the impact of increased openness on the price elasticity of labour demand (see, for example, Hatzius, 2000, Bruno, *et al*., 2004, Riihimäki, 2005, Senses, 2006, and OECD, 2007 as cited in Molnar, *et al.*, 2008). They found that the demand for labour has become more elastic over time as a result. However, Molnar, *et al.* (2008) pointed out at the

possibility for two offsetting forces to work that both increase and decrease domestic labour demand elasticities such that ultimately it is an empirical question to resolve.

On the other hand, globalization may be associated with a lower level of individual income volatility if the international aggregation of shocks across countries resulted in a lower overall volatility. Furthermore, because the relationship may vary from country to country (for example, Haddad, *et al*. 2009 found that if a country has sufficient diversifications, trade openness would not increase output volatility), it is important to investigate the issue using individual micro data from many different countries.

Davidson & Matusz (2012) studied the link between labour market mismatch and globalisation — an issue that they argued to have received little attention. In the study they showed that the effects of globalisation on domestic labour market sorting can be ambiguous. This finding is important because, as argued by the authors of the study, there is a strong public belief that globalisation may lead to a break-down in the employer-employee matching process that can lead to workers being forced take "less than ideal jobs". Based on the finding, we may infer that, at least if income risk is a function of labour market sorting, the effects of globalisation on income risk are also ambiguous. If globalisation-displaced workers can find new jobs without any significant wage cut in a short period of time—that is if there is no significant sorting disruption, then the welfare implications of globalisation is not significant (Liu & Trefler 2011). In reality, Hummels, *et al*. (2010) found in their study of the Danish labour force from 1995-2006 that those workers displaced by offshoring experienced greater and more persistent income loss than workers displaced for other reasons.

We can expect that labour mobility plays a key role in how globalisation is linked to workers income (McCaig & Pavcnik 2012). There are several theoretical papers which built upon the work of Davidson, *et al.* (1988) in order to examine how trade affects labour market reallocation under institutional frictions (Menezes & Muendler, 2011). For example, Kambourov (2009) and Helpman, *et al.* (2010) found that labour reallocation after trade liberalisation depends on the characteristics of domestic labour market institutions such as firing costs and search frictions. However there is not much evidence with regards to how labour reallocates across firms in response to increased export opportunities arising from globalisation. It is possible that such reallocation counteracts the worker reallocation effects from increased import competition, leaving us with ambiguous effects on labour income risk.

The existing literature of the impacts of globalisation including studies which look at income risk is also still limited from the sectoral coverage point of few (Pavcnik, 2011). Almost all of the studies which look at the relationship between globalisation and income risk are based on workers data in the manufacturing sector only.[3] This is in part due to data availability. As discussed by Pavcnik in her survey of the literature, there is little empirical evidence on how trade in services affected wages due to the inherent difficulty in measuring services trade (Jensen, 2009) at the required detail level for empirical analysis. Another reason is the notion that the manufacturing sector is the traditional tradable sector and one may expect that manufacturing is the most

[3] Kletzer (2005) raised another important issue that a more realistic view to study the effects of globalisation is the one that realises the "importers" are often also the exporters. In the U.S., for example, electrical machinery and equipment, motor vehicles, and electronic computing equipment sectors are among the top exporters and importers. She believed there is no obvious way for knowing whether or not a given worker is trade displaced and the common view that "trade-related job loss is commonly understood to mean job loss due to increasing imports, and a trade-displaced worker is a worker for whom increased imports have contributed to job loss" is too simplistic.

sensitive sector with regards to globalisation effects. For example, Liu & Trefler (2011) found that globalisation's negative effect is more severe in the manufacturing sector because in the services sector worker sorting on unobservables is more important. However, the above arguments does not mean that we should ignore any potential negative effects of globalisation on workers' income risks in other sectors beside manufacturing because the manufacturing sector only accounts for less than 10% employment in many developed countries. Also, Pavcnik (2011) argued that since we expect services trade to continue growing, how such trade affects wages would stay as one of topics of future research.

For the case of Australia, there is not much that has been done on the relationship between globalisation and labour income risk. Relevant studies based on Australian data such as the study of Webber & Weller (2001) mostly belong in the group that looks at the income level effects. This is unfortunate because it has been found that the labour market is significantly rigid or if a high minimum wage is instituted, then the globalisation effects on labour income level and risk may be attenuated. The overall effects of globalisation may depend on the features of domestic labour markets. With significant labour market rigidities and binding minimum wage, one may expect a greater effect on the level of (un)employment and a smaller effect in terms of wage adjustment (Davis, 1998; Moore & Ranjan, 2005; OECD, 2005).

Given that in Australia labour protection is (arguably) relatively stronger than in the two countries studied earlier, the negative impacts of globalisation on labour income volatility may be less severe. However, Australia is also a small, open, developed economy with less diversified export industry than the United States. Hence, one may expect that Australian workers may suffer more severe negative

impacts on income volatility. On the other hand, McClaren & Newman (2002)—who modeled the effect of increased international openness on risk bearing when risk-sharing is instituted only via self-enforcing agreements—found that on balance, globalisation reduces risk and raises welfare for workers in small countries, but increases risk and reduces welfare for workers in large countries. All of these suggest that even for the case of Australia, how globalisation is related to labour income risk is still an open question.

3. Empirical Methodology and Data

Income risk

As discussed earlier, we apply a similar framework used by Khrisna & Senses (2009) and Krebs, *et al*. (2010) to estimate Australian workers' income risk using longitudinal data from a household survey. First, denote the log of labour income of individual *i* in industry *j* in time period *t* (month) by y_{ijt}. Then the earning equation for that worker can be specified as

$$y_{ijt} = \alpha_{jt} + \beta_t x_{ijt} + u_{ijt} \qquad (1)$$

where α_{jt} and β_t are time-varying coefficients, x_{ijt} is a vector of observed characteristics (age, gender, education, work experience, industry dummy, etc.), and u_{ijt} is a stochastic term of individual earnings representing changes to labour income that are not due to changes in observable characteristics (that is, u_{ijt} measures the extent of income risk). Notice that α_{jt} also varies by industry in order to capture any persistence industry level effect, however β_t is assumed to be constant across industries in order to save degrees of freedom.

Second, the income risk (the stochastic term, u_{ijt}) is assumed to be composed of two unobserved components as follows:

$$u_{ijt} = \omega_{ijt} + \mu_{ijt} \qquad (2).$$

The first 'error' component (ω_{ijt}) represents the permanent income risk (permanent shocks to income) and the second component (μ_{ijt}) represent the transitory shocks. In particular, we assume that the permanent income shocks are permanent because the shocks follow a random walk:[4]

$$\omega_{ij,t+1} = \omega_{ijt} + \varepsilon_{ijt} \quad (3)$$

where ε_{ijt} is independently identically distributed across time and individuals as $\varepsilon_{ijt} \sim N(0, \sigma_{\varepsilon j}^2)$. On the other hand, the transitory component is assumed to be independently identically distributed across time as $\mu_{ijt} \sim N(0, \sigma_{\mu j}^2)$.

Based on the above specifications, the estimates of $\sigma_{\varepsilon j}^2$ and $\sigma_{\mu j}^2$ provide us with the estimated magnitudes of permanent and transitory labour income risk faced by each individual worker in each industry *j*. Notice also that in equation (1) industry dummies are included as a control variable in x_{ijt}. This is to ensure that we control mean income changes and the associated volatility in the changes of the mean income of the industry. In other words, the risk estimates we obtain reflect idiosyncratic income risk experienced by workers

In order to estimate $\sigma_{\varepsilon j}^2$ and $\sigma_{\mu j}^2$, first note that from (2) - (3) the change in the residual of log income of individual *i* in industry *j* between period *t* and *t+n* is given by

[4] Given the limited time series in our data, in our empirical application we could not investigate other less restrictive "permanent" structures such as autoregressive and/or moving average structures instead of random walk.

$$\Delta_n u_{ijt} = u_{ij,t+n} - u_{ijt} = \varepsilon_{ij,t+1} + \cdots + \varepsilon_{ij,t+n} + \mu_{ij,t+1} - \mu_{ij,t+n} \quad (4)$$

and, its variance ($var[\Delta_n u_{ijt}]$) is given as

$$var[\Delta_n u_{ijt}] = \sigma^2_{\varepsilon j,t+1} + \cdots + \sigma^2_{\varepsilon j,t+n} + \sigma^2_{\mu jt} + \sigma^2_{\mu j,t+n} \qquad (5)$$

which, based on the distributional assumptions on μ_{ijt} and ε_{ijt}, equals to

$$var[\Delta_n u_{ijt}] = (2\sigma^2_{\mu j}) + \text{n } \sigma^2_{\varepsilon j}. \qquad (6)$$

In other words, the variance of income changes over the *n*-period is a linear function of *n* where the slope is equal to $\sigma^2_{\varepsilon j}$ and the intercept (and any unobserved random error in (6)) is $2\sigma^2_{\mu j}$.

For estimation, equation (6) can be estimated by regressing $var[\Delta_n u_{ijt}]$ (measured by the squared of income differences between periods *t* and *t+n* regardless of their employment status in any intermediate period) on the period *n.* The regression in (6) can be run for each industry separately to obtain estimates of the permanent component of labour income volatility faced by workers in each industry ($\sigma^2_{\varepsilon j}$). More importantly, with a long period panel data, we can divide the panel data into several sub-panel (denoted by *s*) and run the regression for subintervals of the data to obtain time-varying estimates of the permanent income volatility ($\sigma^2_{\varepsilon js}$).

GMM estimation of income risk

Another alternative to measure income risk that has been used in existing studies relies on the GMM estimation method. The crucial assumption in arriving at equation (6) is that income shocks ($\sigma^2_{\varepsilon j}$ and $\sigma^2_{\mu j}$) are time-invariant. A more realistic assumption is to allow them to vary overtime by applying a GMM estimation based on the moment conditions in equation (5). As described by Krebs et al. (2010) and used by Meghir & Pistaferry (2004) and Storesletten, *et al*. (2004), the equally weighted minimum

distance (EWMD) estimator of the time-varying income shocks can be obtained by minimizing

$$\sum_{t,n}\left(var\left[\Delta_n u_{ijt}\right] - \left(\sigma^2_{\varepsilon j,t+1} + \cdots + \sigma^2_{\varepsilon j,t+n} + \sigma^2_{\mu jt} + \sigma^2_{\mu j,t+n}\right)\right)^2. \quad (7)$$

Unfortunately, as in the case of Krishna & Senses (2009) and Hogrefe & Yao (2012), we do not have enough sample size to obtain reliable estimates of the annual industry level labour income risks using the GMM approach describe above. Hence, following earlier studies, we use the OLS approach described earlier and time variation of the risk is measured by splitting the sample into three sub-periods.

Effects of globalisation

Given the time-varying[5] estimates of permanent income volatility in industry j and sub-panel period s and the corresponding import penetration data ($M_{js} = imports/(shipment - exports + imports)$, we can specify a linear regression model incorporating both sectoral and sub-period fixed effects to estimate the impact of globalisation on labour income volatility:

$$\sigma^2_{\varepsilon js} = \delta_s + \delta_j + \delta_M M_{js} + \epsilon_{js}\ . \qquad (8)$$

The intuition to equation (8) is simply that we want to control for any time invariant sector wide effect that may determine industry level labour income risk while not wiping all industry-specific effects of the industries in the sector given that we only have data on the broader 2-digit classification and thus relatively low cross-industry variation. The time dummy is to control wider, time varying effects that may affect

[5] The time variation comes from variation across the subpanel. Permanent income risk is assumed to be constant within subpanel.

income risk such as macroeconomic fluctuations and other economic wide changes unrelated to time variation in import penetration.

The way equation (8) is specified means that there is a potential endogeneity bias in its estimation when import penetration is not fully exogenous to income risk, such as when it is a result of endogenous choice of trade policies (Krishna & Senses, 2009 and Krebs, *et al*., 2010). For example, a country with a strong labour union and a labour party government may implement a trade policy which protects more highly unionised industries which are at the same time more stable in terms of labour market outcomes fluctuations. Hence, it is crucial to include industry fixed effects so that δ_M is identified by the within-industry, rather than between-industry, variation. However, there is still another potential bias even with fixed effects estimation. For example, the government might set a higher level of import protection for an industry experiencing a higher intrinsic income risk. In this case, the fixed effects may not be adequate because the government responds to a change in income risk by changing the level of protection. However, if the government may increase import protection for industries experiencing increased labour income risk, then it also means a lower import penetration is associated with a lower income risk. In other words, the endogeneity bias goes against the hypothesis that globalisation increase income risk. Furthermore, there might also be bias arising from worker's self-selection bias (workers more tolerant to income volatility self-select into more import competitive industries) but again in this case the bias goes against the hypothesised positive link between import penetration and income risk. In fact, Krishna & Senses (2009) and Krebs, *et al*., (2010) argued that any form of unobserved endogeneity bias in equation (8) is mitigated by the use of the fixed effects and the fact that the distribution of workers within an

industry is not likely to be correlated with the variation in the level of import penetration. They also argued that there is little evidence that workers with different unobserved abilities tend to systematically self-select into industries according to different level of import penetration. This last point is evidenced by the lack of any systematic relationship between changes in unexplained portion of industry average wages and changes in import penetration.

Data

HILDA

The empirical estimation is based on a rich, Australian household panel database from the Melbourne Institute that was constructed using data collected from the annual Household, Income, and Labour Dynamics in Australia (HILDA) Survey over the period of 2001 – 2011. The HILDA Survey began in 2001 and its design followed those of household panel surveys in other countries as described in more detail in Wooden & Watson (2007). The sample of the survey is drawn from Australian households residing in private dwellings. There were as many as 7682 households interviewed in the first wave ('Wave 1') in 2001, with a response rate of 66%. In each sampled household, all eligible household members (aged over 15) form as the basis of individual panel to be followed in each subsequent wave. Overall, 92% of household members (13,969 individuals) responded to the interviews in Wave 1 and this sample size varies between 12,408 and 13,301 over the survey years due to deaths, non-responses, and the incorporation of new sample members.

More importantly for our purpose is that the HILDA data provide detailed information at the household and individual levels including wages, industry of

employment (2 digit classification), education, health and marital status, and number of children were collected at each wave. We can, for example, estimate labour income based on the survey's information on current weekly gross wages and salary for the main job and the hours worked per week in the main job (Watson, 2008). Because we are interested in estimating labour income risk and to facilitate comparison with other studies, we restrict the sample to males age 25-65 and females age 25-60. The different age range between male and female is to take into account the time age pension benefits in Australia becomes effective. In addition, as in Krebs, *et al*. (2010), we Winsorise the sample by dropping individuals with income below the 5^{th} percentile and above the 95^{th} percentile. After dropping observations with missing values in all dependent and independent variables, we ended up with a total sample size of 54,800.

Table 1 provides a descriptive summary of the sample. Slightly more than half of the individuals in our sample are males. Their average age is around 41 years old and, as in other developed countries, they completed around 13 years of schooling. In terms of labour market experience, our samples have on average 24 years of work experience and earn an average of income of around $37,667 in 2001-02 increasing to around $59,141 in 2011-12.

Table 1: Sample Descriptive Summary

		Wave 1: 2001-02			Wave 11: 2011-12		
		N	Mean	Std. Dev.	N	Mean	Std. Dev.
Male			53%	50%		52%	50%
Education	Number of schooling years		12,8	2,3		13,3	2
Age	Years		40,7	9,5		41,9	10,3
Work experience	Years after left school		24	10,1		24,4	11,1
Wages	Gross wages & salaries (year)		$37.667	$21.426		$59.141	$34.441
Sample size		5265			6340		
Resources (10)		276			279		
Manufacturing (15)		690			5417		
Services (50)		4299			6340		

Note: (): Number of industries within each sector.

Import Penetration

To measure the extent of import penetration, we use the input-output tables published by the Australian Bureau of Statistics (ABS 2006; 2008; 2012). These tables provide data on current values of imports and domestic production for 109 to 112 industries in 2001-02, 2004-05, and 2008-09. We compute import penetration as the share of imports to total domestic supply (import + Australian production). However, because the HILDA data only provide breakdown of 75 industries (most of which are in services), some aggregation of the industries are necessary. After a manual concordance between the two data sources, we have import penetration measures for 41 industries. The simple average of import penetration levels across these industries and the level for each industry within manufacturing are provided in Table 2.

Table 2: Import Penetration

.	2001-02	2004-05	2008-09	Δ2001-05	Δ2005-09
Resources	0,085	0,07	0,077	-0,015	0,007
Services	0,018	0,028	0,034	0,01	0,006
Manufacturing	0,254	0,268	0,305	0,014	0,037
Food, Beverage, Tobacco Mfg.	0,103	0,113	0,135	0,01	0,022
Textile, Clothing, Footwear, Leather Mfg.	0,439	0,56	0,559	0,121	-0,001
Wood, Paper Product, Mfg.	0,217	0,205	0,196	-0,012	-0,009
Printing, Publishing, Recorded Media	0,112	0,112	0,105	0	-0,007
Petroleum, Coal, Chemical Mfg.	0,332	0,372	0,391	0,04	0,019
Non-metallic Mineral Product Mfg.	0,144	0,12	0,133	-0,024	0,013
Metal Product Mfg.	0,106	0,131	0,131	0,025	0
Machinery, Equipment Mfg.	0,538	0,557	0,593	0,019	0,036
Other Manufacturing	0,292	0,37	0,502	0,078	0,132

Note: Import Penetration is defined as the proportion of imports as parts of total domestic supply.

From Table 2, across the periods, it appears the services industry had the least amount of competition from abroad. However, note that services industry's import penetration doubled during the decade, perhaps reflecting increased global trade activities in the services industry. The manufacturing industry is clearly the industry which received the highest level of import penetration (25.4 to 30.5 % over the period), at around 10 times the rates of penetration in services and 3 times the rates in resources industry. In other words, we may expect that if globalisation affects labour income risk, it would be more likely to be observed from workers in the manufacturing industry. Furthermore, within the manufacturing industry, textile and apparel, petroleum and chemical, machinery and equipment, and other manufacturing are the ones with the highest level of competition from imports.

The last two columns in Table 2 show the change in import penetration ratio between two adjacent sub-periods. First, over the 2001-09 periods, import penetration increased for the manufacturing and services sectors. In the resources (agriculture and

mining) sector, import penetration decreased by around 17 per cent between 2001-02 and 2004-05 and increased slightly between 2004-05 and 2005-09.

Another important point from Table 2 is that there is a significant cross-sectoral variation in the changes in import penetration ranging from a 17% decrease in resources between the first two sub-periods to a 56% increase in services in the same time period. However, the within sector cross-industry variation is not as high. For example, in the manufacturing sector, the changes in import penetration ratio range from a decrease of around 16% for non-metallic mineral products manufacturing in 2001-05 to an increase of around 35% for other manufacturing. Note also that the variation is even lower when we exclude industries with negative risk estimates as discussed later. What these mean is that if we use industry fixed effects instead of sectoral fixed effect in order to estimate equation (8), we might not have enough variation in our data to identify the effects of import penetration on labour income risk.

4. Results

Income Risk Estimates

Table 3 presents the estimated coefficients of the basic specification of the earning equation (equation 1) in which the β coefficients are constant over time in order to gauge the predictive power of the explanatory variables. The actual estimation of income risk will be based on a time-varying β and, for space consideration, the full set of time varying β coefficient estimates are not presented here.[6] What is important

[6] These results are available from the author upon request.

from Table 3 is that the sign of the coefficients estimates are as expected. Male workers are on average earning more than female workers. Similarly for older and more experience workers, reflecting their higher marginal productivity.

Table 3: Earnings Equation Estimates (Dep. Var = log (wage in last financial year))

	Coeff.	Std. Error
Male	0.381***	0,006
Married	0.047***	0,006
Union member	0.234***	0,006
Age	0.009**	0,004
Education	0.068***	0,004
Work experience	0.012**	0,005
Work experience squared	-0.004***	0
CONST	8.574***	0,099
Number of observation.	54800	
Adj.R^2	0,33	

Note: The regression allows for time varying slopes and interactions between time and industry; however, only the main effects are shown in the table. Also included in the regression are spoken English ability, number of dependents age 0-24, time, industry and state dummy variables. The symbol *** means the estimate is statistically significant at the 1% significance level.

