To Lee Jae Hun and Michelle
The research and material presented in this thesis are original and solely conducted by the author, except where acknowledged.

Lili Yan Ing
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ABSTRACT

Even though there are gains from trade, there is still a concern that trade opportunities have significant distributional consequences. The conventional trade theorems predict that an increase in trade in developing countries will increase demand for unskilled labour intensive goods which in turn reduces the skill premium. These theorems have failed to explain the rising skill premium in developing countries as their trade expands.

We consider the arguments that trade expansions driven by tariff reductions and technological catch-up affect the skill premium. We use the North-South trade framework and a continuum good model with skilled and unskilled labour in production to show that trade expansions affect the skill premium.

To test the hypothesis, we conduct empirical studies of 27 developing countries across 134 manufacturing industries from 1980 to 2005. We use two proxies for trade expansions, the ratio of exports (imports) to GDP and the range of exports (imports). Moreover, we extend the analysis by classifying manufactures based on skill intensity into unskilled and skilled labour intensive.

Our findings show that while tariff reductions do not necessarily increase imports, expanded exports are significantly affected by technological catch-up. Exports and imports affect the skill premium as predicted in the theoretical framework. The rising skill premium in developing countries is significantly affected by an increase in skilled labour intensive exports which is driven by a resource shift from unskilled labour intensive exports or from skilled labour intensive imports. Exports from developing to developed countries mainly comprise skilled labour intensive intermediate goods (spare parts or assembling parts) that developed countries use for their final goods instead of unskilled labour intensive goods. In fact, from the mid 1980s to 2005, the value and the range of unskilled labour intensive exports such as footwear, textiles, and clothing were surpassed by those of skilled labour intensive exports such as telecommunications, automatic data processing machines, and automotive.

The main value added of our study is the contribution to trade theorem framework, empirical studies of the effects of trade expansions on the skill premium, development of a proxy to measure trade expansions, as well as construction of comprehensive data sets of the skill premium and exports (imports) disaggregated by skill.
Chapter 1

Introduction
1. Introduction

1.1 Background

Even though there are gains from trade, there is still a concern that trade opportunities have significant distributional consequences. Classically, the Heckscher-Ohlin (HO) theorem, in a 2x2 setting, predicts that a country will export a good which is produced by intensively using a relatively abundant factor of production. In the case of developing countries, they are predicted to export goods which are relatively unskilled labour intensive (Markusen et al. (1995); Krugman and Obstfeld (2003); Feenstra (2003)). Moreover, the Stolper-Samuelson (SS) theorem predicts that an increase in the relative price of a good will increase the real return to the factor used intensively in that good and reduce the real return to the other factor (Stolper and Samuelson (1941)). We specify returns to the factors of production as returns to labour in terms of the wages of skilled and unskilled labour. We define skill premium as the ratio of the wage of skilled labour to the wage of unskilled labour.

It implies that an increase in the relative good price due to increased international trade will raise the wage of unskilled labour relative to that of skilled labour in developing countries which are generally unskilled labour abundant. Logically, if both the HO endowment differences prediction on the trade pattern model and the SS returns on factors of production theorem apply, the skill premium in developing countries will decrease.

Apparently, the combination of both theorems has failed to explain the rising skill premium in both developed and developing countries. As the skill premium widened in the United States (US) and Europe since the mid 1980s to the 2000s, an increase in the skill premium is intriguingly also seen in developing countries, noticeably Asia and Latin America, as their trade expanded.
To get a sense of the magnitude of this phenomenon, the skill premium rose by 40.43 percent in a sample of 27 developing countries from 1980 to 2005 (ILO (2005)) at the same time as waves of tariff reductions and trade expansions occurred. As average import tariffs on manufactured goods in these countries decreased by 47.52 percent from 1980 to 2005 (Easterly and Sewadeh (2000); UNCTAD (2005):Table 8.4; Ng (2006)), the ratio of exports (imports) of manufactured goods to GDP increased by 115.82 (18.64) percent (UNCTAD (2005):Table 4.2).

In addition, there was also a shift in the exports of developing countries from unskilled labour intensive to skilled labour intensive. The ratio of unskilled labour intensive exports (e.g. footwear, textiles, and clothing) to exports of manufactured goods decreased from 51.30 percent in 1980 to 25.70 percent in 2005, while the ratio of skilled labour intensive exports (e.g. telecommunications, office and automatic data processing machines, and road vehicles) to exports of manufactured goods increased from 48.70 percent in 1980 to 74.30 percent in 2005 (UNCTAD (2005):Table 4.2). These facts suggest there might indeed be a correlation between trade expansions and the skill premium, and stimulate an analysis of the effects of trade expansions on the skill premium.

Before we discuss the effects of trade expansions on the skill premium, we briefly review interpretations of trade expansions and distributional consequences. Trade expansions are conventionally interpreted as expansions in exports and/or imports relative to the overall economy or Gross Domestic Product (GDP) which is usually measured by the ratio of exports and/or imports to GDP. We acknowledge that there are other factors than trade expansions which are generally considered to affect the skill premium, such as outsourcing and investment (Feenstra and Hanson (1995)) or imported capital...
stock (Robbins (1996)). This study focuses only on what we consider to be the main factors that affect the skill premium which are trade expansions driven by trade liberalisation and technological catch-up. The main reason is that changes in input prices - in this case the skill premium - only occur if there are changes in goods prices; and changes in goods prices could feasibly occur if goods are internationally traded; and changes in trade are predominantly determined by trade policy and technological changes.

Distributional consequences are approached in two main ways. Studies that interpret distributional consequences as income inequality generally use either the Gini coefficient or the Theil index as the proxy. Typically, the literature which uses this interpretation comes up with the result that there is no systematic correlation between income inequality and trade expansions (Higgins and Williamson (1999); Dollar and Kraay (2004)) or between income inequality and trade policies (Edwards (1997)). Alternatively, it is asserted that trade expansions reduce income inequality in developing countries (Chakrabarti (2000); Reuveny and Li (2003)).

Meanwhile, other studies that interpret distributional consequences as the skill premium or wage disparity generally use the ratio of the wage of skilled labour to the wage of unskilled labour (or the ratio of income at the highest fraction to income at the lowest fraction) as a proxy for distributional consequences. They assert that trade expansions raise the skill premium or wage disparity in developing countries (Robbins (1996); Milanovic (2004)).

The main reason for the different results is that the variables are quite different and not compatible. The Gini coefficient or the Theil index measure how income is distributed across individuals, whereas the skill premium illustrates the gap between the wage of a certain group relative to the wage of the other
Despite the different interpretations of distributional consequences, this study does not in any way mean to establish which measurement is better than the other. This study focuses on the facts that there might be a correlation between trade expansions and returns to the factors of production which we refer to as the skill premium.

The SS theorem explains that trade and returns to factors of production are linked through changes in product prices. We expect that there are two external forces that could change product prices which in turn change returns to the factors of production. The first one is tariff reductions and the second one is changes in productivity driven by technological change.

We use the North-South trade framework and a continuum good model to illustrate how trade expansions driven by tariff reductions and technological change affect the skill premium. The framework of how tariff reductions affect the skill premium draws on Xu (2003) and the inclusion of the Southern technological catch-up follows Zhu and Trefler (2005).

We also support our argument by empirical analyses. To test the hypothesis, empirical studies of 27 developing countries across 134 manufacturing industries from 1980 to 2005 are conducted. The large span of time provides a more comprehensive story of developing countries in the period before and after trade liberalisation. Most developing countries implemented significant trade liberalisation. Major changes have occurred in trade policies since the mid 1980s which had significant effects on tariff reductions and trade expansions.

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1 Take an extreme two group example: one group earns USD 100 a month and the other group earns nothing. Then the Gini coefficient for the total groups is 0.5. In reality where there are more than two groups, the Gini coefficient will move if there is a change in the wage of the middle income group. By contrast, the skill premium could show the wage disparity among these groups. One group earns 100 times as much as the other group.

2 For the commencement year of trade liberalisation in developed and developing countries, see Sachs and Warner (1995) and Wacziarg and Welch (2003).
in developing countries (Borrego et al. (1996)).

To examine how trade expansions affect the skill premium, we use two proxies for trade expansions. The first proxy is a conventional and widely used one which is the ratio of exports (imports) of manufactured goods to GDP, hereafter the ratio. There are two main drawbacks with using this conventional measure of trade expansions: first, the ratio of exports (imports) to GDP cannot describe the range (number) of industries that contribute to that ratio, and second, the ratio cannot reveal an actual expansion in trade and thus there is a tendency that the ratio is not strictly comparable across countries. Therefore, we introduce a new proxy for trade expansions which is the range of exports (imports), hereafter the range. The range of exports (imports) is measured by the summation of an index that is based on the share of the value of exports (imports) of each industry to the value of exports (imports) of manufactured goods. The range of exports (imports) could solve the main disadvantages of using the first proxy for trade expansions.

To provide a comprehensive illustration of the effects of trade expansions on the skill premium, this study extends the analysis by classifying manufactures based on skill intensity into unskilled and skilled labour intensive, and examines the effects of exports (imports) disaggregated by skill on the skill premium. Furthermore, this study also conducts a country by country analysis to examine if trade expansions affect the skill premium in most or only certain developing countries.

1.2 Research Question

This study answers the following main question:

*Do trade expansions affect the skill premium in developing countries?*
The main question is broken down into the following three questions which will be analysed in separate empirical analyses.

1. Do trade expansions driven by tariff reductions and technological catch-up affect the skill premium?

2. What kind of exported (imported) goods raise or reduce the skill premium?

3. Do trade expansions affect the skill premium in most or only in certain countries?

1.3 Value Added

The main value added of this study is as follows.

1. In the North-South trade framework with a continuum good model, this study uses skilled and unskilled labour in the production of manufactured goods to illustrate the effects on the skill premium of skill upgrades through trade expansions.

2. Development of a new proxy to measure trade expansions which is the range of exports (imports). There are two main reasons for developing a new proxy for trade expansions: first, it can describe the range of industries which contribute to trade expansions as well as illustrate skill upgrades through trade, and second, it could reveal an actual expansion in trade and thus it is comparable across countries, regardless of the size of the economy or trade.

3. Presentation of empirical analyses of the effects of trade expansions on the skill premium including:
(a) Panel estimations of the effects of trade expansions driven by tariff reductions and technological catch-up on the skill premium

(b) Panel estimations of the effects of trade expansions disaggregated by skill on the skill premium

(c) Country by country estimations of the effects of trade expansions disaggregated by skill on the skill premium.

4. Construction of comprehensive data sets on the following variables of 27 developing countries from 1980 to 2005:

(a) The skill premium, the ratio of the wage of skilled labour to the wage of unskilled labour based on the wage of non-production and production workers which is sourced from wages by occupation in the manufacturing industry (ILO (2005):Table O.1). The classification of non-production and production workers is based on the International Standard Classification of Occupation (ISCO).

(b) Exports (imports) of manufactured goods disaggregated by skill which are categorised as unskilled and skilled labour intensive. Data on exports (imports) comprises 134 manufacturing industries (3 digit-SITC Revision 2) are from UNCTAD (2005) Table 4.2.

1.4 Thesis Framework

Chapter 2 presents a theoretical framework which explains the effects of trade expansions driven by tariff reductions and technological catch-up on the skill premium. We use the North-South trade framework with a continuum good model and two factors of production which are skilled and unskilled labour. The theoretical framework shows how an import expansion driven by the direct
effect of tariff reductions and an export expansion driven by the indirect effect of tariff reductions (the terms of trade) and technological catch-up affect the skill premium.

Chapter 3 links the theoretical framework to empirical analyses. A data set of 27 developing countries across 134 manufacturing industries from 1980 to 2005 is constructed to test the hypothesis of whether trade expansions affect the skill premium. It illustrates the study coverage, defines the main variables, and discusses the data sources. It also explains proxies for trade expansions: first, the ratio of exports (imports) to GDP or the ratio, and second, the range of exports (imports) or the range.

The next three chapters are devoted to supporting the argument by empirical relevance of the effects of trade expansions on the skill premium in developing countries. Chapter 4 presents panel estimations of the effects of import expansions driven by tariff reductions, and export expansions driven by the terms of trade and technological catch-up, on the skill premium in developing countries. We apply the proxies for trade expansions in estimations. The findings support the hypothesis that an export expansion raises the skill premium, while an import expansion reduces it, as predicted in the theoretical framework. Based on the first proxy, the rising skill premium in developing countries is affected by an increase in exports, while imports have no effect on the skill premium. Meanwhile, based on the second proxy, the rising skill premium in developing countries is affected by an increase in exports as well as a decrease in imports. While tariff reductions do not necessarily increase imports, the expanded exports are significantly affected by technological catch-up.

Chapter 5 explains the importance of observing skill intensity in trade expansions in analysing the effects of trade expansions on the skill premium. To
observe the skill intensity of trade expansions, we classify manufactures by skill into unskilled and skilled labour intensive. This chapter presents panel estimations of the effects of exports (imports) disaggregated by skill on the skill premium. Based on the first proxy, the rising skill premium in developing countries is solely affected by an increase in skilled labour intensive exports. Meanwhile, based on the second proxy, the rising skill premium in developing countries is affected by a combination of a decrease in unskilled labour intensive exports, an increase in skilled labour intensive exports, and a decrease in skilled labour intensive imports.

In analysing the effects of trade expansions on the skill premium, the estimations based on the second proxy (the range) could explain the phenomenon of the rising skill premium in developing countries better than the estimations based on the first proxy (the ratio). Using the range in analysing the effects of trade expansions on the skill premium provides a more coherent explanation of how trade expansions affect the skill premium. The reason is that the range could reveal an actual expansion in trade and is comparable across countries, regardless of the size of the economy or trade.

The rising skill premium in developing countries is significantly affected by an increase in skilled labour intensive exports. This finding supports the logical concept derived from the SS theorem, but does not seem to fully support the HO theorem. The weak prediction of the HO model is mainly caused by the ignorance of the role of technological differences. Exports from developing to developed countries, in fact, mainly comprise skilled labour intensive intermediate goods (spare parts or assembling parts) that developed countries use for their final goods instead of unskilled labour intensive goods.
Chapter 6 presents a time series analysis of the effects of export (import) expansions disaggregated by skill on the skill premium in the 27 developing countries. Around one third show that the rising skill premium is affected by a decrease in unskilled labour intensive exports, and half show that it is affected by an increase in skilled labour intensive exports. The effects of both unskilled labour and skilled labour intensive imports on the skill premium are supported at moderate levels. It also presents a country by country analysis. The country analysis illustrates that there is a shift from unskilled labour intensive exports to skilled labour intensive exports or a shift from skilled labour intensive imports to skilled labour intensive exports.