In Table 4 we present the transitory and permanent income shocks estimates (and their associated standard errors) across industries for the three subpanels (2001-03, 2004-06, and 2007-09) computed based on the one-, two-, and three-period ahead of changes on the residuals of the estimated regression equation (1) for each individual worker in the sample. Note that those estimates for the sectors level (Resources, Manufacturing and Services) are simple averages of the industry level estimates within each sector.[7] From the table, we can see that income shocks vary across time and industry. As found in other studies, permanent income shocks are relatively much

[7] Also, note that the sector level standard errors are simple average of the standard errors of the industries within the sector.

smaller than transitory income shocks. However, it does not appear that permanent income shocks are larger on average in traditionally tradable sectors with higher import penetration rate such as Manufacturing. Finally, not that some of the shocks estimates are negative such as the permanent shocks estimate for Textile, Clothing, Footwear and Leather in 2004-06 (-0.0118). Earlier studies who used a similar approach also found negative risk estimates. While we do not know why this is the case, we can report that most of the negative estimates are not statistically significantly different from zero based on their standard errors. Later in our estimation of equation (8), we assess the sensitivity of our estimates by excluding industries with negative risk estimates.

Table 4: Income Shocks Estimates: Permanent and Transitory

	2001-03		2004-06		2007-09	
	Perm.	Trans.	Perm.	Trans.	Perm.	Trans.
Resources	0,0178	0,1333	0,0286	0,0594	0,0064	0,1742
	(0.0096)	(0.0116)	(0.0157)	(0.0143)	(0.0431)	(0.0225)
Services	0,0173	0,1557	0,0204	0,1046	0,0315	0,0838
	(0.0091)	(0.0114)	(0.012)	(0.0113)	(0.0255)	(0.0138)
Manufacturing	0,0113	0,1114	0,0128	0,0874	0,0318	0,0544
	(0.0075)	(0.0148)	(0.0112)	(0.0105)	(0.0263)	(0.0142)
Food, Beverage, Tobacco Mfg.	0,0032	0,1498	0,0136	0,0892	0,0286	0,05
	(0.0051)	(0.0062)	(0.0077)	(0.0072)	(0.0147)	(0.0081)
Textile, Clothing, Footwear, Leather Mfg.	0,0174	0,2331	-0,0118	0,2506	0,0536	0,0622
	(0.0181)	(0.0218)	(0.0271)	(0.0253)	(0.0441)	(0.0239)
Wood, Paper Product, Mfg.	0,0117	0,1718	0,0093	0,0745	-0,0127	0,1656
	(0.0118)	(0.0139)	(0.0112)	(0.0102)	(0.0403)	(0.022)
Printing, Publishing, Recorded Media	0,0138	0,0817	0,0318	0,0346	0,0554	0,0007
	(0.0062)	(0.0078)	(0.0113)	(0.0105)	(0.0216)	(0.0115)
Petroleum, Coal, Chemical Mfg.	0,0124	0,0622	0,0013	0,0948	0,031	0,0492
	(0.0054)	(0.0069)	(0.0083)	(0.0079)	(0.0241)	(0.0135)
Non-metallic Mineral Product Mfg.	0,0104	0,0354	0,0096	0,0125	0,0093	0,0446
	(0.004)	(0.0049)	(0.0028)	(0.0027)	(0.0136)	(0.0076)
Metal Product Mfg.	0,008	0,0468	0,004	0,0828	0,005	0,081
	(0.0033)	(0.004)	(0.0078)	(0.0072)	(0.0175)	(0.0097)
Machinery, Equipment Mfg.	0,0056	0,1502	0,0262	0,0782	0,006	0,0825
	(0.0053)	(0.0064)	(0.0089)	(0.0082)	(0.0141)	(0.0076)
Other Manufacturing	0,0188	0,0713	0,031	0,0693	0,1096	-0,046
	(0.009)	(0.009)	(0.0152)	(0.0152)	(0.0463)	(0.0243)

Note: Resources, Services and Manufacturing figures are simple average of the industries within each sector. The figures in the parentheses are the corresponding (average of) standard errors.

Table 5 provides a comparison of Australian labour income risk estimates in the manufacturing industries with those of the United States, Germany and Mexico as reported in earlier studies (Krishna & Senses, 2009; Krebs, *et al.*, 2010; Hogrefe & Yao 2012). Keeping in mind that the studies may use widely different estimation methods, measures of income and sampled individuals in estimating the risks, the

figures in Table 5 indicate that labour income risks in Australia is smaller than that of the US and Mexico. Perhaps this is an indication of a stronger role of labour union in Australia. Germany's estimates appear to be the smallest, especially the ones based on 1999-2005. It should be noted however that in the study "income" is measured by the (minimum) wage rate rather than actual take home income.

Table 5: Comparisons with Risk Estimates from Other Countries

	AUS 2001-2009		US 1993-2003	GER 1999-2005	1991-2005	MEX 1987-1998	
	Perm.	Trans.	Perm.	Perm.	Perm	Perm.	Trans.
Manufacturing	0,012		0,052	0,004	0,008	0,052	0,440
Food, Beverage, Tobacco	0,009	0,111	0,052	0,004	0,019	0,052	0,440
Textile, Clothing, Footwear, Leather	0,019	0,182	0,060	0,004	0,016	0,028	0,416
Wood, Paper Product	0,014	0,122	0,042	0,003	0,005	0,036	0,456
Printing, Publishing, Recorded Media	0,018	0,069	0,056	0,004	0,007	0,044	0,536
Petroleum, Coal, Chemical	0,001	0,076	0,047	0,003	0,010	0,040	0,380
Non-metallic Mineral Product	0,010	0,030	0,044	0,003	0,002	0,044	0,452
Metal Product	0,005	0,070	0,044	0,004	0,006	0,012	0,440
Machinery, Equipment	0,014	0,108	0,042	0,004	0,010	0,020	0,352
Other Manufacturing	0,021	0,087	0,084	0,004	0,000	0,020	0,572

Note: Germany (GER) estimates are simple averages of the estimates from Hogrefe and Yao (2012). Mexico (MEX) estimates are simple averages of annualised quarterly estimates from Krebs, *et al*. (2010). United States (US) estimates are simple averages of annualized monthly estimates from Krishna and Senses (2009).

Effects of globalisation

Table 6 summarises the coefficient estimates of the fixed effects model in equation (8). Unlike earlier studies, for the dependent variables we use both the industry level of permanent (Model 1A and 1B) and transitory income shocks (Model 2A and 2B) in order to assess whether or not transitory shocks are affected by globalisation to the

same extent.[8] The "All" sample estimates (Model 1A and 2A) show the effects of import penetration when we use all of the industries for which we have labour income risk estimates. The "Shocks>=0" sample estimates (Model 1B and 2B) exclude those industries which income shocks (variance in unexpected income change) estimates are negative. From the table, the results show weak evidence (at 10% significance level) that import penetration are positively related to labour income risk when measured using permanent shocks. However, the relationship is stronger when we exclude industries with negative shocks estimates.

Table 6: Effects of Globalisation: Three Sub-period Panel Data (2001-03, 2004-06, 2007-09)

Dependent variable:	**Permanent shocks**		**Transitory shocks**	
	Model 1A	Model 1B	Model 2A	Model 2B
Import penetration	0.121*	0.234***	0,177	0.259**
	(0.064)	(0.053)	(0.179)	(0.127)
CONST	0,006	-0,001	0.129***	0.128***
	(0.006)	(0.005)	(0.016)	(0.012)
Sample	All	Shocks>=0	All	Shocks>=0
N. Obs.	123	104	123	117
R^2 -within	0,146	0,395	0,251	0,259
R^2 -between	0,007	0,004	0,008	0,018

Note: All regressions include 39 to 41 industry fixed effects and two period dummy variables corresponding to 2004-06 and 2007-09. Robust standard errors are in parentheses. The signs *,**,*** denote statistically significant estimates at 1, 5, or 10% significance level respectively.

According to Model 1B's estimates in Table 6, on average, a one-percentage point increase in import penetration ratio (equivalent to slightly less than a ten per cent

[8] If they are affected significantly, then the efficiency of potential mitigating schemes that individuals can use becomes an important issue for policy consideration.

increase in average import penetration) is associated with an increase in permanent income risk from, for example, a cross-industry and cross-period average of 0.020 by 0.234. In standard deviation term, this is equivalent to a change from the 0.141 to 0.484. This is more than doubling in the standard deviation as a result of around 10% increase in import penetration is significant in magnitude. For comparison, Krebs, *et al*. (2010) found that a 5% reduction in tariff is associated with a 30% increase in the standard deviation of unexpected income change.[9]

To investigate cross-sector variation, we re-estimated equation (8) with the manufacturing and services industries separately. Table 7 summarises the estimation results for the manufacturing industries. As before, we estimate the models with and without industries with negative shocks estimates and for permanent and transitory shocks separately. For permanent shocks, the results strengthen our earlier findings. Higher import penetration is associated with higher permanent income risk. In contrast, the transitory shocks estimates have the opposite signs. We do not have any explanation for these surprising result; possibly it reflects the severely small sample we have and the fact that, by definition, the transitory risk estimates include measurement errors.

[9] If imports demand elasticity with respect to tariff is -1, with an average import penetration ratio of 12.5% in our data and assuming domestic output stays the same, the 10% increase in import penetration rate is equivalent to 20% of tariff reduction.

Table 7: Effects of Globalisation: Manufacturing Sector (2001-03, 2004-06, 2007-09)

Dependent variable:	**Permanent shocks**		**Transitory shocks**	
	Model 1A	Model 1B	Model 2A	Model 2B
Import penetration	0.360***	0.336***	-0.595***	-0.920**
	-0,08	-0,086	-0,165	-0,361
CONST	-0.096***	-0.088***	0.288***	0.386***
	-0,024	-0,025	-0,049	-0,105
Sample	All	Shocks>=0	All	Shocks>=0
N. Obs.	27	25	27	26
R^2 -within	0,591	0,714	0,459	0,366
R^2 -between	0,011	0,037	0,264	0,36

In Table 8 we present the coefficient estimates for the services industries only sector. Unlike in the case of the manufacturing industries, the results are more consistent with the whole economy estimates discussed earlier. Also, for services, it appears that transitory shocks are more important than permanent shocks. Furthermore, comparing the results in Tables 7 and 8, we can conclude that the relationship between import penetration and permanent income risk is weaker in the services sector.

Table 8: Effects of Globalisation: Services Sector (2001-03, 2004-06, 2007-09)

Dependent variable:	**Permanent shocks**		**Transitory shocks**	
	Model 1A	Model 1B	Model 2A	Model 2B
Import penetration	0,04	0.189***	0.414***	0.363***
	(0.042)	(0.054)	(0.092)	(0.08)
CONST	0.017***	0.019***	0.149***	0.159***
	(0.003)	(0.003)	(0.008)	(0.007)
Sample	All	Shocks>=0	All	Shocks>=0
N. Obs.	84	70	84	79
R^2 -within	0,142	0,306	0,456	0,48
R^2 -between	0	0,036	0,002	0,008

Note: All regressions include 28 industry fixed effects and two period dummy variables corresponding to 2004-06 and 2007-09. Robust standard errors are in parentheses. The signs *,**,*** denote statistically significant estimates at 1, 5, or 10% significance level respectively.

5. Conclusion

This study investigated the link between globalisation and Australian labour income risk, focusing on one particular aspect of globalisation namely international trade. Using individual level Australian longitudinal income data over 2001-2011, we estimated the extent of individual income risks measured as the variance of unexpected change in income in the next period.

We obtained both permanent and transitory income risk estimates from the residuals of a Mincerian income equation model for 41 two-digit Australian industries in the resources, manufacturing and services sectors. We then relied on within-industry variation to identify the relationship between import penetration and income risk by estimating fixed effect models of income risk.

We found statistically and economically significant evidence that increased import penetration is associated with increased permanent income risk. This relationship appeared to be robust across sectors. Also, the effects appeared to be stronger in manufacturing than in services.

However, for transitory shocks, the relationship is more mixed when we estimated the relationship for separate sector (that is, when we had a smaller sample size). We obtained a negative relationship for manufacturing and a positive one for services. We believed this might be due to the fact that in our model the transitory shocks estimates also captured measurement errors. Also, for services, the positive relationship between import penetration and transitory income risk appeared to be stronger than the relationship between import penetration and permanent income risk.

Policy implications

Unfortunately, our study did not investigate how specifically higher level of import penetration may lead to increased labour income risk. Hence, we are only able to make general policy inferences. First, while we do not perform any welfare estimation, based on the findings of other studies (Krebs, *et al*. 2010, Krishna & Senses, 2009) we expect the positive relationship between import penetration and labour income risk to have significant negative welfare consequences on Australian workers. As have been argued in this paper and earlier studies, this does not mean that there is no gain from trade and that Australia needs to shun itself away from global trade. Instead, it means that the country needs to be ready in anticipating such negative effects of globalisation in terms of increased transitory and permanent income risk by implementing policies that can mitigate them.

For trade liberalisation policy considerations, our findings that the negative impacts of globalisation may occur across sectors, including those in which import penetration is much less significance stress the importance for policy makers to pay attention to workers in all sectors regardless of their expected changes in the level of import penetration. When transitory shocks increase as a result of globalisation, the efficiency of existing market and non-market mechanisms which enable individuals to self-insure themselves against such fluctuations is important. Our results seem to indicate that this is particularly the case for workers in the services industries. On the other hand, for manufacturing, individuals' ability to cope when they are hit by permanent income shocks is more important. In this case, policies that mitigate labour reallocation effects by reducing the "down time" from employment are desirable.

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CHAPTER 8

Globalization and Wage Inequality: Firm-Level Evidence from Malaysia

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This study attempts to provide an empirical analysis of globalization and wage inequality in Malaysia using three sets of firm-level data from the manufacturing sector. There is some evidence, albeit relatively weak, of a positive relationship between average wage levels and exporting. The evidence on a positive relationship between trade liberalization and wages is stronger especially for skilled workers. However, the hiring of foreign workers is associated with lower average wage levels for skilled workers. Thus, the key policy challenge in Malaysia is the continued emphasis on the enhancement of exporting via trade liberalization without depending on foreign workers.

***Keywords*:** Globalization, Trade, Wage Inequality, Manufacturing

***JEL Classification*:** F12, F16, E24

1. Introduction

The impact globalization on inequality has long been a major topic of interest to policymakers and academic researchers in both developed and developing countries. Underlying this interest is a concern about whether globalization is, on the whole, beneficial. Even though the theoretical arguments highlighting the benefits of trade have been around for a long time, the empirical evidence on the distributive impact of trade continues to be inconclusive.[1] This is partly due the inconsistency between findings from the empirical literature and implications from traditional trade models such as the Heckscher-Ohlin (HO) model.[2] As a consequence, recent theoretical models especially those incorporating heterogeneous firms have taken up the challenge of explaining the impact of trade on wage inequality (Harrison, *et al.*, 2011). For some time, the empirical literature has lagged behind theoretical developments in this area. This is mainly due to the fact that the data required to test the new theories are fairly demanding.

The purpose of this study is to provide further empirical evidence on the relationship between globalization and wage inequality in a developing country by analyzing firm-level data from the Malaysian manufacturing sector. In this study, globalization at the firm-level is a multi-dimensional concept. This study will focus on exporting. Wage inequality is examined in terms of wage distribution across heterogeneous firms (globalized, non-globalized) and heterogeneous workers (with different observable characteristics).

To the author's knowledge, the proposed study will be first study on the topic using Malaysian firm-level data. Malaysia's experience is an interesting one given that it is an Asian developing economy which is smaller than other often-studied middle-income developing countries in South America such as Brazil and Mexico. It also has relatively less unskilled workers compared to other countries in the Southeast

[1] For example, in the *Wealth of Nations*, Adam Smith argued that trade is mutually beneficial (theory of absolute advantage) and can enhance productivity and growth (vent-for-surplus theory). See Hollander (1973, pp.268-269).

[2] Recent empirical literature suggests that the growing wage gap between skilled and unskilled workers in developing countries is inconsistent with the Heckscher-Ohlin (HO) model (Goldberg & Pavcnik, 2007, p.59)

Asian region such as Indonesia. The three datasets used in this study are from the World Bank's *Enterprise Survey* (WBES2006) and the Economic Planning Unit's *Malaysian Knowledge Content Survey* (MKCS2002 and MKCS2006).

A number of specific research questions are posed in this study. These are drawn from the existing literature and selected based on data constraints. The set of research questions addressed in this proposed study comprises the following:

- Do exporters pay higher wages than non-exporters? (exporter wage premium)
- Is wage inequality between high-skilled workers and low skilled workers affected by exporting? (skill wage premium)

This study will also examine additional aspects of globalization such as foreign participation and trade liberalization. The outline for the rest of the paper is as follows. The Malaysian labor market is discussed in Section 2. Section 3 will provide a review of the relevant literature. This will be followed by a discussion of the methodology adopted in this study in Section 4. The findings of this study are reported in Section 5. Policy conclusions are drawn in Section 6. Section 7 concludes the paper.

2. Malaysia: Development and Labor Markets

The Malaysian economy has grown at a relative moderate rate of around five percent since the early 1990s (**Table 1**). This has been accompanied by macroeconomic stability. Both the inflation rate and unemployment rate (which together makes up the "misery index", has be relatively low during this period. There has been, however, a gradual change in the country's economic structure that has raised some concerns amongst the country's policymakers.

Table 1: Malaysian Economy - Structure and Performance, 2000-2010

GDP Share (%)	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Agriculture, Livestock, Forestry and Fishing	8.6	8.5	8.3	8.4	8.2	8.0	7.9	7.5	7.5	7.7	7.3
Mining and Quarrying	10.6	10.3	10.2	10.3	10.0	9.5	8.8	8.5	7.9	7.5	7.0
Manufacturing	30.9	29.4	29.0	30.0	30.7	30.7	30.9	29.9	28.8	26.6	27.6
Construction	3.9	4.0	3.9	3.8	3.5	3.3	3.1	3.1	3.1	3.3	3.3
Utilities	3.0	3.1	3.1	3.1	3.1	3.1	3.1	3.0	2.9	3.0	3.0
Wholesale and Retail Trade, Hotels and Restaurants	13.4	13.7	13.5	13.0	13.2	13.7	13.8	14.7	15.5	16.0	16.0
Transport, Storage and Communication	7.0	7.4	7.3	7.2	7.3	7.3	7.4	7.5	7.7	8.0	8.0
Finance, Insurance, Real Estate and Business Services	13.5	14.1	14.7	14.5	14.2	14.6	15.0	16.0	16.2	17.2	17.2
Other Services	6.0	6.2	6.1	6.0	5.9	5.8	5.7	5.7	5.7	6.0	5.9
Government Services	6.3	6.6	6.6	6.7	6.6	6.8	7.0	6.9	7.2	7.6	7.5
Less : Undistributed FISIM	4.9	4.9	4.5	4.4	4.2	3.9	3.9	3.9	3.8	4.2	4.1
Plus : Import Duties	1.6	1.6	1.7	1.6	1.4	1.3	1.1	1.1	1.3	1.2	1.3
GDP at Purchasers' Prices	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Annual GDP Growth Rate (%)	8.3	0.5	5.4	5.8	6.8	5.3	5.8	6.5	4.8	-1.6	7.2
Inflation Rate (%)	1.5	1.4	1.8	1.2	1.5	3.0	3.6	2.0	5.4	0.6	1.7

Source: Department of Statistics.

The manufacturing sector's share of GDP has decline in recent years (**Table 2**). The country continues to rely on trade as an important source of economic growth in which the manufacturing sector is a major contributor. In 1990, the sector's share of exports was 81 percent but this had declined to 68 percent by 2010. This trend has alarmed policy makers who are concerned that Malaysia is "deindustrializing" prematurely. As Malaysia is still a middle income country, will this development work against the country progress towards achieving a developed country status? (i.e. the so-called "Middle-Income Trap").