Chapter 7 presents conclusions, discusses shortcomings, and draws a way ahead.
Chapter 2

Theoretical Framework
The conventional trade theorems, in a 2x2 setting, explain that trade patterns are determined by factor endowment, and trade and returns to factors of production are linked through changes in product prices.\textsuperscript{1} The theorems are based on the assumption that the level of technology is given and there exists a fixed functional relationship between output of goods and input of factors. This implies that returns to factors of production are related in a deterministic way to the prices of goods. The logic derived from the conventional trade theorems is that developing countries are predicted to export relatively unskilled labour intensive goods, and thus the skill premium in developing countries will decrease relative to autarky.

Nonetheless, the conventional trade theorems have failed to explain the rising skill premium in both developed and developing countries. As the skill premium widened in the US and Europe from the mid 1980s to the 2000s, the rising skill premium was intriguingly also seen in developing countries. The skill premium increased in most developing countries, notably Brazil, Costa Rica, El Salvador, Honduras, and Thailand, as their trade expanded. The observations suggest that there might indeed be a correlation between trade expansions and the skill premium.

The growing literature explains that the rising skill premium in developing countries can be due to outsourcing and investment (Feenstra and Hanson (1995)) or product cycles and technological catch-up (Zhu and Trefler (2005)), while others believe that the rising skill premium is a consequence of trade expansions driven by tariff reductions (Xu (2003)) or economies of scale (Epifani and Gancia (2008)).

\textsuperscript{1}The 2x2 model is the widely used international trade model of two goods and two factors of production.
In our view, investment will affect the skill premium only if the investment affects technology. Technology will affect the skill premium if it affects the marginal cost of production. Conclusively, investment will affect the skill premium through changes in prices driven by improved productivity. Regardless of factors that drive technological change, it will only affect the skill premium through changes in prices if trade exists. Likewise, economies of scale alone have no role in affecting the skill premium (Maurin et al. (2002)). It will only affect the skill premium if goods produced as a result of an efficiency improvement are traded. Therefore, we consider the argument that the rising skill premium in developing countries is purely a consequence of trade expansions.

One of the key tenets of the Stolper-Samuelson (SS) theorem is that trade and returns to factors of production are linked through changes in product prices. We expect there are two major external forces that could change product prices which affect returns to factors of production. The first is a reduction in trade barriers. A tariff reduction will change the consumer price which then alters demand for goods. Changes in demand for the final good will modify demand for the factors of production which finally affect their returns. The second is changes in productivity which are predominantly driven by technological change. Technological change will also alter demand for factors of production which in turn changes returns to those factors.

2.1 Modeling Strategy

This section illustrates how trade expansions driven by the two external factors, tariff reductions and technological change, affect product prices which in turn

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2 This study is aware that changes in productivity may also be driven by changes in the relative supply of skilled and unskilled labour (e.g. a massive increase in basic educational attainment or an increase in women's participation rates (Wood (1995):59)). This study only focuses on changes in productivity driven by technological change.
influence returns to factors of production. We use the North-South trade framework and a continuum good model to illustrate how trade expansions driven by tariff reductions and technological change affect the skill premium. The framework of how tariff reductions and Southern technological catch-up affect the skill premium follows studies by Xu (2003) and Zhu and Trefler (2005), respectively.

Xu (2003) points out that tariff reductions per se can raise the Southern skill premium. By using a continuum good model and imposing an assumption that the good produced is ascending in skill intensity, Xu shows that non-traded goods, which are endogenously determined by the level of tariff, become tradable as tariff decreases, and thus an export expansion induced by a country’s own tariff reductions may raise the skill premium. The main difference of our study to Xu’s study is that in our study the manufactured good is produced by both skilled and unskilled labour. In the study by Xu, the manufactured good is only produced by skilled labour. The main prediction of our study, however, is similar to that of Xu in that tariff reductions in developing countries may raise the skill premium.

Furthermore, in pondering a study by Zhu and Trefler (2005), our study also includes technological catch-up as a factor in expanding exports which eventually raises the skill premium. Zhu and Trefler affirm that Southern technological catch-up is the main factor in driving the rising Southern skill premium. The main difference between our study and theirs is the assumption of price levels. Zhu and Trefler assume that prices are at the free trade levels (Northern and Southern tariffs are zero), whereas our study assumes that prices are affected by Northern and Southern tariffs. Therefore, our study can describe the effects of changes in price due to export (import) expansions driven by
an amalgamation of tariff reductions and technological catch-up on the skill premium.

The illustration of how trade expansions driven by tariff reductions affect the skill premium is in Section 2.1.1 and the explanation of how trade expansions driven by technological catch-up shape the skill premium is in Section 2.1.2.

2.1.1 Trade, Tariff, and Skill Premium

This section explains the effects of trade expansions driven by tariff reductions on the skill premium. Tariff reductions can affect the skill premium through trade in two ways. The first way is by a direct effect. A reduction in import tariffs implemented by Southern countries will increase Southern imports from the North. The increase in demand for imported goods from the North will reduce Southern production of the same goods. The fall in Southern production will lower demand for its skilled labour in producing the same goods as the North. Thus, it will reduce the Southern skill premium.

The second way is by an indirect effect, through Southern relative cost. The increased demand for Northern skilled labour causes the wage of Southern skilled labour to be relatively lower than that of the North. The lower wage of Southern skilled labour relative to that of the North improves the Southern competitive advantage in producing the same goods as the North. The improved competitive advantage of Southern skilled labour intensive goods relative to Northern goods will increase demand for Southern skilled labour intensive goods (Southern exports of skilled labour intensive goods) which will increase demand for Southern skilled labour. This will raise the Southern skill premium.
2. Theoretical Framework

Setup

As in Xu (2003) and Zhu and Treffer (2005), suppose there are two countries North and South \((i = N, S)\), two factors of production skilled and unskilled labour \((L_{si}, L_{ui})\), and a continuum manufactured good \(z \in [0, 1]\). Basically, the model uses the distinguishing feature of the Ricardian model of the determination of the competitive margin in production between imported and exported goods. The continuum good model assumes that the number of goods is continuous instead of discrete.\(^3\) There are two main reasons for using a continuum good model rather than the widely used Heckscher-Ohlin (HO) two good model of international trade in this study.\(^4\) First, we can determine the trade margin in North-South trade based on labour productivity. Second, we can examine the movement of that margin in response to tariff reductions and technological changes, and their effects on returns to factors of production.

Both the North and South are endowed with skilled and unskilled labour. The returns to factors of production are the wages of skilled and unskilled labour, \(w_{si}\) and \(w_{ui}\), respectively. The skill premium is defined as the ratio of the wage of skilled labour to that of unskilled labour, \(\omega_i = w_{si}/w_{ui}\). The Northern and Southern skill premiums are \(\omega_N = w_{si}/w_{ui}\) and \(\omega_S = w_{si}/w_{us}\), respectively.

Units of skilled labour and unskilled labour, \(a_{si}\) and \(a_{ui}\), respectively, are required to produce one unit of good \(z\). Define \(\theta_i(z)\) as the labour productivity

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\(^3\) The Ricardian model explains that trade pattern is determined by labour productivity instead of differences in relative factor endowments. For a comprehensive explanation of the Ricardian model with a continuum of goods, see Dornbusch and Samuelson (1977).

\(^4\) Most contemporary studies in international trade use the HO model of two goods, two factors, and two countries. For a comprehensive explanation of the HO model, see Krugman and Obstfeld (2003) Chapter 4 or Markusen et al. (1995) Chapter 8. The basic arguments of our study are the same as that of the HO model, nonetheless. The logic of the HO theorem suggests that free mobility of commodities in international trade can serve as a partial substitute for factor mobility and will lead to a partial equalisation of relative (and absolute) factor prices. While free factor movements will fully equalise factor prices, free commodity movements might equalise them partially.
of skilled labour relative to unskilled labour in country $i$, $\theta_i(z) = au_i(z)/as_i(z)$. $\theta_N(z)$ and $\theta_S(z)$ are the Northern and Southern skilled labour productivity in good $z$, respectively.

The marginal cost of production of the manufactured good $z$ is $c_i(z)$. At the competitive level, price equals marginal cost, $p_i(z) = c_i(z)$. The marginal cost consists of the units of skilled labour ($as_i(z)$) and unskilled labour ($au_i(z)$) required to produce one unit of good $z$ multiplied by the returns of skilled and unskilled labour, $c_i(z) = as_i(z)ws_i + au_i(z)wu_i$. A country produces good $z$ only if the market price at the competitive level is at least the same as its marginal cost of production, $p_i(z) = as_i(z)[ws_i + (au_i(z)/as_i(z))wu_i]$. Using the definition of skilled labour productivity, it can be rewritten as $p_i(z) = as_i(z)[ws_i + \theta_i(z)wu_i]$.

**Export and import margins**

To see the effects of trade expansions driven by tariff reductions on the skill premium, we start from an initial point where the South and North implement *ad valorem* import tariffs on the manufactured good, $\tau_S$ and $\tau_N$, respectively. The South implements its tariff on imported goods from the North and vice versa. As a consequence of the import tariffs implemented by the South, the Southern consumers need to pay $(1 + \tau_S)p_N(z)$ for imported goods from the North. Likewise, the Northern consumers need to pay $(1 + \tau_N)p_S(z)$ for imported goods from the South.

The South will import a good if the Southern marginal cost of production is higher than the marginal cost of importing that good, $c_S(z) \geq (1 + \tau_S)p_N(z)$. Accordingly, the South can only export a good if the Northern marginal cost of
importing that good from the South is lower than the Northern marginal cost of production of the same good, \((1 + \tau_N)p_S(z) \leq c_N(z)\). Literally, the South imports good \(z\) if and only if \(a_S(z)[w_S + \theta(z)w_N] \geq (1 + \tau_S)a_N(z)[w_N + \theta(z)w_N]\) and the South exports good \(z\) if and only if \((1 + \tau_N)a_S(z)[w_S + \theta(z)w_N] \leq a_N(z)[w_N + \theta(z)w_N]\). These states are defined as the Southern import and export conditions, respectively.

From the Southern import and export conditions, the import and export margins can be established as follows. Label \(A(z) = a_N(z)/a_S(z)\) as the productivity of Southern skilled labour relative to that of the North with an assumption that \(a_S(z) \neq a_N(z)\) for all \(z\), and define the Southern relative cost which will be called the relative cost later on as \(v = [w_S + \theta(z)w_N]/[w_N + \theta(z)w_N]\).\(^5\) By using the definition of the relative Southern to Northern labour productivity \((A(z))\) and the relative cost \((v)\), we can establish the import and export margins.\(^6\)

\[
A(z^m) = \frac{v}{1 + \tau_S} \tag{2.1}
\]

\[
\frac{\partial z^m}{\partial v} < 0 \quad \frac{\partial z^m}{\partial \tau_S} > 0 \tag{2.2}
\]

The import margin is a function of the relative cost and Southern tariff, \(z^m = z^m(v, \tau_S)\). Comparative static result 2.2 shows that a decrease in the relative cost (Northern wages are relatively higher than that of the South), \(v\), will reduce the range of Southern imports from the North (i.e. as Southern imports

\(^5\) The southern relative cost is actually \(c_N(z)/c_S(z) = (a_N(z)[w_S + \theta(z)w_N])/(a_S(z)[w_S + \theta(z)w_N])\). We define the relative cost as \(v = [w_S + \theta(z)w_N]/[w_N + \theta(z)w_N]\) to show the import and export margins as functions of the relative cost.

\(^6\) The import margin is derived from the Southern import condition, see Appendix A.2.1.
are decreasing or the range of \((1 - z^m)\) is smaller, \(z^m\) moves right).\(^7\) Whereas a reduction in the Southern import tariff will expand Southern imports from the North (i.e. as Southern imports from the North are larger, \(z^m\) moves left). The Southern export margin, \(z^x\), can be written as in equation 2.3.\(^8\) The export margin, \(z^x = z^x(v, \tau_N)\), is determined by the relative cost and the Northern tariff. Southern exports will increase if the relative cost falls (i.e. a decreasing relative cost illustrates a situation in which wages in the North are relatively higher than those of the South). As any import tariff implemented by the North decreases, Southern exports will escalate.

\[
A(z^x) = (1 + \tau_N)v
\]  

(2.3)

\[
\frac{\partial z^x}{\partial v} < 0 \quad \frac{\partial z^x}{\partial \tau_N} < 0
\]  

(2.4)

The South produces and exports good \(z\) in the range of \(z \in [0, z^m]\) and imports good \(z\) in the range of \(z \in [z^m, 1]\) or Southern imports equal \((1 - z^m)\). The North produces and exports good \(z\) in the range of \(z \in [z^x, 1]\) and imports good \(z\) in the range of \(z \in [0, z^x]\) or Northern imports equal \((z^x - 0)\) or \(z^x\).

The range between \(z^x\) and \(z^m\) are the tariff driven non-traded goods. If \(\tau_S > 0\) and \(\tau_N > 0\) or at least one of them is positive, the import margin will be greater than the export margin, \(z^m > z^x\). If the Southern and Northern tariffs

\(^7\) It is assumed that the correlation between the relative cost and Southern import tariff is positive, \(\partial v/\partial \tau_S > 0\). Define \(g\) as the rate of change. For the Southern exports, the rate of change in its price is rendered to the rate of change in the Southern wages, termed by \(g(p_S(z)) = g(ws_S + wu_S)\). Likewise, for the Southern imports, the rate of change in its price is given by \(g(p_N(z)) = g(ws_N + wu_N)\). Thus, the ratio of average price of Southern exported goods to the average price of its imported goods changes by \(g(ws_S + wu_S) - g(ws_N + wu_N) = gv\).

\(^8\) The export margin is derived from the Southern export condition, see Appendix A.2.1.
equal zero, $\tau_S = \tau_N = 0$, the import margin will be equal to the export margin, $z^m = z^x$.

Balance of trade

The Northern and Southern consumer spending on good $z$ are termed as $E_N$ and $E_S$, respectively. Expenditure is presumed to be spread out evenly across varieties of types of good $z$. The total world spending on good $z$ is the total of the Northern and Southern consumer expenditure, $E_W = E_N + E_S$, which is normalised to 1. The Northern and Southern consumer spending on good $z$ can be written as the shares of the total world spending on that good, $E_N = (1 - \xi)$ and $E_S = \xi$, respectively.

Suppose both the North and South preserve balance of trade, so that the value of Southern imports of manufactured good $z$ equals that of Southern exports of manufactured good $z$:

$$
(1 - z^m) \frac{E_S}{(1 + \tau_S)} = z^x \frac{E_N}{(1 + \tau_N)}
$$

By the definition of the shares of world expenditure, we can rewrite the balance of trade as:

$$
\frac{\xi}{(1 - \xi)} = \frac{z^x(1 + \tau_S)}{(1 - z^m)(1 + \tau_N)}
$$

Apply comparative static results 2.2 and 2.4 to determine the Southern share of world expenditure as a function of the relative cost and Southern and Northern tariffs, $\xi = \xi(v, \tau_S, \tau_N)$. Take partial derivatives of $\xi$ with respect to $v$, $\tau_S$, and
$\tau_N$ as follows.\footnote{The partial derivation of the Southern share of world expenditure as a function of the relative cost and Southern and Northern tariffs is in Appendix A.2.2}

$$\frac{\partial \xi}{\partial v} < 0 \quad \frac{\partial \xi}{\partial \tau_S} > 0 \quad \frac{\partial \xi}{\partial \tau_N} < 0 \quad \tag{2.7}$$

Market clearing for labour

Demand for Southern labour is driven by demand for good $z$ from Southern consumption, $z \in [0, z^m]$, and demand for good $z$ from Northern consumption for Southern goods (Southern exports), $z \in [0, z^n]$. Likewise, demand for Northern labour is generated by demand for good $z$ from Northern consumption, $z \in [z^n, 1]$, and demand for good $z$ from Southern consumption for Northern goods (Northern exports), $z \in [z^m, 1]$. The unit of good $z$ consumed is defined as consumer spending divided by the good price, $E_i/p_i(z)$. The South consumes $E_S/p_{SS}(z)$ or $E_S/(a_S[w_S + \theta_S(z)w_{US}])$ units of good $z$ and the North consumes $E_N/p_{SN}(z)$ or $E_N/((1 + \tau_N)a_S[w_S + \theta_S(z)w_{US}])$ units of good $z$, respectively, for good $z$ produced by the South.\footnote{\(p_{SS}(z)\) is the price of good $z$ produced by the South and consumed in the South and $p_{SN}(z)$ is the price of good $z$ produced by the South and consumed in the North. The Northern consumers need to pay \((1 + \tau_N)p_{SS}(z)\) or \((1 + \tau_N)a_S[w_S + \theta_S(z)w_{US}]\) for the imported good from the South. Accordingly, $p_{NN}(z)$ is the price of good $z$ produced by the North and consumed in the North and $p_{NS}(z)$ is the price of good $z$ produced by the North and consumed in the South. The Southern consumers need to pay \((1 + \tau_N)p_{NN}(z)\) or \((1 + \tau_S)a_S[w_N + \theta_N(z)w_{UN}]\) for the imported good from the North.}

Demand for Southern skilled labour to produce the Southern good is generated by the total Southern and Northern consumption. Therefore, the market clearing condition for Southern skilled labour can be written as follows.\footnote{The market clearing conditions for Northern skilled and unskilled labour are in Appendix A.2.3.}
Likewise, the market clearing condition for Southern unskilled labour can be set up as follows.

\[ L_{US} = z^m \frac{E_S}{(L_{SS}/L_{SU})w_{US} + w_{US}} + z^{x} \frac{E_N}{(1 + \tau_N)((L_{SS}/L_{SU})w_{US} + w_{US})} \] (2.9)

Tariff reductions and skill premium

Hitherto, we have established the balance of trade and market clearing conditions for Northern and Southern skilled and unskilled labour. The next stage is to analyse the effects of trade expansions driven by tariff reductions on the skill premium. From equations 2.8 or 2.9 and normalising \( L_{US} \) and \( w_{US} \) to 1, the Southern skill premium as a function of consumer expenditure can be established as follows.

\[ \omega_S = \frac{1}{L_{SS}} \left[ z^m E_S + z^x \frac{E_N}{(1 + \tau_N)} - 1 \right] \] (2.10)

Using the definition of the share of world expenditure, \( E_S = \xi \) and \( E_N = (1 - \xi) \), equation 2.10 can be rewritten as:

\[ \omega_S = \frac{1}{L_{SS}} \left[ z^m \xi + z^x \frac{(1 - \xi)}{(1 + \tau_N)} - 1 \right] \] (2.11)
Similarly, the Northern skill premium as a function of the share of world expenditure can be obtained as follows.

\[
\omega_N = \frac{1}{L_{SN}} \left[ (1 - z^n)(1 - \xi) + (1 - z^m) \frac{\xi}{(1 + \tau_S)} - 1 \right] \quad (2.12)
\]

To show the Southern skill premium as a function of the share of world expenditure, the relative cost and Southern and Northern tariffs, equation 2.11 can be rewritten as:

\[
\omega_S = \frac{1}{L_{SS}} \left[ z^m(v, \tau_S)\xi(v, \tau_S, \tau_N) + z^n(v, \tau_N) \frac{(1 - \xi(v, \tau_S, \tau_N))}{(1 + \tau_N)} - 1 \right] \quad (2.13)
\]

From equation 2.13, we can determine the Southern skill premium in correlation to the relative cost and Southern and Northern tariffs in the import framework.\(^{12}\) From comparative static result 2.14, the Southern skill premium in correlation to the relative cost from the import side is negative, as shown in the first term of the expression. As Southern tariffs decrease, the range of Southern imports of Northern goods will increase. This will raise the relative demand for skilled labour in the North. In other words, it will reduce demand for Southern skilled labour which will eventually decrease the Southern skill premium, as described in the second term of the expression. Whereas a reduction in Northern tariffs will increase demand for Southern goods which will decrease demand for Southern unskilled labour and thus raise the Southern skill premium, as illustrated in the last term of the expression.

\(^{12}\) To obtain comparative static result 2.14 from equation 2.13, see Appendix A.2.4.
Now we will see the effects of changes in tariffs on the Southern skill premium from the export side. Substituting the Northern skill premium as in equation 2.12 into the relative cost condition, \( w_{SS} = w_{SN}v + \theta_N(z)v - \theta_S(z) \), yields the equation as follows.\(^{13}\)

\[
\omega_S = \left\{ \frac{1}{L_{SN}} \left[ (1 - z_x(v, \tau_N))(1 - \xi(v, \tau_S, \tau_N)) + (1 - z^m(v, \tau_S)) \frac{\xi(v, \tau_S, \tau_N)}{(1 + \tau_S)} - 1 \right] \right\} v + \theta_N(z)v + \theta_S(z)
\]

(2.15)

From equation 2.15, we can determine the Southern skill premium corresponding to the relative cost and Southern and Northern tariffs in the export framework.\(^{14}\)

\[
\frac{\partial \omega_S}{\partial v} \bigg|_{XX} > 0 \quad \frac{\partial \omega_S}{\partial \tau_S} \bigg|_{XX} < 0 \quad \frac{\partial \omega_S}{\partial \tau_N} \bigg|_{XX} > 0
\]

(2.16)

From comparative static result 2.16, the Southern skill premium in correlation to the relative cost is positive, as shown in the first term of the expression. A reduction in Southern tariffs will increase Southern imports from the North which will increase demand for Northern skilled labour to meet the increasing Southern demand. The rising demand for Northern skilled labour will raise its wages which will increase the marginal cost of Northern goods relative to that of Southern goods. In other words, the wage of Southern skilled labour

---

\(^{13}\) We can rearrange the relative cost, \( v = \frac{w_{SS} + \theta_S(z)w_{US}}{w_{SN} + \theta_N(z)w_{UN}} \) into \( w_{SS} = w_{SN}v + \theta_N(z)v - \theta_S(z) \). \( w_{US} \) and \( w_{UN} \) are normalised into 1.

\(^{14}\) Northern skill premium, equation 2.12, is substituted into \( w_{SS} = w_{SN}v + \theta_N(z)v - \theta_S(z) \). To obtain comparative static result 2.16 from equation 2.15, see Appendix A.2.5.
in producing the same good as the North becomes relatively lower than that in the North (improved Southern competitive advantage). As a result, there will be an increase in demand for Southern skilled labour which will raise the Southern skill premium, as shown in the second term of the expression. The last term shows that Northern tariff reductions will increase Northern imports (Southern exports) which will increase demand for Southern skilled labour. This eventually will raise the Southern skill premium.

As this study focuses on Southern trade expansions, the following section discusses the effects of Southern trade expansions driven by tariff reductions on the Southern skill premium. Consider the South has reduced its tariffs. As mentioned at the beginning of this section, trade expansions driven by tariff reductions have two effects on the skill premium, direct and indirect. A reduction in import tariffs has the direct effect of increasing imports as well as the indirect effect of increasing exports. Southern tariff reductions will increase the range of Southern imports from the North. Increasing Southern imports from the North reduce Southern domestic production of the same good as the North which lowers the relative demand for Southern skilled labour. The decrease in demand for Southern skilled labour relative to demand for unskilled labour reduces the Southern skill premium.

Simultaneously, increasing Southern imports from the North will increase demand for Northern skilled labour, and therefore increase the wage of Northern skilled labour corresponding to the wage of Southern skilled labour.\(^{15}\) The increased wage of Northern skilled labour will increase prices of Northern goods relative to that of the South which lowers the Northern competitive advantage. This will curtail the increase in Southern imports from the North. The de-

\(^{15}\) Nonetheless, in the case of a small economy whose share of exports to total world exports is relatively very small, a change in its wages may not affect the relative cost.
crease in Southern imports due to increased prices of Northern goods relative to that of Southern goods may not outweigh the increase in Southern imports due to its tariff reductions, but overall, the net increase in imports could be slim.

The indirect effect of Southern tariff reductions is that the lower Southern wage of skilled labour relative to that of the North improves the Southern competitive advantage which will increase Southern exports. Rising Southern exports elevate demand for Southern labour in favour of skilled labour which will raise the Southern skill premium.\(^{16}\)

Combining the direct and indirect effects of tariff reductions on exports and imports causes the effect of tariff reductions on imports to be relatively small. Whereas the effect of tariff reductions on exports is obvious, tariff reductions will expand exports through the improved Southern competitive advantage because the freed-up resources from the production of the import competing good move into exports. Therefore, Southern tariff reductions will increase its skill premium if they cause Southern exports to expand more than imports, either in term of values or margins (ranges).\(^{17}\)

Moreover, if we consider that there are also Northern tariff reductions, it will raise the Northern imports from the South (i.e. increase demand for Southern goods). Hence, Southern exports to the North will increase. Increasing Southern exports will raise demand for Southern skilled labour relative to that of unskilled labour to meet rising demand for Southern goods from the North. This will be rendered into the rising Southern skill premium.

\(^{16}\) As Southern exports increase, demand for skilled labour will increase in higher proportions than demand for unskilled labour.

\(^{17}\) The changes of the relative wage of skilled labour to the wage of unskilled labour depend on export and import expansions as well as the elasticities (responsiveness) of export and import expansions in response to changes in tariffs.
Proposition 2.1 In the North-South trade framework, a reduction in import tariffs may raise the skill premium if the tariff reduction causes the range of the traded goods in which export expansion occurs to be greater than the range of the traded goods in which imports expand.

2.1.2 Trade, Technology, and Skill Premium

This section discusses the effects of trade expansions driven by technological change on the skill premium. In the study conducted by Zhu and Trefler (2005), it is assumed that the Northern and Southern tariffs are zero and prices are at the free trade levels. They hence argue that the main driving force in the rising Southern skill premium is Southern technological catch-up (i.e. the speed of Southern technological change to catch up to the speed of Northern technological change).

This study uses an assumption that prices are not at the free trade levels since prices are affected by Northern and Southern tariffs. As we assume that both Northern and Southern tariffs have not yet reached zero, there is a distance between the import and export margins, \( z^m > z^x \), as discussed in Section 2.1.1. As Southern and Northern tariffs approach zero, \( \tau_S = \tau_N = 0 \), \( z^x \) and \( z^m \) will converge into one point, let's say \( z \) which lies somewhere in between \( z^x \) and \( z^m \). At \( z \), prices are at the free trade levels. The story will then be the same as in Zhu and Trefler's model. We expect that Southern technological catch-up will expand exports, and thus raise the Southern skill premium.

We base the analysis of technological catch-up on cost reduction processes instead of product innovation processes. Technological catch-up affects demand for labour in two ways in two types of technology. First, high-technology can be defined as technology which requires certain skill levels to be able to oper-
ate (e.g. computers, medical tools, automatic data processing machines, and other sophisticated technology). The implementation of high-technology will increase demand for skilled labour. Second, low-technology can be defined as technology that is generally built up to replace unskilled labour (e.g. embroidery machines in the textile industry, shoe base cutting machines in the footwear industry, potato cutting machines in the food industry, and other low-technology). Both types of technology are developed for the purpose of improving efficiency as well as for lowering the cost of production. The implementation of either technology will increase demand for labour in favour of skilled labour. The implementation of low-technology will lower demand for unskilled labour, while the implementation of high-technology will increase demand for skilled labour.

Figure 2.1 depicts how Southern technological catch-up expands Southern production and exports which in turn raises its skill premium. To keep this illustration simple, we leave aside the import margin \((z^m)\) and the effects of tariff reductions on import and export expansions, so we can focus on the effects of Southern technological catch-up on its export expansion. The Northern and Southern marginal costs of production of good \(z\) are represented by \(c_N(z)\) and \(c_S(z)\), respectively. Recall \(z\) is a continuum good, \(z \in [0, 1]\). Initially, the South produces and exports good \(z\) in the range of 0 to \(z^x\) where the Southern marginal cost of production is relatively lower than that of the North. Accordingly, the North produces and exports good \(z\) from \(z^x\) to 1.

Southern technological catch-up lowers the Southern marginal cost of production illustrated by the shift of the marginal cost curve from \(c_S\) to \(c_S'\). The marginal cost of production of good \(z\) decreases from \(c^A\) to \(c^B\). The lower marginal cost of production expands Southern exports of good \(z\), as illustrated
by the shift of production of good \( z \) from \( z^x \) to \( z^{x'} \). As a result, the South now exports good \( z \) in the range of 0 to \( z^{x'} \) and the North produces good \( z \) from \( z^{x'} \) to 1 with the assumption that the Northern technology does not change.\(^{18}\)

The effects of technological catch-up on wages are channeled through changes in the relative price of goods, notably if the goods are exported. The more developed technology used in production requires higher demand for skilled labour relative to demand for unskilled labour which raises the skill premium.

\[ \text{Figure 2.1: Southern technological catch-up} \]

\[ \text{Note:} \]
Southern technological catch-up lowers the marginal cost of production which in turn expands Southern exports.

Define \( \Upsilon \) as the state of technology. For each \( \Upsilon \), there is a unique equilibrium and unique equilibrium outcome, \( \omega_S(\Upsilon), \omega_N(\Upsilon), z^x(\Upsilon), \) and \( z^m(\Upsilon) \).