To some extent, this problem is related to the labor market in Malaysia. In the past, the country - a relatively small economy - was driven in no small measure by its export-oriented industrialization policy. At its initial stage, this policy relied on low-skilled assembly operations especially in the electronics and electrical sector. However, over time, as education levels gradually edged upwards - the labour force participation rate began to decline, thus reducing labour supply. This trend is still evident today (**Table 3**). The policy response to this tightening in the domestic labour supply has been a strategy of greater reliance on foreign labour. For example, it has been estimated that foreign workers accounted for as high as 17.5 percent of the labour force in 2008 (World Bank, 2012, p.49). They accounted for a quarter of the labour force in the manufacturing sector (ibid, p.49).

Whilst cheap foreign labour was indeed a early source of the country's manufacturing competitiveness, it has later become an obstacle to efforts to upgrade the manufacturing and other sectors in the economy. Upgrading the country's manufacturing sector requires workers that are productive, innovative and well-paid (World Bank, 2012). Access to cheap foreign labour could have prevented employers from upgrading their production technology (more capital intensive) and investing in human capital development. The country's addiction to cheap foreign labour could also have suppressed wages of lower skilled in the labor market. A consequence of this could be a worsening of wage inequality.

Table 2: Malaysian Economy - Export Structure, 2000-2010

Export Composition	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Food	1.7	2.0	2.1	2.1	2.1	2.0	1.9	2.3	2.7	2.9	2.8
Beverages and Tobacco	0.3	0.4	0.4	0.4	0.3	0.3	0.3	0.4	0.4	0.4	0.4
Crude Materials, Inedible	2.8	2.3	2.4	2.6	2.6	2.6	2.9	2.7	2.7	2.4	3.0
Mineral Fuels, Lubricants, etc.	9.6	9.7	8.6	10.1	11.6	13.4	13.7	14.4	18.3	14.4	16.0
Animal and Vegetable Oils and Fats	3.5	3.7	5.0	6.1	5.5	4.6	4.7	6.5	8.6	7.9	8.5
Chemicals	3.8	4.3	4.7	5.2	5.6	5.8	5.6	6.0	6.0	6.0	6.3
Manufactured Goods	6.9	7.2	7.0	7.0	7.7	7.3	8.1	8.7	8.9	8.9	8.8
Machinery and Transport Equipment	62.5	60.7	60.2	56.8	54.5	54.0	52.5	49.0	43.2	46.8	43.9
Miscellaneous Manufactured Articles	8.0	8.7	8.5	8.5	8.6	8.4	8.5	8.6	8.4	9.4	9.5
Miscellaneous Transactions and Commodities	0.8	1.1	1.2	1.3	1.4	1.5	1.7	1.4	0.9	0.8	0.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.8
Manufacturing Export Share (%)	81.3	80.9	80.4	77.5	76.5	75.5	74.7	72.3	66.5	71.2	68.5

Source: Department of Statistics.

Table 3: Malaysia - Population and Labour Market Indicators, 2000-2010

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0-14 Years	8,003	7,880	7,893	7,891	7,881	7,857	7,824	7,791	7,757	7,724	7,828
15-64 Years	14,560	15,293	15,846	16,400	16,955	17,510	17,857	18,203	18,547	18,890	19,079
65+ Years	932	950	989	1,029	1,069	1,110	1,151	1,193	1,236	1,282	1,427
Total Population ('000)	23,495	24,123	24,727	25,320	25,905	26,477	26,832	27,186	27,541	27,895	28,334
Population Growth Rate (%)	2.5	2.6	2.5	2.4	2.3	2.2	1.3	1.3	1.3	1.3	1.6
0-14 Years (%)	34.1	32.7	31.9	31.2	30.4	29.7	29.2	28.7	28.2	27.7	27.6
15-64 Years (%)	62.0	63.4	64.1	64.8	65.5	66.1	66.6	67.0	67.3	67.7	67.3
65+ Years (%)	4.0	3.9	4.0	4.1	4.1	4.2	4.3	4.4	4.5	4.6	5.0
Total Population (%)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Labor Force ('000)	9,556	9,699	9,886	10,240	10,346	10,413	10,629	10,890	11,028	11,315	11,517
Labour Force Participation (%)	65.4	64.9	64.4	65.2	64.4	63.3	63.1	63.2	62.6	62.9	62.7
Total Employment ('000)	9,269	9,357	9,543	9,870	9,980	10,045	10,275	10,538	10,660	10,897	11,129
Unemployment Rate (%)	3.0	3.5	3.5	3.6	3.5	3.5	3.3	3.2	3.3	3.7	3.4
Employment in Manufacturing ('000)	2,174	2,184	2,069	2,131	2,023	1,989	2,083	1,977	1,945	1,807	1,880
Manufacturing Employment Share (%)	23.5	23.3	21.7	21.6	20.3	19.8	20.3	18.8	18.2	16.6	16.9
Growth in Total Employment (%)		0.9	2.0	3.4	1.1	0.7	2.3	2.6	1.2	2.2	2.1
Growth in Manuf Employment (%)		0.5	-5.3	3.0	-5.1	-1.7	4.7	-5.1	-1.6	-7.1	4.0

Source: Department of Statistics.

There are currently very few studies which have examined these issues in great detail. Almost all rely on industry-level analysis e.g. Athukorala & Devadason (2012) and Mohamad (2010) or the use of household surveys data e.g. Said and Hamid (2011). Athukorala & Devadason (2012) provide industry-level evidence on the negative impact of foreign workers on wages of unskilled workers. This is borne out by the changes in average wage across occupational categories in the manufacturing sector during the period 2000-2005 (which roughly also coincides with of this study's data coverage).

Average wages at the managerial as well as the technical and supervisory levels seemed to have grown faster than for clerical, general and production workers (**Table 4**). A more qualitative analysis was undertaken by Mohamad (2010) who argued that wage inequality worsened during the 1995-2007 period and that this might be due to industry-level effects and job characteristics. In another study, Said & Hamid (2011) argued that micro-level evidence based on household surveys point to decreasing demand for professional workers (rather than technical workers) due to changes in technology.

There is clearly a need for more detailed micro-level evidence on wage inequality in the Malaysian manufacturing sector. The use of industry-level data precludes insights related to worker and firm characteristics whilst household survey lacks information on firm characteristics. A fuller picture awaits pending detailed studies utilizing worker and firm level data. This is the gap that the current study hopes to bridge. Current theoretical and empirical developments based on the heterogeneous firms framework further provides deep interpretation and insights. These are reviewed next.

Table 4: Labour Force Composition in Malaysian Manufacturing, 2000 and 2005

	2000			2005			Change (%)		
	Workers	Wages	Ave Wage	Workers	Wages	Ave Wage	Workers	Wages	Ave Wage
Managerial and professional	85,978	5,642,073	65,622	121,404	8,929,661	73,553	41.2	58.3	12.1
Technical and supervisory	174,631	4,725,659	27,061	190,918	5,856,233	30,674	9.3	23.9	13.4
Clerical and related occupation	98,740	1,735,504	17,577	108,532	2,245,188	20,687	9.9	29.4	17.7
General workers	55,536	713,899	12,855	73,145	1,044,571	14,281	31.7	46.3	11.1
Production/operative workers directly employed	1,030,773	12,038,029	11,679	966,571	12,459,342	12,890	-6.2	3.5	10.4
Production/operative workers directly employed through contractors	97,441	1,196,136	12,275	173,080	2,101,914	12,144	77.6	75.7	-1.1

Source: Department of Statistics.

3. Literature Review

The literature on globalization and inequality has primarily focused on the relationship between trade and wage inequality. The theoretical developments in recent years have evolved towards a stronger micro-foundational approach - one based on heterogeneous firms and more recently, heterogeneous workers in imperfect labour markets. Even though early empirical works by Bernard & Jensen (1995, 1999) predates Melitz's (2003) seminal theoretical contributions on heterogeneous firms, empirical analysis incorporating labour market imperfections is relatively recent. Thus, until recently, the empirical literature has lagged behind theoretical developments due the intensive data requirements of testing the new theories. The body of existing literature on micro analysis (theoretical and empirical), whilst not vast, is fairly substantial and has grown rapidly in recent years.

Given the diversity in the existing theoretical and empirical literature, it is perhaps useful to highlight some of the key elements within the literature. The first relates to "globalization". There are at least three distinct modes of globalization that have been analysed within the literature, namely, trade (exporting and/or importing), ownership (FDI) and offshoring (outsourcing and/or insourcing). Most studies have focused on exporting. As for "wage inequality", this has been analysed in terms of wage inequality between firms (with different modes of globalization), within firms (with composition of workers e.g. non-production/production, low/high skill, and occupational categories), within groups (across workers with identical observable characteristics) and between groups (across occupations/education background, workers with different characteristics).

In what follows, a review of some of the key micro theoretical and empirical contributions that are relevant to this study is undertaken.[3] For greater clarity, the review is divided into theoretical and empirical contributions (even though some works combine both elements). This will facilitate a discussion on the interactions between the two.

[3] For a more comprehensive review, the reader is referred to Harrison, *et al*. (2011).

3.1. Theoretical Literature

The starting point for most studies is Melitz's (2003) seminal contribution which highlighted how trade can result in resource re-allocation within an economy with heterogeneous firms. The paper is an important antecedent to the existing literature on globalization and wage inequality in terms of what is modelled (heterogeneous firms, productivity, selection and exporting) and what is left un-modelled (heterogeneous workers and imperfect labour market). A key element of Melitz's model that continues to influence the existing literature is the role of firm heterogeneity in exporting. In particular, only firms that are more productive will export after incurring a fixed cost (with the less productive firms exiting or serving the domestic market only). In Melitz (2003), workers are assumed to be identical and the labour market, perfect and frictionless. Wage inequality was not a focus of the paper, a challenge taken up by subsequent works.

The post-Melitz (2003) challenge in theorizing the impact of trade on wage inequality has focused on the modelling of the labour market and how it is linked to exporting. There is significant diversity in terms of how the labor market is modelled. The various models differ in terms of how the labor market is modelled.

In an early paper by Yeaple (2005), the labour market was assumed to be perfect (as did Melitz) and workers heterogeneous. In the study, workers are assumed to differ in terms of skill level (in terms of observable characteristics or some measure of quality of ability). Firm heterogeneity takes the form of identical firms adopting different production technology (high-tech/low-tech). Only firms employing high-technology and highly skilled workers will export. The theory predicts the existence of wage inequality across firms (exporters and non-exporters) and within firms (wage premium paid to skilled workers).

A slightly different model is that of Verhoogen (2008) in which firms are heterogeneous due to differences in productivity (exogenously determined and interpreted as entrepreneurial ability). In the paper, more productive firms will choose to produce higher quality products by hiring more skilled workers (white-collar)

compared to less-skilled workers (blue-collar). Thus, the theory predicts that wage premium for skilled workers to increase with exporting (due to quality upgrading).

In other works, the labor market is assumed to be imperfect (determination of wages) and with frictions (matching of workers with firms). In Davidson, *et al*. (2008), firms are ex ante identical but become heterogeneous through exogeneously determined adoption of technology (high-tech and low-tech firms). Heterogeneous workers (low/high-skilled) are randomly matched to firms. High-tech firms will export when matched with high-skilled workers. The theory predicts wage inequality between firms such that exporters will pay higher wages than non-exporters. Furthermore, the wage inequality within group (low/high-skilled wage premium) worsens as the outside opportunity of high-skilled managers in low-tech firms increase.

Egger & Kreickemeier (2009) assume that firms are heterogeneous in terms of productivity and workers are identical (ex ante). However, labour market is imperfect in the sense that efficiency wages are determined by firm-level productivity (exogeneously determined) through a fair-wage mechanism. This implies that wage inequality across firms is determined by differences in productivity. Furthermore, within-group (workers with same characteristics) are driven by differences in firms' productivity and exporting status.

In Amiti & Davis (2012), workers are identical but their wages are functions of firm performance through a fair-wage constraint. Firms are assumed to be heterogeneous in terms of productivity and firm-specific cost of penetrating foreign markets. Their theory predicts wage inequality between firms such that firms that export a larger share of their output or imports a higher share of inputs will have higher wages.

By far the most ambitious approach is that of Helpman, *et al*. (2010) who modelled labor market imperfections (wage bargaining) with frictions (search and match). In their model, exporting is driven by firm-level productivity that is assumed to follow a Pareto distribution. Firms with higher productivity and revenues (from exporting) have greater means to screen and pay for higher ability workers. Thus, for a given firm-level productivity, exporters pay higher wages. In addition, trade worsens wage inequality within each group of workers.

3.2. Empirical Literature

The empirical literature on trade and wage inequality is influenced by both the theoretical models advances as well as data availability. The latter is particularly crucial. The data used in existing studies are either plant/firm-level data or matched employer-employee data. Earlier published studies tend to use plant/firm-level data which can be used to understand wage inequality between firms (average wage differences exporters and non-exporters) and within firms (wage premium). Such analyses can also be undertaken with matched employer-employee data. However, in addition to these, matched employer-employee data can be used to investigate wage inequality in the context of labour market imperfections and frictions. These issues are analysed in terms of inequality in residual wages across worker groups and the presence of positive sorting (matching of workers to firms) in the labour market. In what follows, an attempt is made to link, as far as possible, the theories that are tested using the two types of data.

On a general level, a number of theories such as Yeaple (2005), Verhoogen (2008) and Davidson, *et al.* (2008) predict differences in wages paid by exporters and non-exporters. This is associated with the demand for more skilled workers due to firms adopting more advanced technology (Yeaple, 2005 and Davidson, *et al*., 2008) or produce higher quality goods (Verhoogen, 2008). There are at least two empirical approaches to test these predictions, namely exporter wage premium and skill wage premium.

3.2.1. Wage Inequality Between Firms - Exporter Wage Premium

The most commonly used approach is to test for exporter wage premium by regressing average wage levels of firms against a proxy for exporting. The early empirical papers using this approach pre-dates Melitz (2003). Using pooled plant-level data from the US during 1976-1987, Bernard & Jensen (2005) finds evidence of exporter wage premium. The study also found that the exporter wage premium is lower for two worker categories, namely, production and non-production workers. These results confirm the importance of worker composition.

More recent studies on exporter wage premium has utilized panel data using two types of alternative specifications – level (w_{it}) and differences (Δw_{it}). In the recent

study by Amiti & Davis (2012) using Indonesian panel data, trading status variables (exporting, importing) are interacted with changes in output and input tariffs (respectively) to examine how tariff changes affect wages. The study found that reductions in output tariffs increase wages in exporting firms whilst reduction in input tariffs reduces wages in import-competing firms. In another study by Frias, *et al*. (2012), exporter wage premium do not vary significantly across different quantiles of within firm wage distribution.

More recent studies using matched employer-employee data have extended the Bernard & Jensen (2005) approach in two ways. In Schank, *et al*. (2007), Munch & Skaksen (2008) and Martins & Opromolla (2012), the worker-exporter wage premium is estimated by regressing individual wages against exporting status, other firm characteristics and individual characteristics. Using German plant-level data, Schank, *et al*. (2007) found evidence of worker-exporter wage premium for both blue-collar and white-collar workers. The inclusion of an interacting exporting and skill intensity variable in Munch & Skaksen (2008) suggests that the worker-exporter wage premium is due to high-skill intensity in exporting Danish firms. In addition, Martins & Opromolla (2012) find the wage premium for export-only Portuguese firms are due to firms' characteristics such as size and sales. Another form of extension involves investigating the causal relationship between wages and exporting. In Schank, *et al.* (2007), the use of export entry (starter) variable in estimating the exporter wage premium enable the authors to show that higher wages preceeded exporting, thus confirming the existing evidence of selection to export (Greenaway & Kneller, 2007). Finally, to take into account endogeneous mobility of workes, matching fixed effects can be included. This is undertaken in the study by Frias, *et al*. (2012) which uses Mexican matched employer-employee data. Their study found that the incorporation of matching fixed effects reduces the impact of tariff reductions on the exporter wage premium.

3.2.2. Wage Inequality Within Firms - Skill Wage Premium

Another approach to test for differences in wages in exporting and non-exporting firms is through detection of the presence of wage skill premium for exporters. Both Verhoogen (2008) and Amiti & Cameron (2012) provides some evidence of this albeit their approaches are slightly different. In Verhoogen (2008), changes in the wage ratio

(for white collar/blue collar workers) are regressed against export share and other firm characteristics. In Amiti and Cameron (2012), both export status and an interactive export share-output tariff variable is used. Productivity appears to be an important explanatory variable within the wage skill premium literature. This is not surprising given the importance of productivity within the heterogeneous firm literature.

4. Methodology

4.1. Framework of Analysis

A framework of analysis to study relationship between globalization and trade can be drawn based on the existing theoretical and empirical literature. Underlying almost all the models is firm heterogeneity that based on differences in productivity due to adoption of technology (Yeaple, 2005 and Verhoogen, 2008).

Following Melitz (2003), only firms with higher productivity are capable of exporting due to fixed costs of exporting. It also possible that firms ability to export is due their capability to produce high quality products. However, firms can only achieve higher productivity and higher product quality when they employ highly skilled workers (or those with higher human capital). As exporting is associated with higher revenues, exporting could provide incentives to exporting firms to search for and employ higher skilled workers (Helpman, *et al*., 2010).

The above set-up implies that exporters are likely to pay higher wages than non-exporters. This leads to a prediction on the existence of exporter wage premiums. As exporters also demand more skilled workers, there is also likely to be a skill premium in both exporting and non-exporting firms.

4.2. Empirical Methods

The choice of empirical methods used in this study is based on prevailing approaches within the empirical literature, which in turn, is determined by theoretical considerations and data constraints. A stochastic dominance test is first used to

ascertain whether unconditioned wage levels are different between exporters and non-exporters. This is to be followed by econometric analysis of wage inequality between firms and within firms.

(a) Wage Levels and Globalization

The first task in this study is to determine whether there is differences in wage levels across firms with different globalization status such as exporting status and foreign/local ownership. This can be undertaken by employing a stochastic dominance test of the average wage distribution for exporters over the wage distribution for non-exporters.

Let F and G be the cumulative distribution functions of average wage (w) for exporters and non-exporters. The first-order stochastic dominance of F relative to G implies that:

$$F(w) - G(w) = 0 \qquad (1)$$

for all values of w, with strict inequality for some w.

The Kolgomorov-Smirnov test can be used for this purpose. Several measures of wage differences can be used, name:

- Average wage level - calculated by dividing total remunerations by total number of workers. This can be undertaken using both the MKCS and WBES datasets.
- Average wage level of workers in a given occupational category. The WBES data can be used to compute the average wage levels for different occupational categories such as management, professional, skilled, unskilled and unskilled.

The definitions are summarized in **Table 5**.

Table 5: Summary Explanations of Selected Variables

MKCS2002 & MKCS2006	
lnAveWage	Natural logarithm of average wage
Size	Total number of full time employees
R&D	1 for firms undertaking R&D activities, zero otherwise
Computer Use	Percentage of employees using computer at least once a week
Export Dummy	1 for firms exporting, zero otherwise
Export Share	Percentage share of exports in total revenues
Protect	Effectively applied tariffs obtained from World Bank's WITS database
RER	Effective real exchange rate

WBES2006	
lnAveWage	Natural logarithm of average wWage
Size	Size Total number of full time employees
R&D	1 for firms undertaking R&D activities, zero otherwise
Age Firm	Age of firm in 2006
Export Dummy	1 for firms exporting, zero otherwise
Export Share	Effectively applied tariffs obtained from World Bank's WITS database
Export Share	Percentage share of exports in total revenues
Management	Persons making management decisions (exclude supervisors)
Professional	Trained and certified specialists outside of management such as engineers,
	accountants, lawyers, chemists, scientists, software programmers.
	Generally, Professionals hold a University-level degree.
Skilled Production	Skilled production Skilled Production workers are technicians involved directly in the production
	process or at a supervisory level and whom management considers to be skilled.
Unskilled Production	Persons involved in production process whom management considers to be unskilled.
Non-production	Support, administrative, sales workers not included in management or among professionals.

Source: Author's compilation.

The data from the WBES2006 can be used to undertake the above tests to ascertain whether average wage levels in foreign-owned firms differ from those in locally-owned firms. Note that the results of these tests do not shed light on the sources of such differences. They merely indicate whether there are differences in wages between firms with different globalization status.