Recall from Section 2.1.1 that \( c_N(z) \) and \( c_S(z) \) are the Northern and Southern

\(^{18}\) A recent study by Xiang (2007) asserts that if we induce the Northern technological change, new Northern goods necessarily increase the Southern skill premium if they are unskilled labour intensive and may even increase the premium if they are skilled labour intensive.
marginal costs of production of good $z$, respectively. We assume that these marginal costs are differentiable and non-increasing in $T$ (i.e. technological catch-up never increases marginal cost). Productivity can be determined as efficiency in cost (i.e. there will be a cost reduction holding constant output). Therefore, we define productivity growth as $\frac{\partial \ln c_i}{\partial T}$. Following Zhu and Treﬂer (2005), the measure of productivity growth in the production of good $z$ in country $i$ is $-\frac{\partial \ln c_i(w_{s_i}, w_{u_i}, z^x, z^m, T)}{\partial T}$. Technological catch-up termed as $\Psi$ can be formulated as equation 2.17.

It states that the South is technically catching up in producing good $z$, if Southern rate of productivity growth rises relative to Northern rate productivity growth.

$$\Psi = \frac{\partial \ln c_N(w_{s_N}, w_{u_N}, z^x, z^m, T)}{\partial T} - \frac{\partial \ln c_S(w_{s_S}, w_{u_S}, z^x, z^m, T)}{\partial T} > 0 \quad (2.17)$$

**Proposition 2.2** In the North-South trade framework, Southern technological catch-up, by expanding its range of export goods, will the raise Southern skill premium.
Appendix 2

A.2.1 Import and export margins

The import and export margins are derived from Southern import and export conditions, respectively. The relative cost is \( v = \frac{w_S + \theta_S(z)w_U}{w_N + \theta_N(z)w_N} \).

\[
A(z^m) = \frac{a_S(z)}{a_S(z)} = \frac{[w_S + \theta_S(z)w_U]}{(1 + \tau_S)[w_N + \theta_N(z)w_N]}
\]

\[
A(z^m) = \frac{v}{(1 + \tau_S)}
\]

\[
A(z^x) = \frac{a_S(z)}{a_S(z)} = \frac{(1 + \tau_N)[w_S + \theta_S(z)w_U]}{[w_N + \theta_N(z)w_N]}
\]

\[
A(z^x) = (1 + \tau_N)v
\]

A.2.2 Comparative static of Southern share of world expenditure

We can determine partial derivatives of the Southern share of world expenditure with respect to the relative cost and Southern and Northern tariffs. First, take the total differential of equation 2.6:

\[
\left( \frac{(1 - \xi) + \xi}{(1 - \xi)^2} \right) d\xi = \frac{(1 + \tau_S)}{(1 - z^m)(1 + \tau_N)} dz^x + \frac{z^x(1 + \tau_S)}{(1 + \tau_N)(1 - z^m)^2} dz^m + \frac{z^x(1 + \tau_S)}{(1 - z^m)(1 + \tau_N)} d\tau_N
\]
Use comparative static result 2.2, \( \partial z^m / \partial v < 0 \) and \( \partial z^m / \partial \tau_S > 0 \), and comparative static result 2.4, \( \partial z^x / \partial v < 0 \) and \( \partial z^x / \partial \tau_N < 0 \), and recall the assumptions in the setup that \( 0 < \xi < 1, \tau_N > 0, \tau_S > 0, z^x > 0, \) and \( (1 - z^m) > 0 \). Then, take partial derivatives of the Southern share of world expenditure \( (\xi) \) with respect to \( v, \tau_S, \) and \( \tau_N \):

\[
\left( \frac{1}{(1 - \xi)^2} \right) \frac{\partial \xi}{\partial v} = \frac{(1 + \tau_S)}{(1 - z^m)(1 + \tau_N)} \frac{\partial z^x}{\partial v} + \frac{z^x(1 + \tau_S)}{(1 + \tau_N)(1 - z^m)^2} \frac{\partial z^m}{\partial v} \\
\frac{\partial \xi}{\partial v} < 0
\]

\[
\left( \frac{1}{(1 - \xi)^2} \right) \frac{\partial \xi}{\partial \tau_N} = \frac{z^x(1 + \tau_S)}{(1 + \tau_N)(1 - z^m)^2} \frac{\partial z^m}{\partial \tau_N} + \frac{z^x}{(1 - z^m)(1 + \tau_N)} \\
\frac{\partial \xi}{\partial \tau_N} > 0
\]

\[
\left( \frac{1}{(1 - \xi)^2} \right) \frac{\partial \xi}{\partial \tau_S} = \frac{(1 + \tau_S)}{(1 - z^m)(1 + \tau_N)} \frac{\partial z^x}{\partial \tau_N} - \frac{z^x(1 + \tau_S)}{(1 - z^m)(1 + \tau_N)^2} \\
\frac{\partial \xi}{\partial \tau_S} < 0
\]
A.2.3 Market clearing for Northern labour

The market clearing conditions for Northern skilled and unskilled labour can be established as follows.

\[
\begin{align*}
L_{SN} &= \frac{(1 - z^x)E_N}{[w_{SN} + (Lu_N/L_{SN})wu_N]} + \frac{(1 - z^m)E_S}{(1 + \tau_S)[w_{SN} + (Lu_N/L_{SN})wu_N]} \\
Lu_N &= \frac{(1 - z^x)E_N}{[(L_{SN}/Lu_N)w_{SN} + wu_N]} + \frac{(1 - z^m)E_S}{(1 + \tau_S)[(L_{SN}/Lu_N)w_{SN} + wu_N]}
\end{align*}
\]

A.2.4 Comparative static of import expansions and skill premium

To obtain comparative static result 2.14 from equation 2.13, first, equation 2.13 can be rewritten as follows.

\[
\omega_S = \frac{1}{L_{SS}} \left[ z^m \xi + z^x \frac{(1 - \xi)}{(1 + \tau_N)} - 1 \right] = \frac{1}{L_{SS}} \left[ \left( z^m - z^x \frac{1}{(1 + \tau_N)} \right) \xi + \frac{z^x}{(1 + \tau_N)} - 1 \right]
\]

Second, take partial derivatives of the Southern skill premium with respect to the relative cost and Southern and Northern tariffs. Additionally, use comparative static result 2.2, \( \partial z^m / \partial v < 0 \) and \( \partial z^m / \partial \tau_S > 0 \), and comparative static result 2.4, \( \partial z^x / \partial v < 0 \) and \( \partial z^x / \partial \tau_N < 0 \), and recall the assumption of export and import margins which states that as long as both Southern and Northern tariffs are implemented or at least one of them is implemented, import margin will be greater than export margin, \( (z^m - z^x) > 0 \). The number of Southern skilled labour is always positive, \( 1/L_{SS} > 0 \).
The Southern skill premium in correlation to the relative cost and Southern and Northern tariffs in the import framework can be established as follows.

\[
\frac{\partial \omega_S}{\partial \nu} \bigg|_{MM} = \frac{1}{LSS} \left[ \left( z^m - \frac{z^x}{(1+\tau_N)} \right) \frac{\partial \xi}{\partial \nu} + \xi \left( \frac{\partial z^m}{\partial \nu} - \frac{1}{(1+\tau_N)} \frac{\partial z^x}{\partial \nu} \right) + \frac{1}{1+\tau_N} \frac{\partial z^x}{\partial \nu} \right] \\
< 0
\]

\[
\frac{\partial \omega_S}{\partial \tau_S} \bigg|_{MM} = \frac{1}{LSS} \left[ \left( z^m - \frac{z^x}{(1+\tau_N)} \right) \frac{\partial \xi}{\partial \tau_S} + \xi \left( \frac{\partial z^m}{\partial \tau_S} \right) \right] \\
> 0
\]

\[
\frac{\partial \omega_S}{\partial \tau_N} \bigg|_{MM} = \frac{1}{LSS} \left[ \left( z^m - \frac{z^x}{(1+\tau_N)} \right) \frac{\partial \xi}{\partial \tau_N} + \xi \left( \frac{\partial z^m}{\partial \tau_N} - \frac{1}{(1+\tau_N)^2} \frac{\partial z^x}{\partial \tau_N} \right) \right] \\
< 0
\]
2. Theoretical Framework

A.2.5 Comparative static of export expansions and skill premium

Rearrange the relative cost into \( w_{sS} = w_{SN}v + \theta_N(z)v - \theta_S(z) \), substitute the Northern skill premium into the relative cost, and normalise \( wu_S \) and \( wu_N \) to 1, yields:

\[
\begin{align*}
\omega_S &= \left\{ \frac{1}{L_{SN}} \left[ (1 - z^x(v, \tau_N))(1 - \xi(v, \tau_S, \tau_N)) \\
&\quad + (1 - z^m(v, \tau_S)) \frac{\xi(v, \tau_S, \tau_N)}{(1 + \tau_S)} - 1 \right] \right\} v + \theta_N(z)v + \theta_S(z) \\
\omega_S &= \left\{ \frac{1}{L_{SN}} \left[ \left( \frac{(1 - z^m)}{(1 + \tau_S)} - (1 - z^x) \right) \xi \\
&\quad + (1 - z^x) - 1 \right] \right\} v + \theta_N(z)v - \theta_S(z) \\
\omega_S &= \left\{ \frac{1}{L_{SN}} \left[ \left( \frac{(1 - z^m)}{(1 + \tau_S)} - (1 - z^x) \right) \xi(v, \tau_S, \tau_N) \\
&\quad + (1 - z^x(v, \tau_N)) - 1 \right] \right\} v + \theta_N(z)v - \theta_S(z)
\end{align*}
\]

Use the conditions that \( z^m - z^x > 0 \) so that \( (1 - z^m) - (1 - z^x) < 0 \) and the number of Northern skilled labour is always positive \( 1/L_{SN} > 0 \). Take partial derivatives of the Southern skill premium with respect to the relative cost and Southern and Northern tariffs. The same way to get comparative static result 2.14 from equation 2.13 is taken to obtain comparative static result 2.16 from equation 2.15. The Southern skill premium in correlation to the relative cost and Southern and Northern tariffs in the export framework can be established as follows.

\[
\frac{\partial \omega_S}{\partial v} \bigg|_{XX} > 0 \quad \frac{\partial \omega_S}{\partial \tau_S} \bigg|_{XX} < 0 \quad \frac{\partial \omega_S}{\partial \tau_N} \bigg|_{XX} > 0
\]
Chapter 3

Linking Theory to Empirics
The North-South trade framework with the continuum good model is simply an illustration of how trade expansions driven by tariff reductions and technological catch-up affect the skill premium. This chapter translates the theoretical framework into empirical studies, defines main variables in this study, and discusses the data sources. Section 3.1 defines the skill premium, manufacturing industry, and developing countries. Section 3.2 discusses how to measure trade expansions and assesses the proxies of trade expansions in the context of analysing their effects on the skill premium.

3.1 Study Coverage

This study covers 134 manufacturing industries (J=134) in each of 27 developing countries (I=27) from 1980 to 2005 (T=26). Due to limited data on wages by occupation for certain countries in certain years, the numbers of observations are IT=685 and JIT=91,790. The definition of the skill premium, manufacturing industry, and developing countries, and the data sources are explained as follows.

3.1.1 Skill Premium

The Skill premium is defined as the ratio of the wage of skilled labour to the wage of unskilled labour in the manufacturing industry. Skilled and unskilled labour are proxied by non-production and production workers which are classified by occupation. Wage is defined as average wage or salary rates paid for normal time of work which comprises basic wages and salaries, cost of living allowances, and regularly paid allowances. The wage excludes overtime payments, bonuses and gratuities, family allowances, other social security pay-

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1 The other supporting variables (e.g. tariff, terms of trade, and technological catch-up) and the data sources of these variables will be discussed in Chapter 4.
ments made by the employer directly to employees, and ex-gratia payments in kind supplementary to normal wage and salary rates. The wage is the average monthly wage (hourly, daily, weekly, and fortnightly wage is adjusted into monthly wage). Data on wages by occupation across countries are generally available in domestic currency. However, different domestic currencies across countries do not cause any problem since this study only focuses on the ratio of the wage of skilled labour to the wage of unskilled labour.

In terms of the classification of skilled and unskilled labour, trade theory is largely silent on how to measure skills. Some studies assert that skills are best classified based on education attainments (Forbes (2001):176; Leamer (1994):17-18). Furthermore, it is also claimed that wages by education is the best proxy to measure wages based on skill levels (Richardson (1995):34).

Nonetheless, data on wages by education across countries are very limited. In fact, the skill premium produced by wages by education shows the same trends and magnitudes as the one produced by wages by occupation in certain developing countries such as Hong Kong, Indonesia, the Philippines, South Korea, and Taiwan. Moreover, some prominent studies in this area, such as those conducted by Bernard and Jensen (1995) and Hanson and Harrison (1999), use the ratio of the wage of non-production workers to the wage of production workers as the proxy for the skill premium. This study, therefore, uses data of the ratio of the wage of non-production workers to the wage of production workers as the proxy for the skill premium. The classification of non-production and production workers is based on the International Standard Classification of Occupations (ISCO), ISCO-1968 and ISCO-1988.

\footnote{Appendix Figure A.3.1 presents the skill premium by occupation and education in Hong Kong, Indonesia, the Philippines, South Korea, and Taiwan. The skill premium by occupation of the 27 developing countries is in Chapter 4 Appendix Figure A.4.1.}
ISCO-1968, this study classifies (0-1) to (5) as skilled labour and (7-9) as unskilled labour, and excludes (6). Based on ISCO-1988, this study classifies (1-5) and (7) as skilled labour and (8-9) as unskilled labour, and excludes (0) and (6). Data on the skill premium are based on the author’s calculation. Data on wages by occupation are from the ILO Yearbook of Labour Statistics (ILO (2005):Table O.1) and data on wages by occupation for Taiwan are from the Labour Survey of Taiwan (National Statistics Office of Taiwan (2007)).


3.1.2 Manufacturing Industry

This study mainly examines the effects of trade expansions on the skill premium in the manufacturing industry. There are two main reasons for focusing our discussion only in the manufacturing industry. First, the analysis in the manufacturing industry could demonstrate the effects on the skill premium of skill upgrades through trade expansions, a shift from unskilled labour to
skilled labour intensive industries, since the manufacturing industry employs both skilled and unskilled labour. Second, the role of the manufacturing industry in developing countries grows over years as most developing countries shift from being agricultural-based to manufacturing-based.

Manufacturing is defined as the use of machines, tools, and labour to make things for use or sale, or the branch of manufacture and trade based on the fabrication, processing, and preparation of goods from raw materials and commodities. The classification of manufactures is based on Standard International Trade Classification (SITC), 3 digit-SITC Revision 2. Based on the Handbook of Trade and Development Statistics, manufactured exports are industry SITC 5 to 8, less 68. This study covers 134 manufacturing industries including Chemicals (511-599), Manufactured goods (611-699), Machinery (711-799), and Miscellaneous manufactured products (811-899).

We exclude Agricultural products (000-099), Beverages and tobacco (111-129), Mineral fuels including oil and gas (311-359), Animal, vegetable oil, and fat (411-439), and War manfire, ammunitions, and other transactions (911-999). Considering that some industries included in this study are classified as natural resource intensive industries by Krause (1982) or agricultural and natural resource intensive industries by Ariff and Hill (1985), this study further excludes natural resource intensive industries such as Leather and leather products (611-613), Cork and wood manufactures (633-635), Pearls and precious or semiprecious stones (667), and Pig iron and steel (671). Later in Chapter 5, the manufactures are divided by skill into unskilled and skilled labour intensive. The list of manufacturing industries covered in this study is in Chapter 5 Appendix Table A.5.1.

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3 The correspondence of classification of manufactures between the SITC and International Standard of Industrial Classification (ISIC) is in Balassa (1977) Appendix 2.
3.1.3 Developing Countries

Southern countries characterised as unskilled labour abundant in the theoretical framework are referred to as developing countries in the empirical studies. The classification of developing countries is based on the Human Development Index (HDI) and 1980 to 2000 GDP per capita. Based on the UNCTAD classification, there are 104 developing countries in 2005 (UNCTAD (2005)). By excluding 31 Land Locked Developing Countries (LLDCs) and 29 Small Island Developing States (SIDS), and including only developing countries with complete data sets of relevant variables, this study covers 27 developing countries.

Fortunately, the 27 developing countries are a representative sample of the population in the sense that they represent more and less open countries to trade, technological catch-up and technological stagnancy, and declining, stable, and rising skill premium. The 27 developing countries consist of 13 Asian countries (China, Hong Kong, India, Indonesia, Jordan, Malaysia, Pakistan, the Philippines, Singapore, South Korea, Sri Lanka, Taiwan, and Thailand), 11 Latin American countries (Argentina, Brazil, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Peru, Uruguay, and Venezuela), and 3 African countries (Algeria, Egypt, and Mauritius). The list of 27 developing countries and year of they commenced trade liberalisation is in Appendix Table A.3.1.

4 Based on import tariffs on manufactured goods (Easterly and Sewadeh (2000); UNCTAD (2005):Table 8.4; Ng (2006)) and Sachs-Warner’s and Wacziarg-Welch’s year of commencement of trade liberalisation (Sachs and Warner (1995); Wacziarg and Welch (2003)).

5 These countries are grouped into Newly Industrialised Countries (NICs) which consist of Hong Kong, Singapore, South Korea, and Taiwan; the big 4-South East Asian (SEA) countries which consist of Indonesia, Malaysia, the Philippines, and Thailand; the big 5-Latin American countries which consist of Argentina, Brazil, Costa Rica, Mexico, and Venezuela; and other developing countries.
3.2 Proxy for Trade Expansions

The use of the continuum good model in the theoretical framework is simply to illustrate the range of goods ranked by the ratio of skilled to unskilled labour used in production. The continuum good model describes that a change in trade margins will affect the ratio of skilled to unskilled labour. Thus, this model allows us to analyse the effects of the movement in trade margins on the skill premium.

In an empirical study, how can we measure trade margins and their changes (changing in commodity composition of trade rather than an increase with an unchanged composition)? In other words, how can we measure trade expansions? First, we use a widely used proxy for trade expansions, which is the ratio of exports (imports) to GDP, as illustrated in Section 3.2.1. Second, we introduce a new proxy, which is a range of exports (imports), as explained in Section 3.2.2. Data on the value of exports (imports) of manufactured goods are from UNCTAD (2005) Table 4.2.

3.2.1 Ratio of Exports (Imports) to GDP

The widely used proxy for trade expansions is the ratio of the value of exports (imports) of manufactured goods to GDP (Robbins (1996); Lu (2000); Ho et al. (2005)). $\frac{x}{gdp}$ and $\frac{m}{gdp}$ are defined as the ratio of the value of exports of manufactured goods to GDP (the ratio of exports to GDP) and that of the value of imports of manufactured goods to GDP (the ratio of imports to GDP).  

\[ x/gdp \quad \text{and} \quad m/gdp \]

Most studies of the effects of trade expansions on income inequality also use the ratio of exports (imports) to GDP as a proxy of trade expansions (Higgins and Williamson (1999); Reuveny and Li (2003); Milanovic (2004)). Some studies use the ratio of exports to GDP and that of imports to GDP ($\frac{X}{GDP}$ and $\frac{M}{GDP}$), while some others use the ratio of total exports and imports to GDP ($\frac{(X+M)}{GDP}$).
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GDP), respectively. We name this proxy as the ratio.

The main advantage of using this proxy is that it illustrates the role of exports (imports) in an economy. As the ratio of exports (imports) to GDP increases, exports (imports) become more important in the economy or the economy becomes more open to trade. In addition, data on exports (imports) can be easily obtained across countries over long periods in various periodical systems (e.g. monthly, quarterly, and annually).

However, there are two main drawbacks with using the ratio of exports (imports) to GDP in analysing the effects of trade expansions on the skill premium. First, the ratio of exports (imports) to GDP cannot describe the range (number) of industries contributing to that ratio. If the ratio of exports to GDP is 30 percent, then the exports contribute as much as 30 percent to GDP, but the ratio does not tell the number of industries that have contributed. The ratio cannot reveal if there is a change in the range of types of goods or industries. Suppose the ratio of exports to GDP increased from 30 percent in 1980 to 50 percent in 1990. The ratio cannot tell if the increase of 20 percentage points was driven by one, two, or all industries. Thus, the ratio cannot demonstrate if there is a new good (industry) produced in contributing to the increased ratio of exports to GDP. For example, Malaysia and the Philippines experienced a sharp increase in their ratios of exports to GDP. The observation shows that their export expansions were, in fact, driven only by one growing industry which is the Thermionic, valves, and tubes industry (776).

Second, the ratio cannot reveal an actual trade expansion, and thus it is not strictly comparable across countries. The ratio may contain a dominant effect of major industries in a country. For example, port countries, such as Singapore and Hong Kong have a tendency to experience relatively higher ratios
of exports (imports) to GDP than those of their neighbours. However, their actual trade expansions may not be as high as those portrayed by the ratio of exports (imports) to GDP. We could expect that their actual trade expansions may not outweigh trade expansions of South Korea or Taiwan.

Considering these reasons, we introduce a new proxy to measure trade expansions which could describe trade expansions more precisely.

3.2.2 Range of Exports (Imports)

The second proxy of trade expansions is the range of exports (imports) which is measured by the summation of an index based on the share of the value of exports (imports) of each manufacturing industry to the value of exports (imports) of manufactured goods. $x_r$ and $m_r$ are defined as the range of exports of manufactured goods (the range of exports) and that of imports of manufactured goods (the range of imports), respectively. We name this proxy as the range.

We use a binary value to represent the share of the value of exports (imports) of each manufacturing industry to the value of exports (imports) of manufactured goods. It is 1 for an industry $(j)$ if its value of exports $(x_j)$ relative to the value of exports of manufactured goods $(\sum x_j)$ is greater than $\phi$ percent; 0 otherwise. This also applies for the range of imports. It is 1 for an industry if its value of imports $(m_j)$ relative to the value of imports of manufactured goods $(\sum m_j)$ is greater than $\phi$ percent; 0 otherwise. This study justifies the benchmark of the share as much as one percent ($\phi$ equals 1) considering that there are around 100 active industries in the coverage of 134 manufacturing industries in developing countries. The share of the value of exports (imports)
of one industry relative to the value of exports (imports) of manufactured goods is based on annual data. The range of exports (imports) is formulated as follows.\(^7\)

\[
x^r = \sum I_j \quad I_j = 1 \quad \text{if} \quad \frac{x_j}{\sum x_j} \geq \phi\%
\]

\[
I_j = 0 \quad \text{if} \quad \frac{x_j}{\sum x_j} < \phi\% 
\]

\[
m^r = \sum I_j \quad I_j = 1 \quad \text{if} \quad \frac{m_j}{\sum m_j} \geq \phi\%
\]

\[
I_j = 0 \quad \text{if} \quad \frac{m_j}{\sum m_j} < \phi\%
\]

The inclusion of this proxy in this study is based on two main reasons. First, it exhibits the range (number) of industries or goods and changes in it. We can examine certain industries that contribute to the changes in the value of exports (imports). For example, if the range of exports was 20 types in 1980, it means that there were 20 manufacturing industries in which the share of the value of exports to the value of exports of manufactured goods was greater than one percent in that year. For example, if the range of exports increased from 20 types in 1980 to 30 types in 1990, we can tell that there were 10 new exporting industries over that period.

Second, the range is comparable across countries, regardless of the size of the economy or trade. The range of exports (imports) treats all industries equally

\(^7\)This index can also be applied to measure the range (number) of types of any variable when we only have data on the value of that variable. The value of the benchmark (\(\phi\)) can be adjusted based on the expected proportion of the value of that variable relative to the total value of that variable's group. One of the main disadvantages of the range is that the value of the benchmark (\(\phi\)) is determined by users. There is no strict justification to determine the value of it. The different values of the benchmarks may produce different analysis results.
(an index of 0 or 1) and there is no domination of one or certain industries in producing the range. Therefore, the range of exports (imports) illustrates an actual expansion in exports (imports). For example, the ratios of skilled labour intensive exports to GDP in Sri Lanka, Costa Rica, Uruguay, Malaysia, Singapore, and South Korea were 1.44, 13.20, 1.79, 66.62, 120.37, and 18.02 percent, respectively, in 2005. An industry is classified as skilled (unskilled) labour intensive in its exports if the ratio of non-production to production workers in that sector is greater (less) than one. In fact, the high ratio of skilled labour intensive exports to GDP in Malaysia was only driven by one leading industry which was the Thermionic, valves, and tubes industry (776), and the high ratio of skilled labour intensive exports to GDP in Singapore was driven by the Automatic data processing equipment industry (752) and the Thermionic, valves, and tubes industry (776). The ratios of exports to GDP of Malaysia and Singapore exports were more than three times and six times, respectively, that of South Korea. Meanwhile the range of skilled labour intensive exports of these countries illustrates export expansions at more sensible levels. The ranges of skilled labour intensive exports in Sri Lanka, Costa Rica, Uruguay, Malaysia, Singapore, and South Korea were 2, 8, 10, 12, 14, and 16 types, respectively, in 2005. Additionally, this proxy is easy to read and understand.

8 The detailed explanation and classification of skilled and unskilled labour intensive industries are in Chapter 5 Section 5.1.

9 The reasons that the ratio of skilled labour intensive exports of South Korea was much lower relative to its neighbor are: first, since early development, South Korea focused strongly on sales in domestic markets instead of international markets; second, South Korean exports had been mostly pertaining to the manufacturing of chemicals, semiconductors, motor vehicles, telecommunications, steel, and ships in 1960s and 1970s, but the economic downturn in 1980s had required the government to make structural changes and pushed development on services sectors such as on Finance, Research and Development and Tourism. As a result, even though exports of manufactured goods were growing, its GDP expanded even much more. The ratio of skilled labour intensive exports to GDP was 18.02 percent in 2005 which actually sharply increased from 6.33 percent in 1980 (author’s calculation based on UNCTAD, 2005), but it was still relatively much lower compared to that of Singapore and Hong Kong.
3.2.3 Comparison between Ratio and Range

In comparing the two proxies for trade expansions (the ratio and the range), each proxy has advantages and disadvantages. First, while the ratio shows the importance of exports (imports) in an economy, the range describes the number of types of industries or goods that contribute to exports (imports) and changes in it. For example, there were 20 industries which resulted in the ratio of exports to GDP being as much as 30 percent in 1980 in a country. Suppose the ratio of exports to GDP increased from 30 percent in 1980 to 50 percent in 1990, by using the ratio, we cannot tell how many industries contributed to this increase. However, if we use the range, and the range expanded from 20 types in 1980 to 30 types in 1990, we can tell that there were 10 new industries or goods produced in this country.10

Second, recall from the discussion about the export and import margins in the theoretical framework, a change in the range of industries, which are in the cut-off point of exports (the edge of export margins), can indicate skill upgrades. Therefore, if we work on an analysis of trade expansions which requires a skill upgrade story, the range could provide a more meaningful description of trade expansions than the ratio.

Recall from the theoretical framework, the assumption of equal expenditure across all manufactured goods means that an increase in the number of goods exported by the South will increase Southern relative demand for skilled labour. Empirically, there could be a case that an expansion accompanied by a change in the quantities demanded of the different types of Southern exports such that the relative demand for skilled labour may fall. To address this issue,  

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10 In the theoretical framework, it is assumed that there is no innovation of a new good. A new type of good is one that has already been invented and produced somewhere else, but now is produced domestically.
we classify manufactures into unskilled and skilled labour intensive, so that we could analyse if an expansion actually occurs in unskilled or skilled labour intensive industries. This issue is discussed in Chapter 5.