(b) Wage Inequality Between Firms: Exporter Wage Premium

Wage inequality between exporters and non-exporters can be estimated using specifications similar to the ones first used by Bernard & Jensen (1995), later extended in the works by Amiti & Davis (2012) and Frias, *et al.* (2012).

The specifications essentially entails regressing average firm wage against variables representing exporting (status or export share of revenues) and other firm characteristics such as firm size, firm size-squared, age of firm, ownership (foreign/local), R&D activity and ICT utilization e.g. computer utilization).

The simplest version utilizes cross-section data from the MKCS (2002, 2006) and WBES datasets. These are implemented via OLS regressions for the average firm-level wage *w* for firm *i* that operates in industry *k*, and location *l*:

$$w_i = \beta_1 EX_i + \beta_2 Protect_k + \beta_3 EX_i * Protect_k + \gamma \mathbf{Z}_i + \alpha_k + \varepsilon_i \qquad (2)$$

where *EX* exporting status, *Protect* a trade liberalization variable, **Z** firm characteristics (such as firm size, firm size-squared, age of firm, ownership (foreign/local), R&D activity and ICT utilization (i.e. computer utilization), α_k industry effects and ε_i error term.

A panel version incorporating real effective exchange rate (*RER*) can be estimated using the balanced-panel data from the MKCS datasets based on the following model:

$$w_{i,t} = \beta_1 EX_{i,t} + \beta_2 Protect_{k,t} + \beta_3 RER_t + \beta_4 EX_{i,t} * Protect_{k,t} + \beta_5 EX_{i,t} * RER_t + \gamma \mathbf{Z}_{i,t} + \alpha_{k,t} + \varepsilon_{i,t} \qquad (3)$$

Given the availability of information on occupational categories in the WBES2006 dataset, it is also possible to test for wage premium across these different occupational categories using the above specification (2). The occupational categories are management, professionals, skilled production, unskilled production and non-production. In addition, the impact of employment of foreign workers on wages can also be estimated.

(c) Wage Inequality Within Firms: Skill Wage Premium

The impact of trade on wage inequality within firm can be analyzed empirically by estimating the skill wage premium across the exporting and non-exporting firms. The dependent variable used in existing studies is essentially the log of the ratio of skilled and unskilled workers' wages (*log*(*ws*/*wu*)). The explanatory variables can be very similar to that used in estimating the exporter wage premium (see Amiti & Davis (2012) and Amiti & Cameron (2012)).

The specification for the skill wage premium can be expressed as follows for firm *i* operating in industry *k*, and location *l*:

$$\frac{w_i^s}{w_i^u} = \beta_1 EX_i + \beta_2 Protect_k + \beta_3 EX_i * Protect_k + \gamma \mathbf{Z}_i + \alpha_k + \alpha_l + \varepsilon_i \qquad (4)$$

where *EX* exporting status or export share of revenues, *Protect* a trade liberalization variable, **Z** firm characteristics (such as firm size, firm size-squared, age of firm, ownership (foreign/local), R&D activity, α_k industry effects, α_l location effects and ε error term. The OLS method is used to estimate the above equation.

The definitions of skilled and unskilled workers used depend very much on what worker classifications are available in the data used. In Verhoogen (2008), the two categories of workers are while-collar and blue-collar workers whilst in Amiti & Cameron (2012) it is nonproduction and production workers. Only the WBES has information on worker categories to estimate the skill wage premium. In the dataset, there are five categories of workers, namely, management (*ma*), professionals (*pr*), skilled production workers (*sp*), unskilled production workers (*up*) and nonproduction workers (*np*). The ratios constructed are based on theoretical considerations in terms of their role in various theories:

1. $\frac{w^{ma}}{w^{sp}}$ and $\frac{w^{ma}}{w^{up}}$: wage ratio of management workers to skilled production workers and unskilled production workers. Management workers may be

considered to be proxies for workers with some entrepreneurial ability to improve productivity and quality (Verhoogen, 2008).

2. $\frac{w^{pr}}{w^{sp}}$ and $\frac{w^{pr}}{w^{up}}$: *wup* : wage ratio of professional workers to skilled production workers and unskilled production workers. Professional workers may be considered to be highly skilled workers crucial for adoption of technology (Yeaple, 2005).

3. $\frac{w^{sp}}{w^{np}}$: wage ratio of skilled production and unskilled production workers. Skilled production workers could be crucial for adoption of technology and achievement of high levels of productivity.

4.3. Data

Two different sets of firm-level data are used in this study, namely, the World Bank's *Enterprise Survey* data (WBES) and the Economic Planning Unit's *Malaysian Knowledge Content Survey* (MKCS). The datasets used in this study have a minimum of 10 workers. The WBES data (WBES2006) covers the year 2006 and contains 1,073 firms from the manufacturing sector. The data can be matched to the employee survey which contains 10,615 observations. On average, 10 workers are sampled from each firm in the matched employer-employee data set. The MKCS data covers two years period, namely 2002 and 2006. The MKCS2002 and MKCS2006 contain 1,114 firms and 1,139 firms, respectively.

As the data sets used in this study do not come from manufacturing census or survey, some comments on the sampling methods used in these studies are in order. The respondents in the MKCS surveys were obtained from random sampling. A stratified random sampling is used in collecting the data for the WBES. The stratification is based on sector, region, state and industry. The WBES data contains more details on wages (renumeration) at both the firm-level (total wages earned by various categories of employees such as management, professional, skilled, unskilled and non-production (see **Table 5**). In addition, the WBES dataset contains information on individual wages and worker characteristics (e.g. age, ethnicity, gender, marital

status, foreign/local worker, education level and position). For the MKCS data, only total wage at the firm level is available.

Both the WBES and MKCS datasets contain information on the exporting status. However, only the WBES dataset has information on foreign ownership which is defined in this study as 10% or more the equity owned by foreigners. Both datasets have data on R&D even though they are recorded differently. In the MKCS datasets, firms state whether they undertake R&D activities while in the WBES dataset, firms state the amount of expenditure on R&D. The MKCS dataset has information on percentage of employees using computers at least once a week. The effectively applied tariffs at the two-digit level for year 2001 and 2005 are used as proxies for trade liberalization. This is obtained from World Bank's WITS database available online. Real effective exchange rates were obtained from International Financial Statistics, International Monetary Fund.

5. Results

5.1. Brief Summary Statistics

A brief summary statistics of the data used in this study is presented in **Table 6**. The datasets show some slight variations in firm size (measured in terms of number of full time employees). The mean firm size ranges from 203 to 232 employees in the datasets. Thus, the average firm in the datasets is a large firm (based on the Malaysian official definition of a large firm, namely those exceeding 150 employees).

The percentage of firms exporting in all three datasets is fairly high. There might be some sampling bias as the percentage of firms exporting is lower in census data. In the 2005 manufacturing census, the proportion of firms exporting is much lower, at around 16 percent to 49 percent across the different industries. In the case of foreign ownership, about a third of the firms in the datasets are firms with foreign participation (more accurately, have headquarters located outside Malaysia).

Table 6: Basic Descriptive Statistics

Size (no. employees)	Obs	Mean	Std. Dev.	Min	Max	
MKCS2002	1,114	203	401	10	6,086	
MKCS2006	1,139	232	570	10	9,879	
WBES2006	1,063	211	624	10	14,067	
Exporting Status	**Yes**	**%**	**No**	**%**	**Total**	**%**
MKCS2002	843	75.7	271	24.3	1,114	100.0
MKCS2006	645	56.6	494	43.4	1,139	100.0
WBES2006	651	61.8	403	38.2	1,054	100.0
Foreign Participation*	**Yes**	**%**	**No**	**%**	**Total**	**%**
MKCS2002	191	34.9	357	65.1	548	100.0
MKCS2006	200	31.9	428	68.1	628	100.0
WBES2006	337	31.4	736	68.6	1,073	100.0

**Note*: In MKCS2002 and MKCS2006, foreign participation is defined as firms with headquarters located outside Malaysia while in WBES, foreign participation is defined as firm with 10% of more equity owned by foreigners.

Source: Author's compilation.

5.2. Wage Levels and Globalization

The results from the application of the Kolgomorov-Smirnov (KS) on the datasets confirm that the average wage level in exporting firms are higher than those in non-exporting firms (see **Table 7**).

Table 7: Differences in Average Wage Between Exporters and Non-Exporters

MKCS2002, Average Wage per Worker			
Smaller Group	D	P-Value	
Non-Exporters	0.1614	0.0000	
Exporters	-0.0025	0.9970	
Combined K-S	0.1614	0.0000	0.0000
MKCS2006, Average Wage per Worker			
Smaller Group	D	P-Value	
Non-Exporters	0.1709	0.0000	
Exporters	-0.0047	0.9880	
Combined K-S	0.1709	0.0000	0.0000

WBES2006, Average Wage per Worker			
Smaller Group	D	P-Value	
Non-Exporters	0.1287	0.0000	
Exporters	-0.0028	0.9960	
Combined K-S	0.1287	0.0010	0.0000

Source: Author's compilation.

When the KS tests are carried out for different occupational categories using the WBES2006 dataset, differences between average wage paid by exporters and non-exporters continue to be observed (**Table 8**). It is interesting to note that, comparing across the different occupational categories, average wage gap between the exporters and non-exporters are largest in the management and non-production categories. Managers in exporting firms are essentially paid more than their counterparts in non-exporting firms. This perhaps indirectly confirms the assumptions made in many of the exiting theories about the emphasis on entrepreneurial/managerial abilities in exporting firms e.g. Yeaple (2005). However, it can also be observed that the large gap is also observed in the non-production category of workers. This could be due to the possibility that the depressive effect of low-skilled foreign workers on wages is more significant in non-exporting firms.

Results from the application of the KS test using the WBES2006 dataset also suggest that the average wage levels in firms with foreign participation are higher than in their local counterpart (**Table 9**). The wage gap is found to be particularly large in the management and non-production categories (**Table 10**). This is very similar to the pattern observed between exporters and non-exporters.

Table 8: Differences in Average Wage Between Exporters and Non-Exporters, by Occupational Categories

Management, Average Wage per Worker			
Smaller Group	D	P-Value	
Non-Exporters	0.1409	0.0000	
Exporters	-0.0077	0.9720	
Combined K-S	0.1287	0.0010	0.0000
Professional, Average Wage per Worker			
Smaller Group	D	P-Value	
Non-Exporters	0.0541	0.5150	
Exporters	-0.0351	0.7570	
Combined K-S	0.0541	0.8940	0.8720
Skilled Production, Average Wage per Worker			
Smaller Group	D	P-Value	
Non-Exporters	0.0805	0.0670	
Exporters	-0.0194	0.8550	
Combined K-S	0.0805	0.1340	0.1160
Unskilled Production, Average Wage per Worker			
Smaller Group	D	P-Value	
Non-Exporters	0.0785	0.0660	
Exporters	-0.0026	0.9970	
Combined K-S	0.0785	0.1320	0.1150
Non-Production, Average Wage per Worker			
Smaller Group	D	P-Value	
Non-Exporters	0.1126	0.0060	
Exporters	-0.0030	0.9960	
Combined K-S	0.1126	0.0130	0.0100

Source: Author's compilation.

Table 9: Differences in Average Wage Between Local and Foreign Firms

MKCS2002, Average Wage per Worker			
Smaller Group	D	P-Value	
Non-Exporters	0.1630	0.0000	
Exporters	-0.0183	0.9210	
Combined K-S	0.1630	0.0030	0.0020
MKCS2006, Average Wage per Worker			
Smaller Group	D	P-Value	
Non-Exporters	0.1808	0.0000	
Exporters	-0.0077	0.9840	
Combined K-S	0.1808	0.0000	0.0000
WBES2006, Average Wage per Worker			
Smaller Group	D	P-Value	
Non-Exporters	0.2313	0.0000	
Exporters	-0.0148	0.9080	
Combined K-S	0.2313	0.0000	0.0000

Source: Author's compilation.

Table 10: Differences in Average Wage Between Local and Foreign Firms, by Occupational Categories

Management, Average Wage per Worker			
Smaller Group	D	P-Value	
Non-Exporters	0.1621	0.0000	
Exporters	0.0000	1.0000	
Combined K-S	0.1621	0.0000	0.0000
Professional, Average Wage per Worker			
Smaller Group	D	P-Value	
Non-Exporters	0.1009	0.0580	
Exporters	-0.0411	0.6230	
Combined K-S	0.1009	0.1160	0.0970
Skilled Production, Average Wage per Worker			
Smaller Group	D	P-Value	
Non-Exporters	0.0715	0.1190	
Exporters	-0.0048	0.9900	
Combined K-S	0.0072	0.2380	0.2120

Unskilled Production, Average Wage per Worker			
Smaller Group	D	P-Value	
Non-Exporters	0.1231	0.0020	
Exporters	-0.0393	0.5380	
Combined K-S	0.1231	0.0050	0.0040

Non-Production, Average Wage per Worker			
Smaller Group	D	P-Value	
Non-Exporters	0.1732	0.0000	
Exporters	-0.0143	0.9220	
Combined K-S	0.1732	0.0000	0.0000

Source: Author's compilation.

5.3. Wage Inequality Between Firms: Exporter Wage Premium

The export dummy variable has a positive sign and is statistically significant in the OLS regression using the MKCS2002 dataset (**Table 11**). This is consistent with findings from studies in the literature such as Amiti & Cameron (2012) and Frias, *et al.* (2012). However, the variable is statistically insignificant in regressions using other datasets (MKCS2006 and WBES2006) even though the signs of the coefficients are also positive.

In the fixed-effects panel regression, the export variable has a positive sign and is statistically insignificant.[4] Overall, there is some evidence of an exporter wage premium albeit this evidence is a weak one.

The proxy variable for trade liberalization (protect variable) has a positive sign in the OLS regressions involving both the MKCS2006 and WBES2006 datasets (**Table 11**). In contrast, the variable is statistically insignificant and has a negative coefficient signs for both the WKCS2002 dataset and the panel regression (MKCS2002 and MKCS2006). The negative sign for interacting variable involving exporting and trade liberalization is more consistent across the different datasets and panel regression. However, the variable is only statistically significant for the MKCS2002 dataset. It can be concluded that whilst there is some evidence of a positive impact of trade liberalization on wage levels, this evidence is a weak one.

[4] A Hausman specification test was undertaken to select the appropriate panel regression method i.e. random or fixed effects GLS.

Table 11: Exporter Wage Premium - Cross Section Estimates

	(1)	(2)	(3)	(4)
	MKCS2002 Cross-Section	MKCS2006 Cross-Section	WBES2006 Cross-Section	MKCS2002 & MKCS2006 Panel
	OLS	OLS	OLS	GLS FE
Variables	lnAveWage	lnAveWage	lnAveWage	lnAveWage
Size	-0.00442	0.303*	0.111	1.062**
	(0.154)	(0.159)	(0.0905)	(0.458)
Size-squared	0.00421	-0.0310**	-0.0123	-0.137***
	(0.0145)	(0.0148)	(0.00969)	(0.0439)
Foreign	0.0722	0.0999	0.164***	0.0249
	(0.0525)	(0.0651)	(0.0458)	(0.143)
R&D	-0.186***	-0.0844	0.109*	-0.0272
	(0.0501)	(0.0609)	(0.0584)	(0.0680)
Computer Use	0.112***	0.0895***		-0.0629*
	(0.0204)	(0.0282)		(0.0347)
Export	0.310***	0.164	0.00297	0.129
	(0.105)	(0.113)	(0.0716)	(1.761)
Protect	-0.00759	0.0469***	0.00401	-0.0481
	(0.00999)	(0.0111)	(0.00623)	(0.0521)
Export*Protect	-0.0239***	-0.0121	0.00595	-0.00964
	(0.00817)	(0.00971)	(0.00544)	(0.0101)
RER				-0.00965
				(0.0212)
Export*RER				-0.000993
				(0.0166)
Constant	9.751***	8.437***	9.058***	9.708***
	(0.429)	(0.432)	(0.218)	(2.259)
Industry Dummies	Yes	Yes	Yes	Yes
Observations	520	614	1,041	1,134
R-squared	0.299	0.156	0.134	0.135

Notes: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Source: Author's compilation.

As for the foreign ownership variable, it has a positive coefficient in all cases but the variable is only statistically significant in the WBES2006 dataset. Larger firms are likely to be associated with higher wages up to a point (due to the negative sign of the size-squared variable).

The role of technology is a bit more complex. The R&D variable has a negative sign in the regressions involving the MKCS2002 and MKCS2006 datasets (cross-section and panel). However, the variable is only statistically significant for the MKCS2002 dataset. The explanation for the negative coefficient sign is that Malaysian firms could be involved in non-cutting edge type of innovation activities.

Interestingly, the computer use variable is statistically significant and has a positive sign in the cross-section results. Computer usage could be associated with higher skills. For example, Autor, *et al.* (2003) associates computerization with an increase in labor input of non-routine cognitive task. This result is thus consistent with emphasis on the importance of skills in both the theoretical and empirical literature.

In terms of wages by occupational categories, the exporter wage premium is statistically insignificant (**Table 12**). However, the proxy variable for trade liberalization has a negative sign and is significant for skilled production workers' wages. The sign and significance of the interactive exporting and trade liberalization variable for this occupation category also implies that trade liberalization are likely to be associated with higher wages for skilled production workers in exporting firms.

The inclusion of foreign employment share provides additional insights on the impact of foreign employment on wages. Overall, higher share of foreign employment is associated with lower average wages (**Table 12**). This is particularly true in the case of skilled production workers based on the negative sign and statistical significance of the variable for share of foreign employment of skilled workers.

5.4. Wage Inequality Within Firms: Skill Wage Premium

Most existing theories assume that exporting entails the hiring of high-skill workers which are associated with higher ability that enhances firm productivity and/or its product quality. One key problem with testing such theories empirically is that existing classification of workers may not correspond perfectly with the high skilled / low skilled dichotomy in the theoretical literature.

Table 12: Exporter Wage Premium by Occupational Categories

Variables	(1) WBES2006 All	(2) WBES2006 Management	(3) WBES2006 Professional	(4) WBES2006 Skilled Prod	(5) WBES2006 Unskilled Prod	(6) WBES2006 Non Prod
Size	0.118	0.659***	0.393**	0.158	0.112	0.501***
	(0.0893)	(0.130)	(0.182)	(0.125)	(0.128)	(0.149)
Size-squared	-0.0121	-0.0542***	-0.0240	-0.0136	-0.00728	-0.0488***
	(0.00955)	(0.0139)	(0.0183)	(0.0131)	(0.0137)	(0.0154)
Foreign	0.148***	0.123*	0.0732	0.0637	0.0662	0.124*
	(0.0451)	(0.0667)	(0.0769)	(0.0601)	(0.0635)	(0.0710)
R&D	0.0925	-0.0539	-0.0218	0.00630	0.00697	-0.185**
	(0.0575)	(0.0822)	(0.0902)	(0.0746)	(0.0818)	(0.0885)
Export	0.101	-0.125	-0.151	-0.101	-0.0190	0.0398
	(0.0762)	(0.103)	(0.130)	(0.0999)	(0.107)	(0.115)
Protect	-0.00363	0.00792	-0.00874	-0.0188**	-0.0119	0.00519
	(0.00626)	(0.00906)	(0.0134)	(0.00853)	(0.00870)	(0.0106)
Export*Protect	0.00926*	0.00750	0.0111	0.0155**	0.0129*	0.00239
	(0.00540)	(0.00780)	(0.0103)	(0.00740)	(0.00762)	(0.00879)
PerForeignEmp	-0.0915					
	(0.117)					
Export*PerForeignEmp	-0.478***					
	(0.147)					
PerForeignEmpMgt		-0.491				
		(0.315)				
Export*PerForeignEmpMgt		0.618*				
		(0.355)				
PerForeignEmpPro			0.294			
			(0.393)			
Export*PerForeignEmpPro			-0.355			
			(0.427)			
PerForeignEmpSki				-0.412**		
				(0.185)		
Export*PerForeignEmpSki				-0.193		
				(0.220)		
PerForeignEmpUns					-0.0419	
					(0.120)	
Export*PerForeignEmpUns					-0.243	
					(0.154)	
PerForeignEmpNon						-0.106
						(0.235)
Export*PerForeignEmpNon						-0.192
						(0.282)
Constant	9.204***	8.726***	9.311***	9.483***	8.845***	8.127***
	(0.216)	(0.316)	(0.479)	(0.305)	(0.307)	(0.373)
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,041	995	562	913	920	840
R-squared	0.164	0.114	0.089	0.076	0.047	0.063

Notes: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Source: Author's compilation.