In conclusion, if we investigate changes in the range of industries or goods, trade expansions based on changes in the factors of production and skill upgrades through trade, or examine the effects of trade expansions on the skill premium, the range could provide a relatively better explanation of trade expansions than the ratio. The range can illustrate the number of industries involved in trade and changes in the number of industries (including changes in the number of industries which are in the cut-off point of exports and imports). Considering advantages and disadvantages of these two proxies, we employ the ratio of exports (imports) to GDP as well as the range of exports (imports) in examining the effects of trade expansions on the skill premium.
Table A.3.1: Year of trade liberalisation in developing countries

<table>
<thead>
<tr>
<th>No</th>
<th>Country</th>
<th>Year trade liberalisation began</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Algeria</td>
<td>unreformed</td>
</tr>
<tr>
<td>2</td>
<td>Argentina</td>
<td>1991</td>
</tr>
<tr>
<td>3</td>
<td>Brazil</td>
<td>1991</td>
</tr>
<tr>
<td>4</td>
<td>China</td>
<td>1998</td>
</tr>
<tr>
<td>5</td>
<td>Costa Rica</td>
<td>1986</td>
</tr>
<tr>
<td>6</td>
<td>Egypt</td>
<td>1995</td>
</tr>
<tr>
<td>7</td>
<td>El Salvador</td>
<td>1989</td>
</tr>
<tr>
<td>8</td>
<td>Guatemala</td>
<td>1988</td>
</tr>
<tr>
<td>9</td>
<td>Honduras</td>
<td>1991</td>
</tr>
<tr>
<td>10</td>
<td>Hong Kong</td>
<td>always</td>
</tr>
<tr>
<td>11</td>
<td>India</td>
<td>1994(^c)</td>
</tr>
<tr>
<td>12</td>
<td>Indonesia</td>
<td>1970</td>
</tr>
<tr>
<td>13</td>
<td>Jordan</td>
<td>1965</td>
</tr>
<tr>
<td>14</td>
<td>Malaysia</td>
<td>1963</td>
</tr>
<tr>
<td>15</td>
<td>Mauritius</td>
<td>1995</td>
</tr>
<tr>
<td>16</td>
<td>Mexico</td>
<td>1986</td>
</tr>
<tr>
<td>17</td>
<td>Nicaragua</td>
<td>1991</td>
</tr>
<tr>
<td>18</td>
<td>Pakistan</td>
<td>unreformed</td>
</tr>
<tr>
<td>19</td>
<td>Peru</td>
<td>1991</td>
</tr>
<tr>
<td>20</td>
<td>Philippines</td>
<td>1988</td>
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<tr>
<td>21</td>
<td>Singapore</td>
<td>1965</td>
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<tr>
<td>22</td>
<td>South Korea</td>
<td>1968</td>
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<tr>
<td>23</td>
<td>Sri Lanka</td>
<td>1991</td>
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<tr>
<td>24</td>
<td>Taiwan</td>
<td>1963</td>
</tr>
<tr>
<td>25</td>
<td>Thailand</td>
<td>always</td>
</tr>
<tr>
<td>26</td>
<td>Uruguay</td>
<td>1990</td>
</tr>
<tr>
<td>27</td>
<td>Venezuela</td>
<td>unreformed</td>
</tr>
</tbody>
</table>

Note:

b. Still unreformed, based on Black Market Premium (BMP)
c. Opened in 1994, based on tariff reductions
d. Still unreformed, based on the tariff that was higher than 55 percent in 1990-1999
e. Still unreformed, based on exchange rate restrictions
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Figure A.3.1: Skill premium by occupation and education in developing countries, 1980-2005

Note:
(1) The skill premium based on wages by occupation is the ratio of the wage of non-production workers to the wage of production workers in the manufacturing industry. The skill premium based on wages by education is the ratio of the wage of workers with more than primary graduate qualifications to the wage of workers with the maximum of primary graduate qualifications.

(2) Source: author’s calculation. Data on wages by occupation are from the ILO Yearbook of Labour Statistics (ILO (2005): Table O.1) and the Labour Survey of Taiwan (National Statistics Office of Taiwan (2007)). Data on wages by education are from the Labour Surveys of Hong Kong, Indonesia, the Philippines, South Korea and Taiwan (National Statistics Office of Republic of China, Hong Kong SAR (2006); Statistics Indonesia (2006); National Statistics Office of Philippines (2006); National Statistics Office of South Korea (2006); Department of Statistics, Council of Labor Affairs of Taiwan (2006)). Data on wages by education for the Philippines are only available in five year periods.
Chapter 4

Trade and Skill Premium
This chapter presents an empirical study of the effects of trade expansions driven by tariff reductions and technological catch-up on the skill premium. We employ two proxies for trade expansions, the ratio and the range, in the estimations. Section 4.1 explains an estimation strategy. Section 4.2 defines variables and discusses the data sources. Section 4.3 presents empirical results and analyses of the effects of trade expansions driven by tariff reductions and technological catch-up on the skill premium. The data summary is in Appendix Table A.4.1 and figures of the skill premium, tariffs, terms of trade, technological catch-up, ratio of exports (imports) to GDP, and range of exports (imports) are in Appendix Figures A.4.1-A.4.6, respectively.

4.1 Estimation Strategy

This section explains an estimation strategy to analyse the effects of trade expansions driven by tariff reductions and technological catch-up on the skill premium by using panel estimations. The first step is to analyse the direct effect of Southern tariff reductions on trade expansions which will be illustrated by the effects of reductions in Southern tariffs ($\tau$) on changes in its imports ($m$). We apply the two proxies for import expansions (i.e. the ratio of imports to GDP and the range of imports). The effects of tariff reductions on import expansions can be formulated as $m/gdp = f(\tau)$ and $mr = f(\tau)$, as shown in estimations 4.1 and 4.4, respectively. It is predicted that Southern tariff reductions will increase Southern imports.

The second step is to analyse the indirect effect of Southern tariff reductions on trade expansions. We expect that Southern tariff reductions increase demand for Northern goods which will raise demand for Northern skilled labour. The increase in demand for Northern skilled labour causes its wage to be relatively higher than the wage of Southern skilled labour in producing the same goods.
as the North. The lower Southern relative cost will improve the Southern competitive advantage, and thus increase Southern exports. The lower Southern relative cost represented by the terms of trade \( (v) \) is expected to increase Southern exports \( (x) \). Moreover, as discussed in the theoretical framework, the other factor which is expected to also raise Southern exports is Southern technological catch-up \( (\Psi) \). Therefore, we will examine the effects of the terms of trade and Southern technological catch-up on export expansions. We apply the two proxies of export expansions (i.e. the ratio of exports to GDP and the range of exports). The effects of the terms of trade and Southern technological catch-up on export expansions can be written as \( \frac{x}{gdp}=f(v, \Psi) \) and \( x^r=f(v, \Psi) \), as illustrated in estimations 4.2 and 4.5, respectively.

The last step is to analyse the effects of Southern export (import) expansions on the skill premium, as in estimations 4.3 and 4.6. Since this study focuses on Southern tariff reductions, we presume that only Southern tariff changes, \( d\tau_S \neq 0 \) (i.e. in the case of Southern tariff reductions, \( d\tau_S < 0 \)), and there is no change in Northern tariff, \( d\tau_N = 0 \).
We define exports (imports) by Southern countries as exports (imports) to (from) both Southern and Northern countries. The reason is that the available data are only either exports (imports) by commodity (SITC up to 5 digits) or exports (imports) by destination (origin) country. Nonetheless, there are no data on exports (imports) by commodity and by destination (origin) country all together (i.e. there are no data on exports of ships and floating goods (Industry 779) designated to the US, Hongkong, Singapore, and other countries). Therefore, we use data on exports (imports) by commodity. We only include manufactured goods to fit the theoretical framework which later on divides them into exports (imports) by skill intensity, in Chapters 5 and 6.

Like most empirical studies in this area (Robbins (1996); Lu (2000); Ho et al. (2005)), this study only concentrates on the effects of Southern liberalisation on the Southern skill premium. As this study uses panel data of 27 countries from 1980 to 2005 and estimates the panel data by Pooled Least Square, Fixed Effect, and Random Effect regressions, a potential specification error which may arise in time series data would be automatically canceled out.

Panel data consist of multiple cases observed in more than one time period. Panel data regression techniques provide an understanding of the cross-sectional information reflected in the differences between subjects, and the time-series or within-subject information reflected in the changes for subjects over time. With panel data, it is possible to control for some types of omitted variables even without observing them, by observing changes in the dependent variable over time.

While PLS is widely used on panel data, it may not be optimal. The estimates of coefficients derived from regression may be subject to omitted variable bias which arises when there is some unknown variable or variables that cannot be
controlled for that affect the dependent variable. Therefore, this study uses Pooled Least Square (PLS), Fixed Effect (FE), and Random Effect (RE) regressions. If we find that there is a heteroscedasticity problem in data, then we will choose either FE or RE regression. We conduct a formal heteroscedasticity test to address this issue.

FE regression is the estimation to use when we want to control for omitted variables that differ between cases but are constant over time. Using FE is actually equivalent to generating dummy variables for each of the cases and including them in a standard linear regression to control for the fixed effect (note: in our study, the variations of country characteristics could be captured by using the Fixed Effect (FE) regression). In other cases, RE regression is the estimation to use when we have reasons to believe that some omitted variables may be constant over time but vary between cases, and others may fixed between cases but vary over time. (Wooldridge (2001):Chapter 10). We conduct a formal Hausman test to select the best approach to fit the data between FE and RE regressions.

We apply the two proxies for trade expansions, the ratio of exports (imports) to GDP and the range of exports (imports), in the estimations. Estimations 4.1, 4.2, and 4.3 use the first proxy method and estimations 4.4, 4.5, and 4.6 use the second proxy method.

The reason for estimating equations separately is that we would like to argue that the skill premium is affected by export and import expansions, and the main driving forces of export and import expansions are trade liberalisation (represented by direct and indirect effects of trade liberalisation) and technological catch-up. We, therefore, estimate separately the effect of tariff reductions (the direct effect of trade liberalisation) on imports (equations 4.1
and 4.4), the effect of the terms of trade (the indirect effect of trade liberalisation) and technological catch-up on exports (equations 4.2 and 4.5), and the effect of export and import expansions on the skill premium (equations 4.3 and 4.6). As the value of each variable is available, we do not need to create any instrument variables. The equations are neither estimations which use instrument variables nor simultaneous estimations that substitute one equation into another equation. The variables in this study will be estimated separately.

\[ (m/gdp)_{ti} = \alpha_0 + \alpha_1 \tau_{ti} + \epsilon_{ti} \] (4.1)

\[ (x/gdp)_{ti} = \beta_0 + \beta_1 \psi_{ti} + \beta_2 \Psi_{ti} + \epsilon_{ti} \] (4.2)

\[ \omega_{ti} = \gamma_0 + \gamma_1 (x/gdp)_{ti} + \gamma_2 (m/gdp)_{ti} + \mu_{ti} \] (4.3)

\[ m^r_{ti} = a_0 + a_1 \tau_{ti} + \epsilon_{ti} \] (4.4)

\[ x^r_{ti} = b_0 + b_1 \psi_{ti} + b_2 \Psi_{ti} + \epsilon_{ti} \] (4.5)

\[ \omega_{ti} = g_0 + g_1 x^r_{ti} + g_2 m^r_{ti} + \mu_{ti} \] (4.6)

\( \alpha_0, \beta_0, \gamma_0, \alpha_0, b_0, \) and \( g_0 \) are the country fixed effects that capture unobserved country heterogeneity. From estimations 4.1 and 4.4, the direct effect of Southern tariff reductions is that it will increase Southern imports from the North,
so $\alpha_1$ and $a_1$ are expected to be negative.

The indirect effect of Southern tariff reductions on trade is illustrated by the effects of the Southern relative cost on exports. From estimations 4.2 and 4.5, the lower Southern relative cost ($v$) is expected to expand Southern exports, thus $\beta_1$ and $b_1$ are expected to be negative. Meanwhile, Southern technological catch-up ($\Psi$) is expected to increase Southern exports, so that $\beta_2$ and $b_2$ are expected to be positive. The reason that there are no lags in these relationships is that technological catch-up is defined as the difference between growth of labour productivity of country $i$ and growth of labour productivity of the North country, in the manufacturing industry. So this variable actually includes lagged value of labour productivity (detail definition of technological catch-up is in the following section).

From estimations 4.3 and 4.6, as discussed in the theoretical framework, if Southern tariff reductions cause an export expansion that is larger than an import expansion and it expands the range of the traded goods which are now relatively more skill intensive, it will increase demand for Southern skilled labour and hence, raise the Southern skill premium. The skill premium may rise as a result of an export expansion, yet fall in response to an import expansion. Thus, $\gamma_1$ and $g_1$ are expected to be positive, while $\gamma_2$ and $g_2$ are expected to be negative.

---

2 Theoretically, the assumption of equal expenditure across all manufactured goods means that an increase in the number of goods exported by the South will increase Southern relative demand for skilled labour. Empirically, there could be a case that an export expansion such that the relative demand for skilled labour may fall. To address this issue, we classify manufactures into unskilled and skilled labour intensive, so that we could analyse if an expansion actually occurs in unskilled or skilled labour intensive industries. This issue is discussed in Chapter 5.
4.2 Data

Panel data of 27 developing countries across Asia, Latin America, and Africa from 1980 to 2005 are constructed to test the proposition of whether Southern trade expansions driven by Southern tariff reductions and technological catch-up affect the skill premium. Due to some missing data, the number of observations is 685. The data summary is presented in Appendix Table A.4.1.³ The variable definitions and data sources are as follows.

ω is the skill premium which is measured by the ratio of the wage of skilled labour to the wage of unskilled labour in the manufacturing industry. Skilled and unskilled labour are defined as non-production and production workers based on the International Standard Classification of Occupations (ISCO), ISCO-1968 and ISCO-1988. Data on this variable are based on the author’s calculation. Data on wages by occupation are available in the ILO Yearbook of Labour Statistics (ILO (2005):Table O.1). Data on wages by occupation for Taiwan are from the Labour Survey of Taiwan (National Statistics Office of Taiwan (2007)).

x/gdp and m/gdp are the ratio of the value of exports of manufactured goods to GDP (the ratio of exports to GDP) and that of the value of imports of manufactured goods to GDP (the ratio of imports to GDP), respectively. Exports and imports include 134 manufacturing industries. Data on the value of exports (imports) of manufactured goods (3 digit-SITC Revision 2) are from UNCTAD (2005) Table 4.2. Data on GDP are from the World Development Indicators (World Bank (2006)) and data on GDP for Taiwan are from the IMF World Economic Outlook (IMF (2007)).

³ The detailed definitions of the skill premium, manufacturing industry, developing countries, and proxies of trade expansions are in Chapter 3.
4. Trade and Skill Premium

$x^r$ and $m^r$ are defined as the range of exports of manufactured goods (the range of exports) and the range of imports of manufactured goods (the range of imports), respectively. The range of exports (imports) is measured by the summation of an index which is based on the share of the value of exports (imports) of each industry to the value of exports (imports) of manufactured goods. It is 1 if its share of exports to exports of manufactured goods is greater than one percent; 0 otherwise. So, the range of exports is the summation of an index (0 or 1) of the share of the value of exports of each manufacturing industry to the value of exports of manufactured goods. This measurement also applies to imports. The justification of the benchmark of the share depends on active industries in the group of countries. This study justifies one percent, considering that there are about 100 active industries in the coverage of 134 manufacturing industries in developing countries included in the study. Data on this variable are based on the author’s calculation. Data on the value of exports (imports) of manufactured goods (3 digit-SITC Revision 2) are from UNCTAD (2005) Table 4.2.

$\tau$ indexes tariff which is measured by the unweighted average applied import tariff rates on manufactured goods at ad valorem rates. The reason this study uses the unweighted average tariff is that a simple average tariff is harmonised across products codes, synchronised across countries and widely used in WTO and UNCTAD (Ng (2006)). Moreover, the unweighted tariff might be a better indicator of the level of protection in the economy than a weighted tariff. In the case of a country with little trade in many categories of imports but with some trade in a few import categories with relatively low tariffs, then the trade-weighted tariff would be relatively low and could be misleading regarding levels of protection (Suranovic (2006)). Meanwhile, a weighted tariff is not
synchronised across countries. Different countries may have different weights which result in different weighted tariffs across countries. As our empirical study analyse the effects of tariff on imports across countries, different weighted tariffs may cause a heteroscedasticity problem. Thus, we prefer to use the unweighted tariff. Data on tariffs are from Easterly and Sewadeh (2000), UNCTAD (2005) Table 8.4, and Ng (2006).