Existing common classifications include production/non-production workers (Amiti & Cameron, 2012) and white collar/blue collar (Verhoogen, 2008). In this study, the worker classification method available is that of occupation categories.

In so far as the various wage ratios used capture wage difference between high-skill and low-skill workers, there is no evidence of any systematic skill wage premium associated with exporting (**Table 13**). However, the proxy variable for trade liberalization is significant and has a positive sign for the wage ratio between management and skilled production workers as well as between management and unskilled production workers.

These results are broadly consistent with the results from existing studies such as Verhoogen (2008) and Amiti & Cameron (2012).

Only the firm size variable (measure by total number of employees) is statistically significant which is consistent with the findings from existing studies such as Verhoogen (2008) and Amiti & Cameron (2012). However, the results also suggest that there is an inverse-U relationship between firm size and skill wage premium. The differences between the average wage of high skill and low skill workers increase with size until a particular point after which the relationship is reversed.

However, there might a number of explanations consistent with this finding. One possible explanation could be that high skill workers in the largest firms receive a larger proportion of the compensation in non-wage benefits such as share options and bonus. This would certainly be consistent with the entrepreneurial-type abilities associated with high-skill workers in the theoretical literature (Yeaple, 2005).

Table 13: Skill Wage Premium

Variables	(1) WBES2006 Wage Ratio: Mgt/Skilled	(2) WBES2006 Wage Ratio: Mgt/Unskilled	(3) WBES2006 Wage Ratio: Prof/Skilled	(4) WBES2006 Wage Ratio: Prof/Unskilled	(5) WBES2006 Wage Ratio: Skilled/Unskilled
Size	0.428***	0.469***	0.367*	0.0842	0.164
	(0.150)	(0.175)	(0.196)	(0.242)	(0.155)
Size-squared	-0.0331**	-0.0382**	-0.0255	0.00255	-0.0204
	(0.0157)	(0.0185)	(0.0194)	(0.0242)	(0.0162)
Foreign	0.0439	0.0177	-0.0193	-0.0132	-0.0158
	(0.0732)	(0.0869)	(0.0795)	(0.0967)	(0.0719)
R&D	-0.0897	-0.0385	0.00592	0.0571	0.0532
	(0.0878)	(0.108)	(0.0922)	(0.113)	(0.0902)
Export	-0.0246	-0.0137	0.0270	0.223	-0.0637
	(0.120)	(0.145)	(0.140)	(0.184)	(0.128)
Protect	0.0291***	0.0200*	0.0191	0.0105	0.00187
	(0.0103)	(0.0119)	(0.0141)	(0.0171)	(0.0104)
Export*Protect	-0.00314	-0.0110	-0.00950	-0.0179	-0.000772
	(0.00886)	(0.0103)	(0.0108)	(0.0133)	(0.00902)
PerForeignEmpMgt	-0.207	-0.781*			
	(0.391)	(0.455)			
Export*PerForeignEmpMgt	0.204	1.002**			
	(0.428)	(0.506)			
PerForeignEmpPro			0.145	0.585	
			(0.428)	(0.507)	
Export*PerForeignEmpPro			-0.262	-0.459	
			(0.464)	(0.549)	
PerForeignEmpSki	0.337		0.422		-0.423*
	(0.220)		(0.293)		(0.256)
Export*PerForeignEmpSki	-0.0183		0.0750		0.0909
	(0.261)		(0.339)		(0.302)
PerForeignEmpUns		-0.0244		0.398	0.0546
		(0.166)		(0.252)	(0.152)
Export*PerForeignEmpUns		0.0752		-0.376	0.0968
		(0.210)		(0.293)	(0.189)
Constant	-0.632*	0.142	-0.509	0.781	0.362
	(0.371)	(0.422)	(0.528)	(0.634)	(0.378)
Observations	878	879	534	493	798
R-squared	0.060	0.042	0.068	0.052	0.028

Notes: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Source: Author's compilation.

6. Policy Implcations

Overall, findings from this study suggest that the relationship between exporting average wage levels (exporter wage premium) is relatively weak. The evidence on the positive relationship between wage inequality and trade liberalization is slightly stronger especially on the wages of skilled workers. Interestingly, the wages of this category of workers are likely to be lower when firms higher a higher proportion of skilled foreign workers. Trade liberalization is also likely to be associated with a widening of average wage levels between management and skilled production workers.

What are the policy implications from these findings? The key policy objective in Malaysia continues to be sustained growth via continued reliance on export-oriented manufacturing (given the small size of the economy). A key element of Melitz (2003) and the post-Melitz literature on trade and wage inequality is the importance of productivity (for exporting) and resource reallocation across and within industries. The latter includes reallocation within labor markets. There is clearly a need for further reforms to increase productivity in the economy. In this regard, the evidence in this study suggests that trade liberalization is likely to be an important policy.

The Malaysian government has been very interested in undertaking reforms in the labour market to upgrading the skill profile of the labour force. The implementation of minimum wage - which changes the incentives to use high skill workers - is one such policy. Evidence from this study suggests that this will only work if the country reduces the employment of foreign workers especially those in the skilled production category. Thus, the key policy challenge involves enhancing exporting via trade liberalization without dependence on foreign workers.

7. Conclusions

The relationship between globalization and wage inequality has been an important topic of interest both to policy makers, academics and the general public. The impact on globalization on economic growth, income equality and poverty eradication

development has been extensively researched. A recent development in this area has been the increasing emphasis on micro-level studies incorporating heterogeneous firms and workers, both theoretically and empirically. These studies have emphasized on the importance of the resource allocation and re-allocation process in open economies. This study attempts to extend the empirical literature in this area by studying the Malaysian experience using firm-level data from the country's manufacturing sector.

The results obtained in this study provide some evidence on the relationship between globalization and wage inequality. There is some evidence, albeit relatively weak, that wage levels in exporting firms are higher than those observed in non-exporting firms. The evidence on trade liberalization is stronger especially on wages of skilled production workers. Whilst trade liberalization is associated with higher wages, the employment of foreign workers can have the opposite effect. Therefore, the key policy challenge involves enhancing exporting via trade liberalization without dependence on foreign workers.

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CHAPTER 9

Expansion of Overseas Production and the Impact on Employment in Domestic Supporting Industries: An Empirical Analysis Based on Buyer-Supplier Transaction Relationships*

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This paper focuses on non-internationalized supplier firms and investigates how the expansion of overseas activities by their main customer firms affects their employment, utilizing a unique dataset that includes information on buyer-supplier transaction relationships for Japanese manufacturing firms for the period 1998-2007. We do not find any negative effect of top buyers' overseas expansion on domestic suppliers' employment. Instead, we find a significant positive effect. Our result implies that, contrary to fears of a potential hollowing out of domestic supporting industries, the expansion of overseas activities of customer firms has a positive impact on suppliers' employment. Expansion of overseas production by downstream firms may increase purchases from upstream firms in Japan and this would be the case if downstream firms can increase their world-wide sales by expanding overseas production. Therefore, our result suggest that having a transaction relationship with successful downstream multinational firms that expand their global sales through overseas production is important for non-internationalized suppliers in Japan.

Keywords: Labor demand; Supplier firms; Multinational enterprises; Transaction relationships; Japan.

JEL Classification: F23, F14, F16, F61, J23

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1. Introduction

There is a large body of literature pointing to the existence of various positive relationships between firms' overseas activities and their domestic performance. Compared to that, relatively few studies have examined the effects of such international activities on other, non-internationalized firms. In particular empirical investigations on this issue using micro data are very limited. On the other hand, studies examining the performance of firms with overseas operations show that such firms tend to perform better than firms without overseas operations in terms of productivity, wage rates, sales, employment, and various other performance measures. Based on such evidence, and given that, as shown by, e.g., Mayer & Ottaviano (2008), only a very small number of firms appear to actually engage in international activities, many researchers argue that an expansion of overseas activities is likely to have a positive impact on the domestic economy and that it is important to increase the number of internationalized firms. As a result, many governments have put in place policy schemes to promote the internationalization of domestic firms.

Such recommendations and policy steps, however, ignore the fact that our knowledge on the impact that the expansion of overseas activities by internationalized firms has on non-internationalized firms that rely on transactions with such internationalized firms is limited. Particularly in the case of assembly-type machinery industries, small parts suppliers often rely on a direct or indirect transaction relationship with a large final-goods manufacturer. While some suppliers may follow their main transaction partners abroad, there are a large number of suppliers which cannot follow their transaction partners, and such non-internationalized suppliers may be negatively affected by the expansion of overseas production by their main

transaction partners; that is, their transaction partners may switch to foreign suppliers. This possibility has raised fears of a potential hollowing out of domestic industry in Japan, but to date this issue has not been discussed based on any rigorous empirical evidence. Moreover, the expansion of overseas production by transaction partners does not necessarily have to have a negative effect on domestic suppliers. For example, an expansion of overseas production does not necessarily have to be accompanied by a reduction of domestic production and may even result in an increase in purchases from domestic suppliers in order to support the increased production abroad. Thus, how the expansion of overseas production affects domestic non-internationalized suppliers is a purely empirical question, depending on a variety of factors, such as firms' global sourcing strategies, suppliers' technological capabilities, the nature of transaction relationships, market conditions, trade costs, and so on.

As mentioned, a considerable number of empirical studies have confirmed that internationalized firms, i.e., firms that engage in exporting or have invested in overseas operations, tend to have a superior performance to non-internationalized firms.[1] On the other hand, several empirical studies, focusing on multinational enterprises (MNEs), have examined the effects of overseas operations on MNEs' home operations, looking at sales, investment, employment, employee compensation, and other performance measures at home and abroad. For example, Brainard & Riker (1997), Blomström, *et al*. (1997), Harrison & McMillan (2011), Desai, *et al*. (2009), Braconier & Ekholm (2000), and Barba Navaretti, *et al*. (2010), using parent-affiliate linked data, investigate whether MNEs' overseas operations and home operations complement or substitute each other. Although the evidence overall is rather mixed, the more recent

[1] In many countries, internationalized firms show better performance than non-internationalized firms in terms of their productivity, employment size, wage rates, skill intensity, etc. (see, *e.g*., Mayer & Ottaviano 2008; Wakasugi, *et al*. 2008).

studies tend to show that overseas operations and home operations are complementary (e.g., Desai, *et al*. 2009). Moreover, Harrison & McMillan (2011) show that the effect of overseas activities on employment at home differs depending on the tasks performed at home and abroad, and overseas employment and home employment are complementary in the case where operations at overseas affiliates are quite different from domestic operations. They also show that although the increase in U.S.-based MNEs' offshoring has been associated with a decline in manufacturing employment in the United States, the impact was rather small. There is also a growing body of empirical studies on the relationship between the expansion of overseas operations and domestic employment of MNEs for Italy, France, Germany, etc., most of which do not find a negative relationship and some of which find a complementary relationship (*e.g*., Castellani, *et al*. 2008; Wagner, 2011; Hijzen, *et al*. 2011).

Similarly, for Japan, Yamashita & Fukao (2010), using a matched dataset of parent firms and their affiliates, find no evidence that the expansion of overseas operations reduces MNEs' home employment. Moreover, Ando & Kimura (2011) find that Japanese manufacturing firms expanding their operations in East Asia are actually more likely to increase domestic employment. Further, Tanaka (2012), though not relying on parent-affiliate linked data but focusing on the short-run effect of FDI, finds that both manufacturing and non-manufacturing firms tend to increase their domestic employment after they became MNEs. On the other hand, Edamura, *et al*. (2011) find that FDI in Asia has a negative effect on domestic employment for Japanese MNEs. Although Edamura, *et al*.'s finding is consistent with the finding by Debaere, *et al*. (2010) for Korean MNEs, according to the survey conducted by Wagner (2011), most empirical studies on the impact of FDI on domestic employment do not find a statistically significant effect or find a *positive* effect.

Overall, studies such as these do not support the popular view that the expansion of overseas operations comes at the expense of home employment and, in fact, indicate that instead it tends to have a positive effect on the domestic performance and employment of the firms expanding their operations overseas. However, these studies do not consider the effect that the expansion of the overseas operations of such MNEs has on other, non-internationalized firms, and to date, there has been hardly any rigorous empirical evidence on this effect taking firm-level transaction relationships into account.

Against this background, the purpose of the present study is to focus on non-internationalized supplier firms and investigate how such supplier firms react when their main customers expand their overseas production and how such expansion abroad impacts on the supplier firms' employment and wages, utilizing a unique dataset that includes information on buyer-supplier transaction relationships for Japanese manufacturing firms.[2] We believe that a close look at the effects of the overseas expansion of internationalized firms on non-internationalized firms at home is necessary in order to devise appropriate policies to support firms' growth in a globalized economy. Although there are several empirical studies on the relationship between domestic employment and import competition using industry-level data (*e.g.*, Revenga 1992, Tomiura 2003), the present study is the first attempt to examine the impact of a firm's main customers' overseas expansion on the firm's domestic employment by using a firm-level dataset that makes it possible to link firm-level information with information on the major customers of each firm. Specifically,

[2] Another issue of interest in this context is skill-upgrading. However, due to data constraints, we will leave this issue for the future and focus on employment at the firm level instead. In our dataset, the only information on wages at the firm level available is the average wage rate; that is, firm-level information on wages for production and non-production workers separately, which would be necessary to analyze skill-upgrading, is unfortunately not available at present.

utilizing the firm-level information on transaction relationships, this paper tries to answer whether non-internationalized firms increase or reduce their employment when their main customers expand overseas production.[3]

The organization of this paper is as follows. Section 2 briefly explains the expected impact of overseas expansion by MNEs based on the results obtained in previous studies. Section 3 then describes the sources and data we use for the construction of our dataset and provides an overview of the characteristics of the data. Next, Section 4 describes the empirical framework and presents the estimation results. Finally, Section 5 discusses the policy implications and concludes.

2. Related Literature

The effect of the expansion of overseas production on domestic economic activities has long been a vigorously debated issue in many developed countries. Substitutability or complementarities between overseas production and exports have been studied since the 1970s in the United States and in European countries, where many domestic firms started becoming multinationals in the 1950s or 1960s. In the case of Japan, the so-called hollowing out problem started drawing the attention of the public and policy makers in the late 1980s, when the Japanese economy was suffering from the rapid appreciation of the yen after the Plaza Accord.

Against this background, a considerable number of empirical studies have been

[3] Studies such as Bernard, *et al*. (2006) examine how an increase in industry-level imports from low-wage countries affects domestic plants' survival, employment growth, and industry switching. However, they do not examine the effect of overseas production on domestic plants/firms. Moreover, this type of study shows the average effect of globalization on domestic plants/firms and does not take into account whether plants/firms are engaged in overseas activities.

conducted on the relationship between overseas and domestic activities, and in this section, we briefly review major studies on this issue since the late 1970s. On the relationship between overseas and domestic activities, various research questions have been raised and examined so far, using country-, industry-, or firm-level data. Popular research topics include, for example, the effects of overseas production and/or offshoring on home production and exports, on home employment and investment, and on home productivity.[4]

Among the pioneering empirical studies, Bergsten, *et al*. (1978), Lipsey & Weiss (1981), and Blomström, *et al*. (1988), relying on industry-level data for the United States (the first two studies) and the United States and Sweden (the third study), found that sales of MNEs' foreign affiliates tended to be positively associated with exports from the MNEs' home country. Similarly, focusing on the United States and Japan, Eaton and Tamura (1994) found a positive relationship between FDI and home-country exports to the host country. The weight of evidence from early empirical studies including these points to either no effect or a positive effect of overseas production in a host-country market on home-country exports to that market.

With the increasing availability of firm-level data since the 1980s, there has been a growing use of such data for the analysis of the effect of MNEs' overseas activities on their home-country activities. However, firm-level data are not universally available and most studies have focused on the United States, Sweden, and Japan, which collect detailed data on multinational parents and affiliates. Employing such data for U.S. multinationals, Lipsey & Weiss (1984) found a positive relationship between MNEs' overseas production and home exports, while Swedenborg (1985),

[4] For a comprehensive survey of early empirical studies on the effects of MNEs' overseas activities on their home country, see Lipsey (1994).

focusing on Swedish MNEs, found no significant effect overall but a positive effect of the expansion of production affiliates abroad on home exports to the overseas affiliates. For Japan, Ramstetter (1997), focusing on 20 electrical machinery MNEs, did not find evidence of substitutability between the activities of foreign affiliates and exports from parent firms. Meanwhile, Head & Ries (2001), using panel data for Japanese manufacturing firms, found that outward FDI and home exports tend to be complementary, although the relationship between the two varies across firms. On the other hand, Fukao & Nakakita (1996) found that although firms which increased production at overseas subsidiaries in Asia had greater levels of exports to Asia, once reverse import were subtracted, the net export effect was negative. Moreover, the expansion of production at North American subsidiaries was associated with lower levels of exports to North America. Thus, whereas Lipsey (1994), for example, argues that the effect of production outside the United States by U.S.-based firms on exports from the United States by parent firms or all U.S. firms was more likely to be positive than negative, Fukao & Nakakita (1996) suggest that the effect of overseas expansion on home-country exports may depends on the motivation or type of FDI (i.e., whether FDI is resource- or market-seeking, or whether alternatively it is aims at export substitution or reverse imports).

Turning to the effects of overseas expansion on home employment, Lipsey (1994) found that within MNEs, the higher the share of overseas operations in the total production of the multinational, the higher tended to be the ratio of home employment to home production. He argued that a larger share of foreign production requires a larger number of headquarters employees, such as R&D staff and supervisory personnel, whose contribution to output is not confined to the firm's domestic production. His results thus suggest that rather than the *level* of employment,

overseas production affects the *composition* of employment at home. Meanwhile, Brainard & Riker (1997) and Riker & Brainard (1997), also using data for U.S. multinationals, found that jobs abroad did substitute for jobs at home, but the effect was small. As already mentioned in the introduction, however, a more recent study by Desai, *et al*. (2009) finds the opposite for U.S. multinationals, and many other recent studies relying on firm-level data provide evidence of a positive relationship between outward FDI and home employment. In the case of Japanese MNEs, Yamashita & Fukao (2010) as well as a few of the studies mentioned in the introduction find complementarities between overseas operations and home employment.[5]

Yet, despite all the empirical evidence suggesting that, on balance, overseas operations do not have a negative effect on domestic activities and may, in fact, boost them, workers and journalists frequently express fears that MNEs are "exporting jobs" by substituting foreign production for home production. Part of the reason for this may be that, as suggested by some industry-level studies, there may be a negative relationship between industry-level globalization (overseas production or offshoring) and domestic employment. That is, while the overseas operations of MNEs may not necessarily have a negative effect on their own home employment, the increase in industry-level offshoring and reverse imports resulting from increased overseas production by MNEs may have a negative impact on domestic firms' employment. For example, using industry-level data, Revenga (1992) found a negative impact of changes in import prices on U.S. employment growth, and Katz & Murphy (1992)

[5] However, the evidence on complementarities may not be sufficiently robust in the case of Japan. For example, although Higuchi & Shimpo (1999) find complementarities between overseas employment and home employment for Japanese MNEs, they also find a negative impact of the expansion of overseas employment on domestic employment in the case of the manufacturing sector. Similarly, Edamura, *et al*. (2011) suggest there may be a negative relationship in the case of Japanese FDI in Asia.

found that increased import competition negatively affected labor demand in the United States in the 1980s. These studies imply that the inflow of cheap imported goods negatively affected employment growth in the United States. Similarly, Bernard, *et al*. (2006), focusing on manufacturing plants in the United States, find that there tends to be a larger reduction in plant-level employment in industries that experience greater imports from low-wage countries. For Japan, Fukao and Yuan (2001), using industry data at the three-digit level, found that Japanese FDI in East Asia was associated with a substantial decrease in employment at home, while this was not the case for FDI in other regions. On the other hand, distinguishing FDI in East Asia by motive, they found that FDI that was market-oriented was associated with an increase in home employment. These findings suggest that outward FDI of the cheap labor-seeking type is likely to increase imports from low-wage countries and thus tends to have a negative impact on domestic firms.

In sum, the effect of an expansion of overseas activities on domestic activities is not quite straightforward and depends on what exactly one focuses on. For example, overseas employment and home employment may be complementary within an MNE (the same corporate group), but this is not necessarily the case within an industry. In fact, it is quite conceivable that the effects within an MNE and within the industry in which the MNE operates may differ considerably, for example as a result on the impact that the expansion of overseas activities has on domestic suppliers transacting with such MNEs.

To the best of our knowledge, there are no rigorous empirical analyses of the effect of overseas production by MNEs on their domestic suppliers taking firm-level transaction relationships into account, and the direction of the effect cannot be determined *a priori*. If expansion of overseas production by MNEs is accompanied

by supplier switching or a reduction in procurement of domestic parts and components, the supplier firms may be forced to reduce their employment as a result of the reduction in orders. But it is also possible that the expansion of overseas production by MNEs increases the procurement of parts and components from their domestic suppliers. For example, the MNEs' global sales and production may increase when they expand their overseas production. If overseas demand for the MNEs' products increases as a result of efforts to develop products for the local market or of local marketing, procurement from suppliers at home may actually increase rather than decrease. This is particularly likely if domestic suppliers have technological capabilities that are superior to those of local suppliers abroad.

Several of the studies mentioned above show that MNEs' overseas production and home-country exports are complementary. Such results indicate that expansion of overseas production by MNEs does not necessarily reduce their purchases from suppliers at home. In the following sections, we investigate the relationship between MNEs' overseas expansion and employment at domestic suppliers.

3. Domestic and Overseas Operations of Japanese Manufacturing Firms

3.1. Data

This study uses three databases. The first is the firm-level panel dataset underlying the *Basic Survey on Business Structure and Activities* (*BSBSA*) collected annually by the Ministry of Economy, Trade and Industry (METI). We use the data for the period 1998-2007. The survey covers all firms with at least 50 employees and 30 million yen of paid-in capital in the Japanese manufacturing, mining, and commerce sectors as well as several other service sectors. The survey contains detailed information on firm-level business activities such as the three-digit industry in which the firm operates, its number of employees, sales, purchases, exports, imports, and so on. This dataset contains information on approximately 14,000 manufacturing firms (defined as firms with manufacturing activities) each year. Out of the 14,000 manufacturing firms, about 2,500 firms own one or more manufacturing affiliates abroad, while the rest (11,000+ firms) are domestic firms that do not have a manufacturing affiliate abroad.

The second dataset is the affiliate-level panel dataset for overseas affiliates of Japanese firms underlying the *Basic Survey on Overseas Business Activities* (*BSOBA*) collected annually by METI. In 2005, approximately 3,000 parent firms with a foreign affiliate responded to the survey, and nearly 70 % of these parent firms fell into the manufacturing sector. The survey contains information on approximately 16,000 affiliates, half of which fall into the manufacturing sector, and provides details on affiliate-level business activities such as sales, procurements, investment, and employment. Moreover, each affiliate can be linked with the parent firm in Japan, which is included in the first dataset (*BSBSA*). Using these two datasets, we can identify which Japanese MNEs' sales and employment increased or decreased, and

where (in which country, including Japan) it was that their sales and employment increased or decreased.

The third dataset is a firm-level dataset compiled by Teikoku Databank, Ltd., a private company. The dataset, called *COSMOS2*, contains the names of the top-five customer firms (in terms of sales) and top-five suppliers (in terms of procurements) for each firm. Using this information, we identify who the major transaction partners of a particular firm are. Moreover, the *COSMOS2* dataset can be linked with the METI firm-level data, the *BSBSA* and the *BSOBA*, at the firm level. By linking the *COSMOS2*, the *BSBSA*, and the *BSOBA*, we can obtain information on a firm's main customers' overseas activities such as the sales and employment of the customers' affiliates abroad. However, it should be noted that the *BSBSA* is not a complete census and covers only firms with 50 or more employees and with 30 million yen or more paid-in capital. Moreover, a substantial part of the service sector is not covered by the *BSBSA*. For example, the coverage is very small for transportation services, financial intermediation and insurance, and medical and other social services, because these service industries do not fall under the jurisdiction of METI but other ministries. Therefore, it is not possible to link information on firms' main customers in the *COSMOS2* when customers are relatively small firms or are not manufacturing firms.

In sum, combining the three datasets, the *BSBSA*, the *BSOBA*, and *COSMOS2*, at the firm level, we construct a firm-level panel dataset with information on each firm's transaction relationships and information on MNEs' overseas activities. A graphic representation of the structure of our source data and the steps we use to construct our dataset is provided in Figure 1. We start by first identifying whether a firm owns a manufacturing affiliate abroad or not, using the information from the *BSBSA* and the *BSOBA*. Second, for each manufacturing non-MNE, we then identify which firms

are the main (top five) customers, using the information from the *COSMOS2*. Third, linking the *COSMOS2* and the *BSOBA* data, we identify whether the main customers are manufacturing MNEs or not and obtain the number of workers employed by the overseas affiliates for each customer firm. Fourth, linking the *COSMOS2* and the *BSBSA* data, we obtain the number of domestic workers for each customer firm. Finally, mainly relying on the information on domestic and overseas employment for each customer firm taken from the linked dataset, we measure the extent of the expansion of overseas production of the main customers for each domestic supplier.

We should note that the response rate for the *BSOBA* is relatively low at around 60-70 %, while the response rate for the *BSBSA*, which is a mandatory survey, is relatively high at around 80-85 %. Due to the low response rate to the *BSOBA*, there are a lot of missing observations on MNEs' overseas activities. In order to obtain a reasonably large sample, we therefore linearly interpolated employment data for missing observations if an affiliate provided information on the number of workers for at least two years.[6]

At the end of this procedure, we have annual observations for approximately 4,500 manufacturing non-MNEs with information on their main customers, and we use these 4,500 firms in our econometric analysis below. Table 1 shows the coverage of our dataset relative to the firms included in the *BSBSA*. As shown in Table 1, the number of firms without a manufacturing affiliate abroad ranged from ca. 11,600 in 2007 to more than 13,000 in 1998, and depending on the year, they employed between 2.4 and 3 million workers in Japan. Further, the table shows that the number of firms in our

[6] Although we could in theory measure overseas production using the amount of sales of overseas affiliates, we use employment data instead, since we need to interpolate data for missing observations and expect employment to be more stable over time than sales. That is, we think we will have smaller measurement errors using employment data rather than sales data.

dataset, depending on the year, ranges from about 4,000 to close to 4,900, and these firms employed roughly 700,000 to 900,000 workers. Therefore, the coverage rate of our dataset is around 30-40 % in terms of the number of firms and around 25-35 % in terms of number of workers. Although this coverage rate may not be very large, we believe that the size of our sample is sufficiently large for our empirical analysis. Using the dataset, we examine the impact of the expansion of overseas production on domestic employment and wages.

Figure 1: The Structure of Our Sample Data and the Steps to Construct Our Data

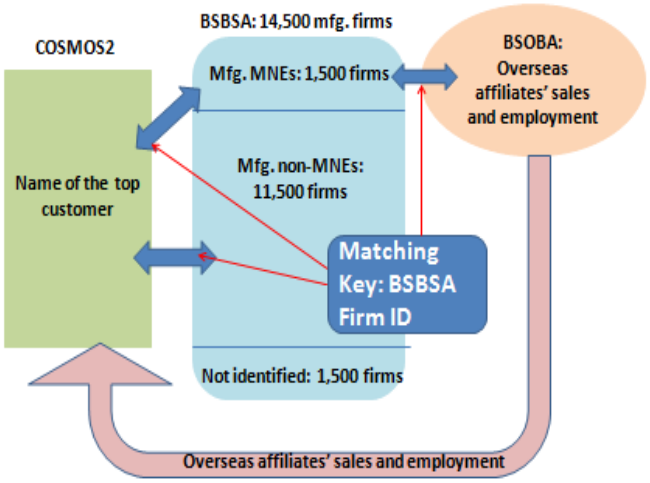


Table 1: Comparison between BSBSA and Our Sample: Non-MNEs

Year	Number of firms	Employment, total	Wage bill, total (mil. yen)	Sales, total (tril. yen)	Exports, total (tril. yen)
			(A) BSBSA		
1998	13,268	3,007,390	15,171,878	116.73	6.48
1999	13,009	2,870,212	14,272,757	113.48	4.08
2000	12,476	2,729,623	14,172,403	114.78	4.39
2001	12,251	2,609,400	13,734,290	108.66	4.39
2002	11,873	2,471,044	12,590,058	107.43	3.94
2003	11,266	2,423,932	12,363,770	112.65	4.71
2004	11,832	2,523,487	12,920,479	121.76	4.65
2005	11,452	2,442,560	12,370,612	122.41	4.68
2006	11,191	2,451,058	11,671,103	126.00	5.44
2007	11,647	2,606,213	12,199,059	133.00	5.81
			(B) This paper		
1998	4,624	898,906	4,478,670	30.73	0.89
1999	4,143	721,999	3,452,034	24.26	0.51
2000	4,835	918,559	4,784,053	35.39	0.97
2001	4,068	671,739	3,431,207	22.97	0.50
2002	4,860	892,358	4,619,044	35.90	1.16
2003	4,637	859,858	4,501,594	36.23	1.16
2004	5,020	917,097	4,807,023	40.83	1.20
2005	4,856	878,537	4,551,142	38.79	0.91
2006	4,492	799,535	3,822,951	36.85	1.06
2007	4,869	896,223	4,143,890	46.45	1.42
			Coverage of our sample, (B)/(A)		
1998	34.9%	29.9%	29.5%	26.3%	13.8%
1999	31.8%	25.2%	24.2%	21.4%	12.6%
2000	38.8%	33.7%	33.8%	30.8%	22.0%
2001	33.2%	25.7%	25.0%	21.1%	11.4%
2002	40.9%	36.1%	36.7%	33.4%	29.4%
2003	41.2%	35.5%	36.4%	32.2%	24.6%
2004	42.4%	36.3%	37.2%	33.5%	25.8%
2005	42.4%	36.0%	36.8%	31.7%	19.5%
2006	40.1%	32.6%	32.8%	29.2%	19.5%
2007	41.8%	34.4%	34.0%	34.9%	24.5%

Note: Figures for the wage bill, sales, and exports are in nominal terms.

3.2. Overview of the Domestic and Overseas Operations of Japanese Manufacturing Firms

We start by providing a brief overview of the domestic and overseas operations of Japanese manufacturing firms based on the original *BSBSA* data (i.e., not the data linked with the *BSOBA* and *COSMOS2* data), supplemented with data from the *Census of Manufactures*. As mentioned, the *BSBSA* includes only firms with 50 or more employees and at least 30 million yen of paid-in capital, and firms below this threshold are not covered by the *BSBSA*, meaning that smaller firms are excluded. We therefore supplement the *BSBSA* data with information on smaller firms from the *Census of Manufactures* (also compiled by METI), which covers firms with 4 or more employees. Taken together, the firms in the two datasets almost cover the entire universe of Japanese manufacturing firms.

Using these two sets of data, Figure 2 shows the number of Japanese manufacturing firms or affiliates (panel (a)) and the domestic and overseas employment (panel (b)) of Japanese manufacturing firms for the period from 1998 to 2007. In 1998, approximately 15,500 manufacturing firms responded to the *BSBSA*, out of which 2,300 firms (approximately 15 %) had one or more manufacturing affiliates abroad.[7] In 2007, approximately 14,600 manufacturing firms responded to the *BSBSA*, out of which 3,000 firms (20 %) had one or more manufacturing affiliates abroad. The number of firms with 4-49 workers decreased drastically by more than 107,000 from 313,500 to 206,200 firms. On the other hand, the number of manufacturing affiliates abroad increased from 6,400 in 1998 to 8,300 in 2007,

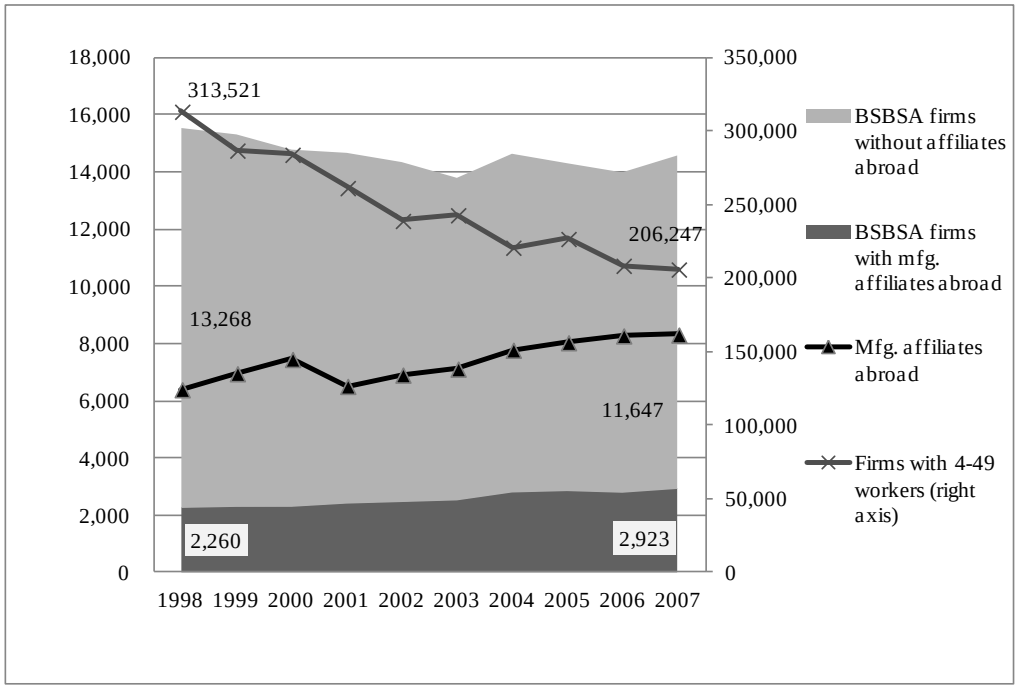
[7] Japanese manufacturing firms here are defined as firms with manufacturing divisions or establishments in Japan based on the information reported in the *BSBSA*. In the *BSBSA*, each firm also provides information on how many affiliates or subsidiaries the firm has in Japan and in other countries and on which industry the affiliates or subsidiaries belong to. Affiliates or subsidiaries in the *BSBSA* are defined as firms in which the parent firm has an ownership stake of 20 % or more.

according to the official report based on the *BSOBA*.

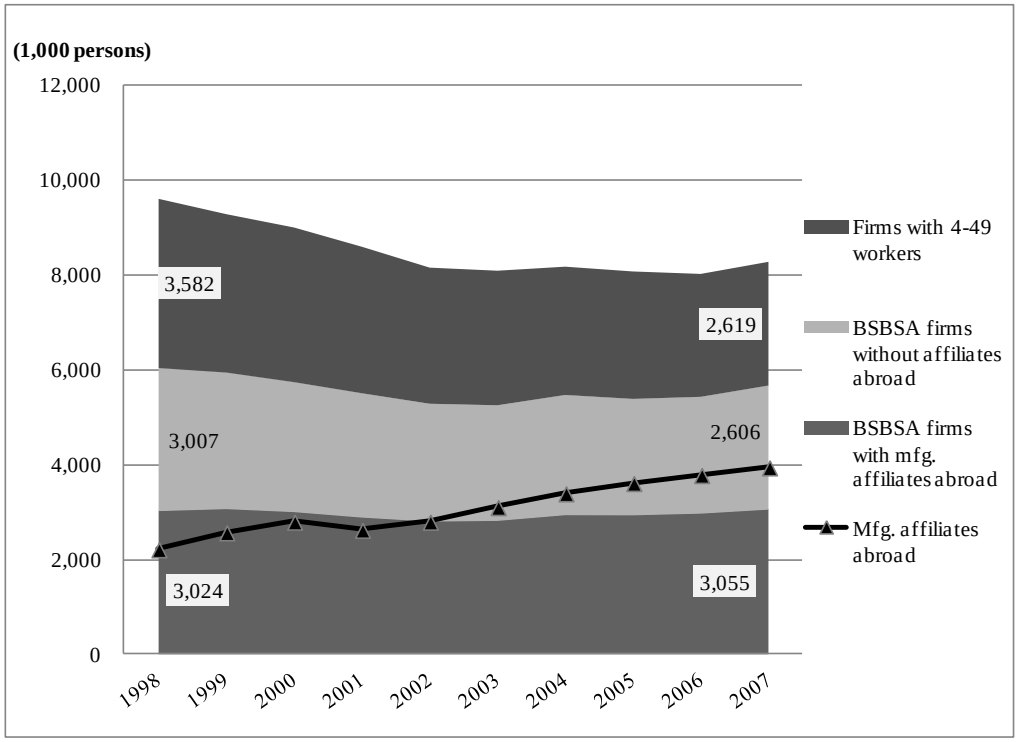
As for domestic employment, the number of workers employed in Japanese manufacturing firms decreased from 9.6 million to 8.3 million during the period 1998-2007 (panel (b)). While the level of employment in firms with manufacturing affiliates abroad remained more or less unchanged, employment in firms without manufacturing affiliates abroad fell considerably from 6.5 million to 5.2 million between 1998 and 2007. (We assume that all firms with 4-49 workers are non-MNEs). However, looking at domestic employment per firm, firms with manufacturing affiliates abroad reduced employment from 1,300 workers on average in 1998 to 1,000 workers in 2007, while the average number of employees at firms without manufacturing affiliates abroad remained largely unchanged at around 220 workers for firms with 50 or more workers and around 12 workers for firms with 4-49 workers. On the other hand, the total number of workers employed by manufacturing affiliates abroad and the number of workers per affiliate increased from 2.2 million to 4.0 million and from 347 workers to 475 workers, respectively.

Figure 2: Domestic and Overseas Activities of Japanese Manufacturing Firms with 50 or more Employees and 30 million yen of Paid-in Capital

(a) Number of Firms or Affiliates



(b) Domestic and Overseas Employment



Note: Firms with 49 or fewer employees: Data compiled by the Ministry of Economy, Trade, and Industry based on the *Census of Manufactures*.
Sources: BSBSA and BSOBA.

Although Figure 2 implies that domestic manufacturing activities shrank in terms of employment and number of firms along with the expansion of overseas manufacturing activities, the aggregate data do not allow us to tell whether the decline in aggregate employment was caused by the expansion of overseas activities. Even though the average number of workers per firm decreased for MNEs, previous empirical studies have not found strong evidence that overseas expansion caused the reduction in domestic employment for MNEs, as summarized in the previous section. As for non-MNEs, although the average number of workers per firm was quite stable over time, our knowledge regarding the relationship between the overseas expansion of MNEs and employment at domestic firms is still very limited.

Next, let us take a closer look at the firms in our dataset. Table 2 shows that out of the approximately 14,000 manufacturing firms included in the original *BSBSA* annually, the name of the top buyer is available in the *COSMOS2* database for 10,000 firms. We can distinguish whether these 10,000 firms are MNEs or not and find that approximately 16 % of them are MNEs. For each firm, we calculate the number of workers employed by its top five or top three customers in Japan and by those customers' overseas affiliates, and use these to calculate the overseas employment ratio of suppliers' customers. Specifically, column (6) in Table 2 shows the overseas employment ratio of the top five customers of non-MNEs, while column (8) shows the equivalent ratio for MNEs. Similarly, columns (10) and (12) show customers' overseas employment ratios when focusing only on the top three customers. The figures indicate that on average the customers of MNEs tend to have a higher overseas employment ratio than the customers of non-MNEs. Moreover, for both MNEs and non-MNEs, the overseas employment ratio of their top customers is increasing over time.