\( v \) stands for the relative cost which is measured by the terms of trade. The terms of trade is proxied by the ratio of export price index to import price index (Bidarkota and Crucini (2000)). Data on export price index and import price index are from UNCTAD (2005) Table 2.1.E and the World Development Indicators (World Bank (2006)).

\( \Psi \) is Southern technological catch-up which is measured by the difference between growth of labour productivity in the manufacturing industry in country \( i \) and growth of labour productivity in the manufacturing industry in the North (represented by the United States\(^5\)). Labour productivity is defined as the value added in the manufacturing industry at constant 2000 price divided by the number of workers in that industry (Antweiler and Trefler (2002); Zhu and Trefler (2005)). Data on the value added in the manufacturing industry at constant 2000 price are available from the World Development Indicators (World Bank (2006)) and data on this variable for Taiwan are from the IMF.

---

\(^4\) There are two ways to weight tariff. The nominal tariff is weighted by either the value or the volume of imports.

\(^5\) The justification for the US as the benchmark of Southern technological catch-up is that the US has the highest technology level, based on the share in total business enterprise research and development (R&D) in the world (OECD (1992):114).

\(^6\) Another measure of technological catch-up is Total Factor Productivity (TFP) growth rate in the manufacturing industry which is the ratio of total output in that sector to an index of total factor input. The input measure is a factor share weighted average of aggregate capital input and labour input. Nonetheless data on capital input in the manufacturing industry across countries are limited, therefore we use productivity catch-up as a measure of technological catch-up.
World Economic Outlook (IMF (2007)). Data on the number of workers in
the manufacturing industry are from the ILO Yearbook of Labour Statistics
(ILO (2005)) Table 2.B.

*i* denotes country. There are 27 developing countries (*I*=27).

*t* denotes time which is an annual period from 1980 to 2005 (*T*=26).

### 4.3 Empirical Result

This section presents empirical results of the effects of trade expansions driven
by tariff reductions and technological catch-up on the skill premium in develop­ing countries. Sections 4.3.1 and 4.3.2 explain the correlation between trade expansions and the skill premium by using the first and second proxies for
trade expansion methods, respectively.

Based on the first proxy, the increased ratio of imports to GDP is significantly
affected by tariff reductions and the increased ratio of exports to GDP is
significantly affected by the increased terms of trade. The rising skill premium
is significantly affected by the increased ratio of exports to GDP. Meanwhile,
based on the second proxy, tariff reductions do not necessarily increase the
range of imports. The increased range of exports is positively affected by
technological catch-up. The rising skill premium is affected by the expanded
range of exports and the decreased range of imports. The results are produced
by using PLS, FE, and RE regressions as follows.\(^7\)

---

\(^7\) As it is often argued that Hong Kong and Singapore can be outliers in the ratio of ex­
ports (imports) to GDP and thus can cause a heteroscedasticity problem in PLS estimation,
this study also conducts an analysis which excludes Hong Kong and Singapore in the sam­
ple. The empirical analysis using the first proxy method on 25 developing countries which
excludes Hong Kong and Singapore shows exactly the same significance but slightly lower
magnitudes of the effects of the ratio of exports to GDP on the skill premium. Nonetheless,
the estimations using FE and RE regressions are reliable since they control for heteroscedas­
ticity. Moreover, there is no heteroscedasticity problem with Hong Kong and Singapore in
the estimation that uses the second proxy method.
4.3.1 Empirical Result—the Ratio

This section examines how tariff reductions affect imports, how the terms of trade and technological catch-up affect exports, and how exports (imports) affect the skill premium, based on the first proxy method. The estimation results are presented in Tables 4.1, 4.2, and 4.3, respectively. The data summary is in Appendix Table A.4.1.

Table 4.1 depicts the correlation between tariff (TARIFF) and the ratio of imports to GDP (M/GDP). Tariff reductions significantly expand imports in developing countries. Based on FE estimation\(^8\), a reduction of one percent in the tariff will increase the ratio of imports to GDP by 0.096 percent. Most developing countries significantly reduced tariffs, notably in the 1980s, which expanded the ratio of imports to GDP.

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>PLS</th>
<th>FE</th>
<th>RE</th>
</tr>
</thead>
<tbody>
<tr>
<td>M/GDP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>38.48*</td>
<td>25.92*</td>
<td>26.36*</td>
</tr>
<tr>
<td></td>
<td>(28.4)</td>
<td>(40.6)</td>
<td>(7.02)</td>
</tr>
<tr>
<td>TARIFF</td>
<td>-0.684*</td>
<td>-0.096*</td>
<td>-0.104*</td>
</tr>
<tr>
<td></td>
<td>(-13.6)</td>
<td>(-3.60)</td>
<td>(-3.89)</td>
</tr>
<tr>
<td>(R^2)</td>
<td>0.214</td>
<td>0.200</td>
<td>0.200</td>
</tr>
<tr>
<td>Hausman test ((\chi^2))</td>
<td>5.500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>((Prob &gt; \chi^2))</td>
<td></td>
<td></td>
<td>(0.00)</td>
</tr>
</tbody>
</table>

Note:
1. The number of observations is 685
2. Based on t-test, (*) shows significant coefficients at 5%
3. Based on the Hausman test, FE is preferred to RE

---

\(^8\) Based on the Breusch-Pagan and Cook-Weisberg tests for heteroscedasticity, \(\chi^2\) is 184.21 which is greater than \(\chi^2(1,5\%)\) that is 3.48. It means that there is a heteroscedasticity problem in PLS estimation.
Table 4.2 shows the effects of the terms of trade (TOT) and Southern technological catch-up (TECH) on the ratio of exports to GDP (X/GDP). Based on FE estimation\(^9\), the terms of trade affects the ratio of exports to GDP positively. However, technological catch-up surprisingly has an insignificant effect on the ratio of exports to GDP. One justification for this insignificant effect is that the first proxy for trade expansions may not reflect an actual trade expansion, so that the estimation produced by the first proxy cannot reflect the effect of technological catch-up on export expansions.\(^{10}\)

Table 4.2: Effects of terms of trade and technological catch-up on ratio of exports to GDP

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>PLS</th>
<th>FE</th>
<th>RE</th>
</tr>
</thead>
<tbody>
<tr>
<td>X/GDP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>25.11*</td>
<td>13.77*</td>
<td>14.00*</td>
</tr>
<tr>
<td></td>
<td>(7.86)</td>
<td>(9.41)</td>
<td>(2.71)</td>
</tr>
<tr>
<td>TOT</td>
<td>-6.998*</td>
<td>4.152*</td>
<td>4.048*</td>
</tr>
<tr>
<td></td>
<td>(-2.35)</td>
<td>(3.01)</td>
<td>(3.02)</td>
</tr>
<tr>
<td>TECH</td>
<td>0.097</td>
<td>-0.009</td>
<td>-0.009</td>
</tr>
<tr>
<td></td>
<td>(0.53)</td>
<td>(-0.13)</td>
<td>(-0.13)</td>
</tr>
<tr>
<td>F(2, 682)</td>
<td>3.230</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F(2, 656)</td>
<td></td>
<td>4.840</td>
<td></td>
</tr>
<tr>
<td>Wald $\chi^2$</td>
<td></td>
<td></td>
<td>8.680</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.009</td>
<td>0.014</td>
<td>0.014</td>
</tr>
<tr>
<td>Hausman test ($\chi^2$)</td>
<td>4.380</td>
<td>(Prob $&gt; \chi^2$) (0.04)</td>
<td></td>
</tr>
</tbody>
</table>

Note:
1. The number of observations is 685
2. Based on t-test, (*) shows significant coefficients at 5%
3. Based on the Hausman test, FE is preferred to RE

\(^9\) Based on the heteroscedasticity test, $\chi^2$ is 9.47 which is greater than $\chi^2(2,5\%)$ that is 5.99. It means that there is a heteroscedasticity problem in PLS estimation.

\(^{10}\) The shortcomings of the first proxy of trade expansions, see Chapter 3 Section 3.2.1.
Table 4.3: Effects of ratio of exports (imports) to GDP on skill premium

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>PLS</th>
<th>FE</th>
<th>RE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SKILL PREMIUM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>2.022*</td>
<td>1.908*</td>
<td>1.907*</td>
</tr>
<tr>
<td></td>
<td>(35.2)</td>
<td>(39.0)</td>
<td>(10.6)</td>
</tr>
<tr>
<td>X/GDP</td>
<td>-0.016*</td>
<td>0.016*</td>
<td>0.015*</td>
</tr>
<tr>
<td></td>
<td>(-4.21)</td>
<td>(5.74)</td>
<td>(5.46)</td>
</tr>
<tr>
<td>M/GDP</td>
<td>0.019*</td>
<td>0.001</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>(4.71)</td>
<td>(0.39)</td>
<td>(0.34)</td>
</tr>
<tr>
<td>F(2, 682)</td>
<td>11.20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F(2, 656)</td>
<td></td>
<td>55.95</td>
<td></td>
</tr>
<tr>
<td>Wald $\chi^2$ (3)</td>
<td></td>
<td></td>
<td>104.1</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.032</td>
<td>0.145</td>
<td>0.145</td>
</tr>
<tr>
<td>Hausman test ($\chi^2$)</td>
<td>15.45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>($Prob &gt; \chi^2$)</td>
<td></td>
<td></td>
<td>(0.00)</td>
</tr>
</tbody>
</table>

Note:
1. The number of observations is 685
2. Based on t-test, (*) shows significant coefficients at 5%
3. Based on the Hausman test, FE is preferred to RE

Table 4.3 shows the effects of the ratio of exports to GDP (X/GDP) and the ratio of imports to GDP (M/GDP) on the skill premium. Based on FE estimation\footnote{Based on the heteroscedasticity test, $\chi^2$ is 14.87 which is greater than $\chi^2(2,5\%)$ that is 5.99. It means that there is a heteroscedasticity problem in PLS estimation.}, the rising skill premium in developing countries is affected by the increased ratio of exports to GDP. An increase of one percent of the ratio of exports to GDP will raise the skill premium by 0.016 points, holding the ratio of imports to GDP constant, whereas the ratio of imports to GDP has an insignificant effect on the skill premium. The increased ratio of exports to GDP is expected to be predominantly driven by the increased exports which are at the cut-off point of exports and imports (goods which are relatively skilled labour intensive).
4.3.2 Empirical Result — the Range

This section examines how tariff reductions affect imports, how the terms of trade and technological catch-up affect exports, and how exports (imports) affect the skill premium, based on the second proxy method. The estimation results are presented in Tables 4.4, 4.5, and 4.6, respectively. The data summary is in Appendix Table A.4.1.

Table 4.4: Effects of tariff on range of imports

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>PLS</th>
<th>FE</th>
<th>RE</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-RANGE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>26.35*</td>
<td>26.39*</td>
<td>26.36*</td>
</tr>
<tr>
<td></td>
<td>(85.7)</td>
<td>(78.3)</td>
<td>(41.1)</td>
</tr>
<tr>
<td>TARIFF</td>
<td>0.085*</td>
<td>0.083*</td>
<td>0.084*</td>
</tr>
<tr>
<td></td>
<td>(7.48)</td>
<td>(5.94)</td>
<td>(6.24)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.075</td>
<td>0.051</td>
<td>0.051</td>
</tr>
<tr>
<td>Hausman test ($\chi^2$)</td>
<td>0.010</td>
<td></td>
<td>0.010</td>
</tr>
<tr>
<td>($Prob &gt; \chi^2$)</td>
<td></td>
<td></td>
<td>(0.90)</td>
</tr>
</tbody>
</table>

Note:
1. The number of observations is 685
2. Based on t-test, (*) shows significant coefficients at the 5% level
3. Based on the Hausman test, FE is preferred to RE

Table 4.4 illustrates the correlation between tariff (TARIFF) and the range of imports (M-RANGE). Theoretically, we expect that tariff reductions will expand the range of imports. Yet, empirically, based on PLS estimation\(^\text{12}\), a reduction of one percent in the import tariff will decrease the range of imports by 0.085.

The reason is that developing countries may increase importing more skilled labour intensive goods (higher prices) and reduce importing unskilled labour.

\(^\text{12}\) Based on the heteroscedasticity test, $\chi^2$ is 0.82 which is lower than $\chi^2(1, 5\%)$ that is 3.48. It means that there is no heteroscedasticity problem in PLS estimation.
intensive goods (lower prices), therefore the range of imports could fall while
value rises. This occurs in most of developing countries. For example, there was
a significant increase in the value of imports of Malaysia due to development
of the telecommunication industry. The ratio of total imports of manufactured
goods to GDP increased from 28.20 percent in 1980 to 59.42 percent in 2005,
but the range of imports of manufactured goods fell from 26 types to 16 types
in the same period.

Table 4.5: Effects of terms of trade and technological catch-up on range of exports

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>PLS</th>
<th>FE</th>
<th>RE</th>
</tr>
</thead>
<tbody>
<tr>
<td>X-RANGE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>21.77*</td>
<td>24.38*</td>
<td>24.28*</td>
</tr>
<tr>
<td></td>
<td>(30.7)</td>
<td>(43.8)</td>
<td>(23.4)</td>
</tr>
<tr>
<td>TOT</td>
<td>-0.202</td>
<td>-2.791*</td>
<td>-2.693*</td>
</tr>
<tr>
<td></td>
<td>(-0.31)</td>
<td>(-5.33)</td>
<td>(-5.18)</td>
</tr>
<tr>
<td>TECH</td>
<td>0.147*</td>
<td>0.062*</td>
<td>0.065*</td>
</tr>
<tr>
<td></td>
<td>(3.67)</td>
<td>(2.29)</td>
<td>(2.37)</td>
</tr>
<tr>
<td>F(2, 682)</td>
<td>7.220</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F(2, 656)</td>
<td></td>
<td>18.07</td>
<td></td>
</tr>
<tr>
<td>Wald $\chi^2$</td>
<td></td>
<td></td>
<td>35.00</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.021</td>
<td>0.053</td>
<td>0.052</td>
</tr>
<tr>
<td>Hausman test ($\chi^2$)</td>
<td>12.87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>($Prob &gt; \chi^2$)</td>
<td>(0.00)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note:
1. The number of observations is 685
2. Based on t-test, (*) shows significant coefficients at 5%
3. Based on the Hausman test, FE is preferred to RE

Table 4.5 shows the effects of the terms of trade (TOT) and Southern technolog­
ical catch-up (TECH) on the range of exports (X-RANGE). Based on PLS
estimation\(^{13}\), the terms of trade shows an insignificant effect on the range of
exports, whereas technological catch-up of developing countries significantly

\(^{13}\) Based on the heteroscedasticity test, $\chi^2$ is 0.42 which is lower than $\chi^2(2,5\%)$ that is
5.99. It means that there is no heteroscedasticity problem in PLS estimation.
increases their range of exports, as predicted. An increase of one percent of technological catch-up will increase the range of exports by 0.147, holding the terms of trade constant.