In our dataset, the names of a maximum of five customers are available (in order from top one to top five customer). However, while some firms provide information on all five top customers, others provide only the name of the top customer or, say, the top three customers. Moreover, the ranking of customers often changes for a particular firm and there are often new customers in the list. In fact, buyer-supplier transaction relationships seem quite dynamic. Unfortunately, we do not have information on the importance of each transaction relationship (such as the share it accounts for in a firm's total transactions), but only have the ranking. Therefore, we use the extent of customer firms' overseas activities for each supplier, which we measure as the mean of the overseas employment ratios of the top five or the top three customers. It should be noted that when we focus on, e.g., the top five customers, but a firm has only two customers, the mean is calculated using information for these two customers. Similarly, when we focus on the top three customers, if the firm has only one customer, we use the information for that one customer. In the following empirical analysis, we mainly use the mean value for the top five customers; however, we also use the mean value for the top three customers in order to check the robustness of our estimation results.

Table 2: Number of Firms by Firm Types

	Firms included in the BSBSA											
		Firms with information on the top 1 buyer										
					Firms for which data on the overseas affiliates of the top 5 buyers are available				Firms for which data on the overseas affiliates of the top 3 buyers are available			
	All	All	Non-MNEs	MNEs	Non-MNEs		MNEs		Non-MNEs		MNEs	
Year	Obs.	Obs.	Obs.	obs.	Obs.	Top 5 buyers' overseas ratio (mean)	Obs.	Top 5 buyers' overseas ratio (mean)	Obs.	Top 3 buyers' overseas ratio (mean)	Obs.	Top 3 buyers' overseas ratio (mean)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1998	15,528	11,467	9,861	1,606	4,624	16.6%	808	22.7%	3,843	17.4%	617	23.7%
1999	15,305	9,756	8,675	1,081	4,143	17.0%	543	22.7%	3,517	18.0%	440	23.9%
2000	14,774	11,478	9,808	1,670	4,835	18.7%	902	26.7%	4,038	19.8%	732	27.4%
2001	14,661	9,489	8,354	1,135	4,068	18.2%	580	25.9%	3,236	19.8%	422	27.7%
2002	14,338	11,204	9,437	1,767	4,860	18.6%	1011	26.5%	3,808	20.2%	778	28.0%
2003	13,788	10,941	9,099	1,842	4,637	18.7%	1083	27.3%	3,657	20.7%	817	29.8%
2004	14,630	11,729	9,664	2,065	5,020	18.9%	1188	26.4%	3,991	20.3%	906	28.4%
2005	14,299	11,487	9,382	2,105	4,856	20.2%	1211	28.8%	3,795	21.9%	909	30.3%
2006	13,980	10,768	8,792	1,976	4,492	20.2%	1124	27.8%	3,541	21.8%	836	30.0%
2007	14,570	11,632	9,457	2,175	4,869	19.9%	1204	28.6%	3,802	21.3%	908	30.0%

Note: Top buyers' overseas employment ratio is the ratio of workers in foreign affiliates to total employment.

In this paper, we focus on the effect of overseas expansion of customer firms on the employment of non-MNEs. The reasons are as follows. First, the effect of the overseas expansion of production on domestic employment within MNEs has already been examined in quite a number of studies. And second, MNEs take both domestic and overseas factors (market conditions, factor prices, etc.) into account when they decide their input and output, while non-MNEs take only domestic factors into account. This means that it would be problematic to treat the two in one theoretical and empirical framework, so that we would need to develop and estimate separate models. We therefore decided to focus only on non-MNEs in this paper.

In Table 3, we look at differences in the characteristics of non-MNEs that sell their products to non-MNE customers and those that sell their products to MNE customers. In terms of the number of firms, the latter group is much larger than the former. Moreover, the average employment size, the average total wage bill, and average exports tend to be larger for the latter than the former, and the difference in the mean values is statistically significant for many years during the period analyzed in this paper. Average sales also tend to be larger for the latter, although the difference is not statistically significant. These observations indicate that non-MNEs selling their products to MNE customers tend to be larger than other non-MNEs.

Table 3: Comparison of Mean Level by Firm Type

Year	Number of firms	Employment per firm	Wage bill per firm (mil. yen)	Sales per firm (mil. yen)	Exports per firm (mil. yen)
Non-MNEs total					
1998	4,624	194	969	6,646	193
1999	4,143	174	833	5,855	124
2000	4,835	190	989	7,319	200
2001	4,068	165	843	5,646	123
2002	4,860	184	950	7,386	238
2003	4,637	185	971	7,813	249
2004	5,020	183	958	8,134	239
2005	4,856	181	937	7,989	188
2006	4,492	178	851	8,204	236
2007	4,869	184	851	9,540	292
Non-MNEs that sell their products to non-MNEs (A)					
1998	1,821	187	891	6,571	131
1999	1,724	165	752	5,780	52
2000	1,822	174	865	6,979	88
2001	1,632	154	758	5,114	81
2002	1,935	172	857	6,533	133
2003	1,890	179	919	7,117	120
2004	2,101	175	861	7,889	197
2005	1,889	173	864	7,356	122
2006	1,658	167	769	8,467	159
2007	1,836	176	764	9,465	225
Non-MNEs that sell their products to MNEs (B)					
1998	2,803	200	1,019 *	6,694	233
1999	2,419	181 *	891 *	5,908	176
2000	3,013	200 *	1,067 *	7,525	268
2001	2,436	173 *	901 *	6,003	152 *
2002	2,925	191 *	1,012 *	7,951	308 *
2003	2,747	190	1,006	8,292	339 *
2004	2,919	188	1,027	8,309	269 *
2005	2,967	186	984	8,391	230 *
2006	2,834	185 *	899 *	8,050	281
2007	3,033	189	904 *	9,585	333 *

Notes: * indicates that the mean is significantly different from that in the middle panel at the 5% level (two tailed t-test). Figures for the wage bill, sales, and exports are in nominal terms.

4. Empirical Analysis

4.1. Empirical Specification

This section explains the empirical strategy we employ to investigate the impact of the expansion of overseas production by downstream firms on their suppliers' domestic employment. We estimate the standard labor demand function employed by Hamermesh (1993), which has been used in a number of related studies, including Harrison & McMillan (2011) and Yamashita & Fukao (2010).

Let us consider a supplier firm using N factors of production, X_1, X_2, ….., X_N. The production function of firm i producing output Y_i is:

$$Y_i = f(X_{1i}, X_{2i}, \ldots\ldots, X_{Ni}). \quad (1)$$

Then the associated cost function is given by

$$C_i = g(w_{1i}, w_{2i}, \ldots\ldots, w_{Ni}, Y_i), \quad (2)$$

where the w_i are the N input prices. Using Shepard's lemma, the factor demand for the nth input for firm i is given by

$$X_{ni} = X_{ni}^{d}(w_{1i}, w_{2i}, \ldots\ldots, w_{Ni}, Y_i) \quad (3)$$

n=1, 2, …, N.

Following Harrison & McMillan (2011), Yamashita & Fukao (2010), and others, we estimate a log-linear version of equation (3). We allow two types of factor inputs: labor and physical capital. We should note that output Y for firm i is jointly determined with employment, which possibly raises a significant simultaneity problem. As in Harrison & McMillan (2011), we assume that output Y for firm i is a function of domestic prices, and equation (3) is now written as

$$X_{ni} = X_{ni}^{d}(w_{1i}, w_{2i}, \ldots\ldots, w_{Ni}, P) \quad (4)$$

n=1, 2, …, N.

This factor demand equation (4) is expanded to incorporate the variable influencing the factor demand by firm *i*, namely, the variable capturing the overseas operations of downstream firms. Therefore, the labor demand function to be estimated is as follows:

$$lnL_{it} = \propto + \beta lnw_{it} + \gamma lnr_{it} + \delta lnP_{jt} + \rho FOR_{ift} + \omega V'_{it} + \varphi_i + \tau_t + \varepsilon_{it}, \quad (5)$$

where subscripts *i*, *f*, and *t* denote the firm, the main customers, and the year. *L*, *w*, *r*, and *P* denote employment, the wage rate, the user cost of capital, and final goods prices, respectively. *FOR* represents the extent of the overseas operations of the main downstream customers and is a proxy for the extent to which a firm is exposed to international competition. Variables with *ln* are in logarithm, and the log-linear specification allows us to examine the elasticity between factors. *V'* is a vector of other control variables, and we control for firm-specific and year-specific effects, φ and τ. ε is the error term. Looking at the estimated coefficient on the *FOR* variable, we examine whether the expansion of overseas activities of downstream firms affects their domestic suppliers' employment and how large the effect is.

To estimate equation (5), we need data on employment, factor prices, and final goods prices for Japanese firms. The number of regular employees and the average wage rate (calculated as total wage payments including non-wage compensation divided by the number of regular employees) for each firm are taken from the *BSBSA*. The nominal wage is deflated by the GDP deflator. The user cost of capital is calculated for each firm using the price of investment goods, the interest rate, the

depreciation rate, the corporate tax rate, and so on.[11] Data on investment goods prices, interest rates, and corporate tax rates were taken from the JIP Database 2011, the Bank of Japan's website, and the *Ministry of Finance Statistics Monthly*, respectively. The depreciation rate for each sector was taken from the JIP Database 2006. As for the final goods price data, Harrison and McMillan (2011) assume that domestic final goods prices are captured by real industry sales. In this paper, we include industry-by-year dummy variables, which capture final goods prices and other industry-level characteristics.

The *FOR* variable is constructed as follows. *FOR* is the average overseas employment ratio of the top five buyers, which is calculated as the employment at overseas manufacturing affiliates divided by total employment, *i.e.*, employment at the parent firm in Japan and at the overseas manufacturing affiliates. If a firm's top five buyers do not have any overseas manufacturing affiliates, *FOR* for this firm takes zero. Further, with regard to the top five buyers' overseas employment ratio, we also distinguish between the average ratio of employment in manufacturing affiliates in Asia to total employment and the average ratio of employment in manufacturing affiliates in non-Asian countries to the total employment. The data on employment in overseas manufacturing affiliates for each parent firm are taken from the *BSOBA*.

Regarding other control variables, we prepare two dummy variables. The first dummy variable, *MNE(t+1)*, takes a value of one if a firm becomes an MNE the following year. This variable captures the possible impact of starting overseas

[11] The user cost of capital is estimated as follows:

$$c_k = \frac{1-z}{1-u} p_k \{\lambda r + (1-u)(1-\lambda) i + \delta_i - (\frac{\dot{p}_k}{p_k})\},$$

where $p_k, i, \delta, u, \lambda$ and z are the price of investment goods, the interest rate, the depreciation rate, the corporate tax rate, the equity ratio, and the present value of depreciation deductions on a unit of nominal investment, respectively.

production on their own domestic employment.[12] The second dummy variable, *Change of buyers*, takes a value of one if at least one of the top five buyers of a firm changes. More specifically, the dummy variable takes one if at least one new customer appears in the top five customer list in year *t* compared with the top five customer list in year *t-1*.

4.2. Empirical Results

The results of estimating equation (5) are reported in Table 4. In order to eliminate firm fixed effects, we take the first-difference for all the variables except the dummy variables, *MNE(t+1)* and *Change of buyers.* The equation is estimated using OLS.[13] As shown in Table 4, the top five buyers' overseas employment ratio takes a positive and statistically significant coefficient. Further, the top five buyers' overseas employment ratio for Asia and that for other regions also take positive and significant coefficients; however, the former coefficient is smaller than the latter, suggesting that the expansion of operations in Asia has a smaller positive impact on the employment of supplier firms in Japan. Nevertheless, these results indicate that there is a positive relationship between an increase in customer firms' overseas employment ratio and non-multinational supplier firms' domestic employment.

Turning to the other variables, the coefficients on the wage rate are significantly negative in all cases, as expected. On the other hand, the coefficients on the user cost of capital are negative but not significant. The estimated coefficients on the

[12] However, the decision to become an MNE may be endogenously determined. For example, if a firm's main customer expands production abroad, the firm may decide to follow the main customer and become an MNE. Therefore, we also estimated the model using only firms which did not become MNEs in year *t+1* and obtained estimation results that are consistent with those reported here.

[13] Summary statistics and the correlation matrix are presented in Appendix Tables 2 and 3.

MNE(t+1) dummy and the *Change of buyers* dummy are not significant in all cases in Table 4. This implies that neither starting production overseas nor changes in customers have a significant impact on the growth of domestic employment.

Table 4: Estimation Results

Changes in domestic employment: Baseline OLS specifications (1998-2007)

Dependent variable: dln # of workers	All workers (1)	All workers (2)	All workers (3)
dln Real wage rate	-0.151***	-0.151***	-0.151***
	[0.003]	[0.003]	[0.003]
dln User cost of capital	-0.051	-0.017	-0.016
	[0.104]	[0.105]	[0.105]
MNE (t+1)	0.007	0.005	0.005
	[0.005]	[0.005]	[0.005]
Change of buyers	0.001	0.001	0.001
	[0.002]	[0.002]	[0.002]
d (Top five buyers' ratio of workers in foreign affiliates)	0.018***		
	[0.006]		
d (Top five buyers' ratio of workers in foreign affiliates in Asia)		0.013*	
		[0.007]	
d (Top five buyers' ratio of workers in foreign affiliates in non-Asia)			0.021**
			[0.011]
Observations	27455	26879	26879
F-statistic	11.51	11.196	11.197
R-squared	0.107	0.106	0.106

Notes: Robust standard errors are shown in brackets. Constants are suppressed. All regressions are OLS specifications that include year/industry fixed effects. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Next, we estimate the same equation using the first difference of the number manufacturing workers at suppliers in Japan as the dependent variable (where "manufacturing workers" are measured in terms of the number of workers in domestic manufacturing divisions). In this case, the average wage rate for manufacturing workers should be included as an explanatory variable instead of the average wage rate for all workers. However, we use the average wage rate for all workers because information on wages for manufacturing workers is not available. Table 5 shows the estimation results. In this specification, the coefficients on the growth of the top five buyers' overseas employment ratio turns out to be insignificant. The difference between the results in Tables 4 and Table 5 suggests that Japanese non-MNEs may have increased the number of workers in non-manufacturing divisions such as headquarter divisions, but did not increase the number of workers in manufacturing divisions when their customers expanded foreign operations.

Table 5: Estimation Results: Demand for Manufacturing Workers

Changes in domestic manufacturing employment: OLS specifications (1998-2007)

Dependent variable: dln # of manufacturing workers	Manufacturing workers (1)	Manufacturing workers (2)	Manufacturing workers (3)
dln Real wage rate	-0.190***	-0.187***	-0.187***
	[0.017]	[0.018]	[0.018]
dln User cost of capital	-0.45	-0.395	-0.394
	[0.555]	[0.560]	[0.560]
MNE (t+1)	-0.022	-0.02	-0.02
	[0.027]	[0.027]	[0.027]
Change of buyers	0.004	0.004	0.004
	[0.009]	[0.009]	[0.009]
d (Top five buyers' ratio of workers in foreign affiliates)	0.011		
	[0.031]		
d (Top five buyers' ratio of workers in foreign affiliates in Asia)		0.01	
		[0.038]	
d (Top five buyers' ratio of workers in foreign affiliates in non-Asia)			0.019
			[0.057]
Observations	27455	26879	26879
F-statistic	2.149	2.107	2.107
R-squared	0.022	0.022	0.022

Notes: Robust standard errors are shown in brackets. Constants are suppressed. All regressions are OLS specifications that include year/industry fixed effects. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

We conduct a number of robustness checks and confirm that there is a positive correlation between customers' expansion abroad and changes in domestic employment at their non-MNE suppliers. A possible criticism of the analysis here is that the overseas employment ratio does not fully capture the extent of the expansion of buyers' overseas and domestic operations. For example, some buyers may expand their overseas operations while at the same time shrinking their domestic operations,

whereas other buyers may not shrink their domestic operations. In order to control for changes in the size of domestic operations, we split our sample into two groups of firms depending on the growth rate of the top five buyers' domestic employment. We first calculate the average number of domestic workers employed by the top five buyers for each firm and year and then calculate the growth rate of the top five buyers' average domestic employment. We calculate the median of the growth rate of the top five buyers' average domestic employment by year and industry (industry of the firm, not of the buyers) and identify whether the growth rate of the domestic employment of the firm's top five customers is higher than the median growth rate for each year and industry. Splitting our sample of firms into those whose buyers' growth rate of domestic employment falls above the median and firms whose buyers' growth rate of domestic employment falls below the median, we estimate equation (5) for each group of firms.

Tables 6 and 7 show the estimation results for firms whose buyers have a higher growth rate and for firms whose buyers have a lower growth rate than the median, respectively. In both Tables 6 and 7, the top five buyers' overseas employment ratio has a positive coefficient in all cases, and the estimated coefficient is statistically significant in column (1) in both tables. These results suggest that even controlling for growth in buyers' domestic employment, buyers' expansion of overseas operations has a positive effect on supplier firms' domestic employment. Further, although the coefficient on the *MNE(t+1)* dummy is not significant in Tables 4, 5, and 7, it becomes statistically significant and positive in Table 6. This result suggests that firms which decide to become a multinational increase their domestic employment in the case where their customers increase or maintain their domestic employment. In other words, the result implies that firms' own decision to become a multinational and the

expansion of customer firms' domestic operations tend to lead firms to expand their domestic operations.

Table 6: Estimation Results for Firms whose Customers Registered High Employment Growth

Changes in domestic employment: OLS specifications (1998-2007)

Dependent variable: dln # of workers	All workers (1)	All workers (2)	All workers (3)
dln Real wage rate	-0.156***	-0.155***	-0.155***
	[0.005]	[0.005]	[0.005]
dln User cost of capital	-0.056	-0.036	-0.037
	[0.150]	[0.152]	[0.152]
MNE (t+1)	0.019**	0.016**	0.016**
	[0.008]	[0.008]	[0.008]
Change of buyers	0	0	0.001
	[0.002]	[0.002]	[0.002]
d (Top five buyers' ratio of workers in foreign affiliates)	0.015*		
	[0.009]		
d (Top five buyers' ratio of workers in foreign affiliates in Asia)		0.012	
		[0.011]	
d (Top five buyers' ratio of workers in foreign affiliates in non-Asia)			0.012
			[0.016]
Observations	13546	13275	13275
F-statistic	6.076	5.951	5.947
R-squared	0.115	0.115	0.115

Notes: Robust standard errors are shown in brackets. Constants are suppressed. All regressions are OLS specifications that include year/industry fixed effects. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 7: Estimation Results for Firms whose Customers Registered Low Employment Growth

Changes in domestic employment: OLS specifications (1998-2007)

Dependent variable: dln # of workers	All workers (1)	All workers (2)	All workers (3)
dln Real wage rate	-0.146***	-0.146***	-0.146***
	[0.005]	[0.005]	[0.005]
dln User cost of capital	-0.006	0.05	0.051
	[0.148]	[0.149]	[0.149]
MNE (t+1)	-0.004	-0.005	-0.004
	[0.007]	[0.007]	[0.007]
Change of buyers	0.002	0.002	0.002
	[0.002]	[0.002]	[0.002]
d (Top five buyers' ratio of workers in foreign affiliates)	0.015*		
	[0.008]		
d (Top five buyers' ratio of workers in foreign affiliates in Asia)		0.012	
		[0.010]	
d (Top five buyers' ratio of workers in foreign affiliates in non-Asia)			0.018
			[0.015]
Observations	13909	13604	13604
F-statistic	6.25	6.046	6.045
R-squared	0.115	0.114	0.114

Notes: Robust standard errors are shown in brackets. Constants are suppressed. All regressions are OLS specifications that include year/industry fixed effects. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

As another robustness checks, we estimate equation (5) using the overseas employment ratio of the top three rather than the top five buyers. The results are shown in Table 8. While we obtain similar results to those in Table 4, the size of the coefficient increases from 0.018 to 0.031 in the first column. This increase in the coefficient implies that expansion abroad by the top three buyers has a greater positive impact on the growth of suppliers' domestic employment. Further, we again estimate

the same equation splitting the sample depending on the growth rate of the domestic employment of the top three buyers in the same manner as we did for the top five buyers for the estimations reported in Tables 6 and 7. The results are shown in Tables 9 and 10. Although the estimated coefficients on the overseas employment ratio of the top three buyers are larger and have greater statistical significance in the results in Tables 9 and 10, they are consistent with those in Tables 6 and 7. Again, these results imply that overseas expansion by customers does not have a negative effect on non-MNEs' domestic employment and in fact has a significant positive effect.

Table 8: Robustness Checks: Top Three Buyers

Changes in domestic employment: OLS specifications (1998-2007)

Dependent variable: dln # of workers	All workers (1)	All workers (2)	All workers (3)
dln Real wage rate	-0.146***	-0.146***	-0.146***
	[0.004]	[0.004]	[0.004]
dln User cost of capital	0.021	0.056	0.06
	[0.117]	[0.119]	[0.119]
MNE (t+1)	0.011*	0.008	0.008
	[0.006]	[0.006]	[0.006]
Change of buyers	0.000	0.000	0.000
	[0.002]	[0.002]	[0.002]
d (Top three buyers' ratio of workers in foreign affiliates)	0.031***		
	[0.007]		
d (Top three buyers' ratio of workers in foreign affiliates in Asia)		0.025***	
		[0.009]	
d (Top three buyers' ratio of workers in foreign affiliates in non-Asia)			0.029**
			[0.012]
Observations	21249	20674	20674
F-statistic	8.825	8.534	8.523
R-squared	0.106	0.106	0.106

Notes: Robust standard errors are shown in brackets. Constants are suppressed. All regressions are OLS specifications that include year/industry fixed effects. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 9: Robustness Checks: Estimation results for firms whose customers registered high employment growth (Top three customers)

Changes in domestic employment: OLS specifications (1998-2007)

Dependent variable: dln # of workers	All workers (1)	All workers (2)	All workers (3)
dln Real wage rate	-0.150***	-0.149***	-0.149***
	[0.005]	[0.005]	[0.005]
dln User cost of capital	0.009	0.028	0.025
	[0.167]	[0.169]	[0.169]
MNE (t+1)	0.022**	0.018**	0.018**
	[0.009]	[0.009]	[0.009]
Change of buyers	-0.001	0	0
	[0.002]	[0.002]	[0.002]
d (Top three buyers' ratio of workers in foreign affiliates)	0.035***		
	[0.011]		
d (Top three buyers' ratio of workers in foreign affiliates in Asia)		0.030**	
		[0.013]	
d (Top three buyers' ratio of workers in foreign affiliates in non-Asia)			0.030*
			[0.017]
Observations	10504	10244	10244
F-statistic	4.751	4.635	4.625
R-squared	0.116	0.116	0.116

Notes: Robust standard errors are shown in brackets. Constants are suppressed. All regressions are OLS specifications that include year/industry fixed effects. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 10: Robustness Checks: 'Estimation Results for Firms whose Customers Registered Low Employment Growth (Top three customers)

Changes in domestic employment: OLS specifications (1998-2007)

Dependent variable: dln # of workers	All workers (1)	All workers (2)	All workers (3)
dln Real wage rate	-0.142***	-0.142***	-0.142***
	[0.005]	[0.005]	[0.005]
dln User cost of capital	0.068	0.133	0.14
	[0.168]	[0.171]	[0.171]
MNE (t+1)	0	-0.001	-0.001
	[0.009]	[0.009]	[0.009]
Change of buyers	0	0	0
	[0.002]	[0.002]	[0.002]
d (Top three buyers' ratio of workers in foreign affiliates)	0.022**		
	[0.010]		
d (Top three buyers' ratio of workers in foreign affiliates in Asia)		0.019	
		[0.012]	
d (Top three buyers' ratio of workers in foreign affiliates in non-Asia)			0.019
			[0.017]
Observations	10745	10430	10430
F-statistic	4.94	4.749	4.744
R-squared	0.118	0.117	0.117

Notes: Robust standard errors are shown in brackets. Constants are suppressed. All regressions are OLS specifications that include year/industry fixed effects. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

In addition, we estimate the same equation adding industry- or firm-level control variables or using another measure of top buyers' overseas operations. First, to control for industry characteristics, we estimate equation (5) with a dummy for capital intensive industries and its interaction term with the top five buyers' overseas employment ratio. We classify industries into capital intensive and labor intensive industries based on the median value of the capital-labor ratio. The capital intensive industry dummy takes one for firms which belong to a capital intensive industry.

Appendix Table 4 reports the estimation results. We do not obtain a statistically significant coefficient for the capital intensive industry dummy and its interaction terms. Although the coefficient on the top five customers' overseas employment ratio becomes insignificant, it remains positive.[14]

Second, we estimate equations that instead of the overseas employment ratio include the absolute number of workers employed by the top five buyers' foreign affiliates and that of domestic workers employed by the top five buyers as separate variables. Appendix Table 5 shows the results. When we include both the top five buyers' domestic employment and overseas employment, the estimated coefficient on the overseas employment variable is not significant, while that on the domestic employment variable is positive and significant. However, when excluding the domestic employment variable, the estimated coefficient on the overseas employment variable is positive and significant. (The results are not shown in this paper but are available from the authors upon request.) In fact, these two variables, the top five buyers' domestic employment and overseas employment, are highly correlated (the correlation coefficient is more than 0.6), and it seems that the variable for buyers' domestic employment captures the effect of their overseas expansion as well. However, as before, we do not find any negative impact of top buyers' expansion abroad on domestic employment.

Third, we estimate the equation further controlling for other firm-level characteristics such as exporting and productivity. We add an exporter dummy variable

[14] We conducted the same estimations using the overseas employment ratio for the top three buyers instead of the top five buyers and obtained similar results. Again, the estimated coefficients on the capital intensive industry dummy and its interaction term were not statistically significant. However, the estimated coefficient on the top three buyers' overseas employment ratio remained positive and statistically significant in this case. The estimation results are available from the authors upon request.

and its interaction term with the top five buyers' overseas employment ratio to the baseline specification shown in Table 4. However, the estimated coefficients for both the exporter dummy and its interaction term are not statistically significant. Thus, although one might expect that overseas expansion by a firm's main customers has a larger impact for firms that are exporters by leading to an increase in exports to the foreign affiliates of those customers, we find that this hypothesis is not supported by the data. One possible explanation is that domestic suppliers do not necessarily export directly to their main customers' foreign affiliates, but do so indirectly through their main customers in Japan. If this is the case, we cannot capture the increase in exports resulting from the customers' overseas expansion, because our data source, the *BSBSA*, only asks firms about direct exports. Finally, when we add firm-level total factor productivity (TFP) and its interaction term with the top five buyers' overseas employment ratio to the baseline specification in Table 4, the estimated coefficients are not statistically significant for both the TFP variable and its interaction term, suggesting that TFP does not have a significant impact on employment.[15]

Thus, we do not find a significantly negative effect of main customers' overseas expansion on non-MNEs' employment and instead in fact tend to obtain a positive impact.[16]

[15] Firm-level TFP is calculated based on industry-level production functions estimated using the semi-parametric estimation technique proposed by Levinsohn & Petrin (2003).

[16] Additionally, we examine the relationship between domestic wage payments and the expansion of overseas production of firms' top five buyers, using a reduced-form equation à la Desai, *et al*. (2009). The OLS estimation results are shown in Appendix Table 7. As in the labor demand estimation above, we take the first difference for all variables except the dummies and include industry-by-year dummies. The coefficients on the top five buyers' overseas employment ratio are insignificant but positive, indicating that non-MNEs' total wage bill is not negatively affected by their customers' expansion of foreign activities.

5. Conclusion and Policy Implications

This paper investigated the effects of main customers' expansion of overseas operations on non-multinational firms' employment, using a unique firm-level dataset with information on buyer-supplier transaction relationships. We do not find any negative effects of top buyers' expansion of foreign activities on non-MNEs' employment. Rather, we in fact find a significantly positive effect in several cases. Contrary to fears of a potential hollowing out of domestic industry in Japan, our results imply that the expansion of overseas production does not have a negative effect on the employment of domestic supplier firms. Put differently, our results can be interpreted as indicating that the impact on non-MNEs' employment may actually be positive if their main customer firms are successful in foreign markets and increase foreign activities. As suggested in some previous studies (*e.g.*, Blonigen 2001 and Nishitateno 2013 for the case of the Japanese automobile industry), the expansion of overseas production by downstream firms may increase purchases from upstream firms in Japan, resulting in an increase in employment at the upstream firms. This would be the case if downstream firms can increase their world-wide sales by expanding overseas production. Therefore, our results suggest that selling to a firm which is successful in overseas production may be important for supplier firms in Japan. Upstream firms which have a transaction relationship with such "good" downstream MNEs may be able to benefit from their customers' overseas expansion.

However, as argued in Section 2, in practice, total manufacturing employment and the total number of manufacturing firms in Japan have been declining dramatically. This macro-level observation seems to contradict our empirical result. How can we interpret the apparent contradiction? First, as shown in Figure 2 in Section 2, the

biggest decline in both employment and the number of firms can be seen for firms with less than 50 employees, which we were unable to cover in this paper due to data constraints. Therefore, the negative impact of MNEs' overseas expansion may be more serious and conspicuous for smaller firms. Smaller firms are likely to be lower down in the supply chain (i.e., more upstream), and an issue worth investigating is whether the impact of MNEs' overseas expansion on their suppliers differs depending on firms' position in the supply chain. Second, although successful overseas expansion by downstream firms is likely to positively affect domestic suppliers' employment, the shift from domestic to overseas production by their main customers may increase the probability of death for supplier firms or the probability that transaction relationships are broken off. This risk may be particularly high for smaller supplier firms. Thus, the dynamics of transaction relationships represent another issue that deserves further scrutiny. As part of the preliminary analysis for this paper, we estimated the labor demand function using the Heckman selection model in order to take account of the possible bias arising from the death of supplier firms; however, the results of the statistical tests indicated that it was not necessary to employ the selection model and we therefore did not do so here. Nevertheless, selection in transaction relationships, i.e., whether firms find new partners, cease transacting with each other, replace partners, etc., is a further issue that should be more closely examined in the future in order to examine the heterogeneous impacts of downstream firms' overseas expansion on supplier firms.

Closely related, the third reason why our results may appear to be in contradiction with the observed decline in manufacturing employment and firms is that our measure of overseas expansion may not be able to fully capture the dynamic changes in the overseas and domestic production of the main buyers. For example, our current

measure does not sufficiently take account of the frequency of changes in customers and the strength of transaction relationships (*i.e.*, the length of transaction relationships and/or the transaction volume). While taking these factors into account is not straightforward due to data constraints, doing so would be a worthwhile exercise.

Although our result should be interpreted with some reservation, it is noteworthy that we found no evidence of a negative relationship between the overseas expansion of downstream firms and employment at domestic suppliers. This result provides an important policy implication. That is, overseas expansion itself should not be criticized and in fact instead should be promoted. Policy support for overseas expansion is appropriate and is not responsible for accelerating the hollowing out of supporting industries. Our results suggest that supplier firms that have a transaction relationship with "good" buyers that can expand their overseas operations are likely to be positively affected by the overseas expansion of their buyers. In order to establish new transaction relationships, supplier firms may have to incur some costs to collect information on potential buyers, innovate new products, change their line of business, or even invite a new manager. Government policy should support such efforts of supplier firms for establishing new transaction relationships, not discourage the expansion of overseas operations by MNEs.

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Appendix

Table A1: Number of non-MNE observations by industry: Non-MNE firms with manufacturing divisions or establishments in Japan (2007)

	(A) BSBSA	(B) This paper	(B)/(A)
1: Food products and beverages	1,551	416	26.8%
2: Textiles	428	126	29.4%
3: Lumber and wood products	230	76	33.0%
4: Pulp, paper, and paper products	331	176	53.2%
5: Printing	583	210	36.0%
6: Chemicals and chemical fibers	187	87	46.5%
7: Paint, coating, and grease	86	36	41.9%
8: Pharmaceutical products	199	76	38.2%
9: Miscellaneous chemical products	191	79	41.4%
10: Petroleum and coal products	47	22	46.8%
11: Plastic products	579	327	56.5%
12: Rubber products	104	50	48.1%
13: Ceramic, stone and clay products	416	153	36.8%
14: Iron and steel	358	174	48.6%
15: Non-ferrous metals	257	138	53.7%
16: Fabricated metal products	806	404	50.1%
17: Metal processing machinery	202	94	46.5%
18: Special industry machinery	523	302	57.7%
19: Office and service industry machines	98	33	33.7%
20: Miscellaneous machinery	448	211	47.1%
21: Electrical machinery and apparatus	337	167	49.6%
22: Household electric appliances	87	37	42.5%
23: Communication equipment	212	82	38.7%
24: Computer and electronic equipment	145	57	39.3%
25: Electronic parts and devices	562	227	40.4%
26: Miscellaneous electrical machinery	183	78	42.6%
27: Motor vehicles and parts	647	330	51.0%
28: Other transportation equipment	221	110	49.8%
29: Precision machinery	549	211	38.4%
30: Miscellaneous mfg. industries	29	9	31.0%
37: Wholesale trade	1,051	371	35.3%
Total	11,647	4,869	41.8%

Table A2: Summary Statistics

Variable	N	Min	Mean	Max	SD
dln # of workers in parent firm	27,455	-1.36	0.00	2.55	0.12
dln # of manufacturing workers in parent firm	27,455	-7.85	-0.02	6.79	0.61
dln Real wage bill in parent firm	27,455	-3.79	0.03	5.02	0.29
dln Real wage rate in parent firm	27,455	-2.22	0.02	2.38	0.22
dln User cost of capital in parent firm	27,455	-0.14	0.00	0.08	0.01
MNE (t+1)	27,455	0.00	0.02	1.00	0.14
Change of top five buyers	27,455	0.00	0.78	1.00	0.41
d (Top five buyers' ratio of workers in foreign affiliates)	27,455	-0.95	0.01	0.94	0.12
d (Top five buyers' ratio of workers in foreign affiliates in Asia)	26,879	-0.93	0.01	0.94	0.10
d (Top five buyers' ratio of workers in foreign affiliates in non-Asia)	26,879	-1.20	0.00	1.19	0.07
dln Top five buyers' workers in foreign affiliates	27,455	-10.94	0.03	10.99	1.98
dln Top five buyers' workers in foreign affiliates in Asia	26,882	-10.18	0.06	10.41	1.88
dln Top five buyers' workers in foreign affiliates in non-Asia	26,840	-10.65	-0.03	10.31	1.86
dln Top five buyers' domestic workers	27,455	-6.07	-0.02	5.86	0.70
Change of top three buyers	21,249	0.00	0.64	1.00	0.48
d (Top three buyers' ratio of workers in foreign affiliates)	21,249	-0.88	0.01	0.95	0.11
d (Top three buyers' ratio of workers in foreign affiliates in Asia)	20,674	-0.87	0.01	0.98	0.09
d (Top three buyers' ratio of workers in foreign affiliates in non-Asia)	20,674	-1.20	0.00	1.19	0.07
dln Top three buyers' workers in foreign affiliates	21,249	-10.89	0.02	10.99	1.77
dln Top three buyers' workers in foreign affiliates in Asia	20,677	-10.18	0.05	10.41	1.68
dln Top three buyers' workers in foreign affiliates in non-Asia	20,641	-10.51	-0.04	10.38	1.66
Exporter	27,455	0.00	0.22	1.00	0.41

Table A3: Correlation matrix

Correlation matrix (Obs.=26,879)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1)	dln # of workers in parent firm	1.000										
(2)	dln # of manufacturing workers in parent firm	0.222	1.000									
(3)	dln Real wage bill in parent firm	0.175	0.041	1.000								
(4)	dln Real wage rate in parent firm	-0.264	-0.059	0.886	1.000							
(5)	dln User cost of capital in parent firm	-0.009	0.018	0.001	0.008	1.000						
(6)	MNE (t+1)	0.009	-0.004	0.014	0.010	-0.013	1.000					
(7)	Change of buyers	0.002	0.005	-0.008	-0.008	0.029	0.017	1.000				
(8)	d (Top five buyers' ratio of workers in foreign affiliates)	0.017	0.006	0.013	0.007	-0.017	0.008	-0.010	1.000			
(9)	d (Top five buyers' ratio of workers in foreign affiliates in Asia)	0.014	0.004	0.010	0.005	-0.008	0.012	-0.007	0.817	1.000		
(10)	d (Top five buyers' ratio of workers in foreign affiliates in non-Asia)	0.007	0.003	0.007	0.005	-0.022	-0.003	-0.009	0.562	0.016	1.000	
(11)	dln Top five buyers' domestic workers	0.027	0.001	0.002	-0.010	-0.018	0.004	0.003	0.348	0.229	0.280	1.000

Table A4: Estimation results: OLS specifications with capital intensity control variables (1998-2007)

Dependent variable: dln # of workers	All workers	All workers	All workers
	(1)	(2)	(3)
dln Real wage rate	-0.151***	-0.151***	-0.151***
	[0.003]	[0.003]	[0.003]
dln User cost of capital	-0.051	-0.017	-0.016
	[0.104]	[0.105]	[0.105]
MNE (t+1)	0.006	0.005	0.005
	[0.005]	[0.005]	[0.005]
Change of buyers	0.001	0.001	0.001
	[0.002]	[0.002]	[0.002]
Capital intensive industry dummy	-0.031	-0.032	-0.031
	[0.039]	[0.039]	[0.039]
Capital intensive industry dummy * Buyers' overseas employment ratio	0.012	0.001	0.02
	[0.012]	[0.015]	[0.022]
d (Top five buyers' ratio of workers in foreign affiliates)	0.013		
	[0.008]		
d (Top five buyers' ratio of workers in foreign affiliates in Asia)		0.013	
		[0.010]	
d (Top five buyers' ratio of workers in foreign affiliates in non-Asia)			0.012
			[0.015]
Observations	27455	26879	26879
F-statistic	11.472	11.156	11.161
R-squared	0.107	0.106	0.106

Notes: Robust standard errors are shown in brackets. Constants are suppressed.

All regressions are OLS specifications that include year/industry fixed effects.

***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table A5: Robustness Checks: Number of Workers Employed by the Top Five Buyers' Foreign Affiliates

Changes in domestic employment: OLS specifications (1998-2007)

Dependent variable: dln # of workers	All workers	All workers	All workers
	(1)	(2)	(3)
dln Real wage rate	-0.151***	-0.151***	-0.151***
	[0.003]	[0.003]	[0.003]
dln User cost of capital	-0.051	-0.016	-0.016
	[0.104]	[0.105]	[0.105]
MNE (t+1)	0.007	0.005	0.005
	[0.005]	[0.005]	[0.005]
Change of buyers	0.001	0.001	0.001
	[0.002]	[0.002]	[0.002]
dln Top five buyers' domestic workers	0.003***	0.004***	0.004***
	[0.001]	[0.001]	[0.001]
dln Top five buyers' workers in foreign affiliates	0		
	[0.000]		
dln Top five buyers' workers in foreign affiliates in Asia		0	
		[0.000]	
dln Top five buyers' workers in foreign affiliates in non-Asia			0
			[0.000]
Observations	27455	26997	26840
F-statistic	11.471	11.229	11.202
R-squared	0.107	0.107	0.107

Notes: Robust standard errors are shown in brackets. Constants are suppressed.

All regressions are OLS specifications that include year/industry fixed effects.

***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table A6: Estimation Results: Total Wage Bill

Changes in foreign inputs and domestic total wage bill: OLS specifications (1998-2007)

Dependent variable: dln real total wage bill	Total wage bill	Total wage bill	Total wage bill
	(1)	(2)	(3)
MNE (t+1)	0.020	0.020	0.020
	[0.013]	[0.013]	[0.013]
Change of buyers	-0.004	-0.002	-0.002
	[0.004]	[0.004]	[0.004]
d (Top five buyers' ratio of workers in foreign affiliates	0.018		
	[0.015]		
d (Top five buyers' ratio of workers in foreign affiliates in Asia)		0.020	
		[0.018]	
d (Top five buyers' ratio of workers in foreign affiliates in non-Asia)			0.020
			[0.027]
Observations	27455	26879	26879
F-statistic	3.968	3.929	3.926
R-squared	0.039	0.04	0.04

Notes: Robust standard errors are shown in brackets. Constants are suppressed.

All regressions are OLS specifications that include year/industry fixed effects.

***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.