Table 4.6 shows that the rising skill premium in developing countries is significantly affected by the range of exports (X-RANGE) and the range of imports (M-RANGE) in the expected way as discussed in the theoretical framework. Based on FE estimation\textsuperscript{14}, the rising skill premium is affected by both the expanded range of exports and the narrowed range of imports. An increase of one type of the range of exports will raise the skill premium by 0.018 points, holding the range of imports constant. In other words, an increase of 10 types of goods in the range of exports will increase 18 percent of the wage gap between the skilled and unskilled labour which support that the effect of export expansions is quite significant. An increase in the range of exports which are relatively skilled labour intensive will increase demand for skilled labour which in turn will raise the skill premium in developing countries. Costa Rica, Hong Kong, South Korea, and Taiwan experienced the rising skill premium as their range of exports expanded.

Meanwhile, a decrease of one type of the range of imports will raise the skill premium by 0.036 points, holding the range of exports constant. In other words, a decrease of 10 types of goods in the range of imports will increase 36 percent of the wage gap between the skilled and unskilled labor. This illustrates that changing in the range of imports brings quite significant effects on the skill premium in developing countries. The negative effect of the range of imports on the skill premium can be explained as follows. The decreased imports will increase demand for skilled labour in developing countries to produce

\textsuperscript{14} Based on the heteroscedasticity test, $\chi^2$ is 75.36 which is greater than $\chi^2(2,5\%)$ that is 5.99. It means that there is a heteroscedasticity problem in PLS estimation.
### Table 4.6: Effects of the range of exports and imports on skill premium

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>PLS</th>
<th>FE</th>
<th>RE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SKILL PREMIUM</td>
<td>2.257*</td>
<td>2.922*</td>
<td>2.910*</td>
</tr>
<tr>
<td>Constant</td>
<td>(9.80)</td>
<td>(23.8)</td>
<td>(13.49)</td>
</tr>
<tr>
<td>X-RANGE</td>
<td>0.007</td>
<td>0.018*</td>
<td>0.018*</td>
</tr>
<tr>
<td></td>
<td>(1.18)</td>
<td>(3.67)</td>
<td>(3.67)</td>
</tr>
<tr>
<td>M-RANGE</td>
<td>-0.007</td>
<td>-0.036*</td>
<td>-0.036*</td>
</tr>
<tr>
<td></td>
<td>(-1.00)</td>
<td>(-10.4)</td>
<td>(-10.4)</td>
</tr>
<tr>
<td>F(2, 682)</td>
<td>1.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F(2, 656)</td>
<td></td>
<td>59.02</td>
<td></td>
</tr>
<tr>
<td>Wald $\chi^2$ (4)</td>
<td></td>
<td></td>
<td>116.7</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.003</td>
<td>0.152</td>
<td>0.152</td>
</tr>
<tr>
<td>Hausman test ($\chi^2$)</td>
<td></td>
<td></td>
<td>1.930</td>
</tr>
<tr>
<td>(Prob $&gt; \chi^2$)</td>
<td></td>
<td></td>
<td>(0.38)</td>
</tr>
</tbody>
</table>

Note:
1. The number of observations is 685
2. Based on t-test, (*) shows significant coefficients at 5%
3. Based on the Hausman test, FE is preferred to RE

goods which were previously imported goods or the goods that are similar to imported goods. The increased demand for skilled labour in developing countries will then raise the skill premium. The negative effect of the range of imports on the skill premium could be mainly caused by the decreased range of skilled labour intensive imports in developing countries since 1990, particularly in Latin America (e.g. Costa Rica, Mexico, Nicaragua, Peru, Uruguay, and Venezuela).

In an earlier draft of this study, we tested the hypothesis by using the classification of five divisions of agriculture, mineral, technology, unskilled and skilled labour intensive industries. Nonetheless, as this study concentrates on factors of production of skilled and unskilled labour, we classify industries into unskilled and skilled labour intensive. The results of the effect of trade liberal-
isation on the skill premium produced by the former classification of industries are consistent with the results produced by the later classification of industries.

4.4 Conclusion

Based on the first proxy, the increased ratio of imports to GDP is significantly affected by tariff reductions, the increased ratio of exports to GDP is significantly affected by the increased terms of trade, and the rising skill premium in developing countries is significantly affected by the increased ratio of exports to GDP. Meanwhile based on the second proxy, tariff reductions do not necessarily increase the range of imports, the increased range of exports is positively affected by technological catch-up, and the rising skill premium in developing countries is driven by the expanded range of exports as well as the decreased range of imports.\(^{15}\)

Based on the number of satisfactory variables referred to in the theoretical framework and the value of coefficient of determination (Table 4.6)\(^{16}\), the range could explain the effects of trade expansions on the skill premium relatively better than the ratio. The range could describe trade expansions relatively more precisely than the ratio in the sense that the range treats all industries equally so that there is no dominant effect of one or certain number of industries over the other industries. Therefore, the estimation using the range could show that the rising skill premium in developing countries is driven by both export and import expansions.

\(^{15}\) This study limits the analysis to only the manufacturing industry. The estimation results are different from the estimation results using data of exports (imports) of total goods which cover agricultural and natural resources intensive goods including oil and gas. The detailed estimation results using the latter specification of goods is available in Ing (2009).

\(^{16}\) Coefficient of determination or \(R^2\) shows the proportion or percentage of the total variation in dependent variable explained by the regression model (Gujarati (1995):74-80).
Further explanation of the effects of trade expansions disaggregated by skill intensity (skilled and unskilled labour intensive exports (imports)) on the skill premium is in the following chapter. Moreover, Chapter 5 also discusses the importance of the skill intensity of trade expansions in analysing the effects of trade expansions on the skill premium.
### Appendix 4

**Table A.4.1: Data summary**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>SKILL PREMIUM</td>
<td>2.209</td>
<td>0.971</td>
<td>1.000</td>
<td>6.170</td>
</tr>
<tr>
<td>TARIFF</td>
<td>21.38</td>
<td>16.44</td>
<td>0.000</td>
<td>100.0</td>
</tr>
<tr>
<td>TOT</td>
<td>1.034</td>
<td>0.361</td>
<td>0.354</td>
<td>2.938</td>
</tr>
<tr>
<td>TECH</td>
<td>-0.694</td>
<td>5.757</td>
<td>-23.92</td>
<td>19.94</td>
</tr>
<tr>
<td>X</td>
<td>2.36e+10</td>
<td>4.41e+10</td>
<td>3.88e+06</td>
<td>2.82e+11</td>
</tr>
<tr>
<td>M</td>
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<td>4.14e+10</td>
<td>1.96e+08</td>
<td>3.02e+11</td>
</tr>
<tr>
<td>X/GDP</td>
<td>18.09</td>
<td>26.77</td>
<td>0.049</td>
<td>131.9</td>
</tr>
<tr>
<td>M/GDP</td>
<td>24.11</td>
<td>24.65</td>
<td>2.149</td>
<td>128.0</td>
</tr>
<tr>
<td>X-RANGE</td>
<td>21.41</td>
<td>5.938</td>
<td>6.000</td>
<td>36.00</td>
</tr>
<tr>
<td>M-RANGE</td>
<td>28.26</td>
<td>5.103</td>
<td>12.00</td>
<td>44.00</td>
</tr>
</tbody>
</table>

**Note:**
This study covers 134 manufacturing industries (J=134) in each of 27 developing countries (I=27) from 1980 to 2005 (T=26). Due to the limited data on wages by occupation for certain countries in certain years, the numbers of observations are IT=685 and JIT=91,790.
Figure A.4.1: Skill premium in developing countries, 1980-2005

Note:
(1) The skill premium is the ratio of the wage of non-production workers to the wage of production workers in the manufacturing industry.
(2) Source: author’s calculation. Data on wages by occupation are from the ILO Yearbook of Labour Statistics (ILO (2005):Table O.1) and the Labour Survey of Taiwan (National Statistics Office of Taiwan (2007)).
Figure A.4.2: Import tariffs in developing countries, 1980-2005

Note:
(1) Import tariffs are the unweighted average applied import tariffs on manufactured goods.
(2) Source: Easterly and Sewadeh (2000); UNCTAD (2005) Table 8.4; Ng (2006).
Figure A.4.3: Terms of trade in developing countries, 1980-2005

Note:
(1) Terms of trade is the ratio of export price index to import price index in the manufacturing industry.
(2) Source: author's calculation. Data on export and import price indexes are from the World Development Indicators (World Bank (2006)).
Figure A.4.4: Technological catch-up in developing countries, 1980-2005

Note:
(1) Technological catch-up is the difference between growth of labour productivity of country $i$ and growth of labour productivity of the US, in the manufacturing industry. Labour productivity is variable in the way that a country may have high growth of labour productivity in one year but then low growth of labour productivity in the following year or the other way around. Growth of labour productivity in developing countries shows quite a different pattern to that of the US and it is not immediately apparent why it displays such high year-to-year variation.

(2) Source: author's calculation. Data on the value added in the manufacturing industry are from the World Development Indicators (World Bank (2006)) and data on this variable for Taiwan are from the IMF World Economic Outlook (IMF (2007)). Data on the number of workers in the manufacturing industry are from the ILO Yearbook of Labour Statistics (ILO (2005): Table 2.B).
Figure A.4.5: Ratio of exports (imports) to GDP in developing countries, 1980-2005

Note:
(1) Y-axis is the ratio of the value of exports (imports) of manufactured goods to GDP.
(2) Source: author’s calculation. Data on the value of exports (imports) of manufactured goods are from UNCTAD (2005) Table 4.2. Data on GDP are from the World Development Indicators (World Bank (2006)) and data on GDP for Taiwan are from the IMF World Economic Outlook (IMF (2007)).
Figure A.4.6: Range of exports (imports) in developing countries, 1980-2005

Note:
(1) Y-axis is the range of exports (imports) of manufactured goods.
(2) Source: author’s calculation. Data on the value of exports (imports) of manufactured goods is from UNCTAD (2005) Table 4.2.
Chapter 5

Skill Intensity of Trade Expansions and Rising Skill Premium
5.1 Skill Intensity of Trade Expansions

The empirical results in the previous chapter illustrate that trade expansions have statistically significant effects on the skill premium, as predicted in the theoretical framework. Based on the first proxy, the rising skill premium in developing countries is affected by increased exports. Based on the second proxy, the rising skill premium is affected by increased exports and decreased imports.

This chapter examines in detail the effects of trade expansions on the skill premium. What kind of exported (imported) goods raise or reduce the skill premium? Recall from the theoretical framework, an export expansion in or near the export and import margins will raise the skill premium (the definition of export and import margins is in Chapter 2, Section 2.1, 'Export and import margins'), while the effects of an import expansion is expected to be the opposite of that of an export expansion. Thus, we restate Proposition 2.1 by emphasizing the importance of the skill intensity of trade expansions.

**Proposition 5.1** In the North-South trade framework, if an export expansion occurs in the range of relatively skilled labour intensive goods, it will raise the skill premium, while if an import expansion occurs in the range of relatively skilled labour intensive goods, it may reduce it.

The next question then is, how can we determine the cut-off point of relatively unskilled or skilled labour intensive goods? Even though the cut-off point of export (import) expansions cannot be observed, we can still determine if an expansion is driven by unskilled or skilled labour intensive goods by setting the range of exports (imports) of manufactured goods based on the proportion of skilled to unskilled labour used in production. First, we rank manufac-
tures such that the ratio of skilled to unskilled labour used in production is increasing in that rank. We classify manufactures based on factor intensity (skill intensity) into unskilled and skilled labour intensive which are discussed in Section 5.1.1. Second, we apply the rank of the ratio of skilled to unskilled labour used in production into the two proxies for trade expansions which is illustrated in Section 5.1.2.

Section 5.2 explains an estimation strategy to investigate the effects of trade expansions disaggregated by skill on the skill premium. Section 5.3 defines variables and discusses the data sources. Section 5.4 presents empirical results of the effects of trade disaggregated by skill on the skill premium. Section 5.5 discusses the empirical results in an assessment of proxies of trade expansions. Section 5.6 concludes and discusses the empirical results in relation to the Heckscher-Ohlin (HO) and Stolper-Samuelson (SS) theorems.

5.1.1 Classification of Manufactures

Recall from Chapter 3 Section 3.1.2, manufacturing is defined as the use of machines, tools, and labour to make things for use or sale, or the branch of manufacture and trade based on the fabrication, processing, and preparation of goods from raw materials and commodities. Based on the Handbook of Trade and Development Statistics, manufactured exports are industry SITC 5 to 8, less 68. This study covers 134 manufacturing industries including Chemicals (511-599), Manufactured goods (611-699), Machinery (711-799), and Miscellaneous manufactured products (811-899). We exclude Agricultural products (000-099), Beverages and tobacco (111-129), Mineral fuels including oil and gas (311-359), Animal, vegetable oil, and fat (411-439), and War manfire, ammunitions, and other transactions (911-999). Considering that some industries
included in this study are classified as natural intensive industries by Krause (1982) or agricultural and natural intensive industries by Ariff and Hill (1985), this study further excludes resource intensive industries such as Leather and leather products (611-613), Cork and wood manufactures (633-635), Pearls and precious or semiprecious stones (667), and Pig iron and steel (671).

To determine if a good is relatively unskilled or skilled labour intensive, we rank the manufactures based on the ratio of skilled to unskilled labour used in production. Based on the widely used studies on the classification of manufactures, Wood (1994), Wood and Mayer (1998), and UNCTAD (2002), we classify the manufactures into two categories based on the ratio of skilled labour to unskilled labour used in production. The benchmark of relatively unskilled or skilled labour intensive is less or greater than unity.¹ Later on, we refer to factor intensity as skill intensity. Based on skill intensity, the manufactures are classified into two categories: unskilled labour intensive (lu) and skilled labour intensive (ls).²

¹ Wood (1994) ranks each manufacturing industry based on the ratio of skilled labour relative to unskilled labour, using data from the US 1980 manufacturing industry, and he classifies manufactures into low-skill and high-skill intensive industries. Footwear, textiles, and clothing products are classified as low-skill intensive. Whereas chemicals, machinery, road vehicles, aircrafts, and instruments are classified as high-skill intensive. This classification of manufactures is similar to that of Balassa (1977). For the detailed classification of manufactures based on the ratio of skilled and unskilled labour and other measurements, see Wood (1994) Chapter 3.

² The other studies classify manufactures into certain categories. Krause (1982) classifies manufactures into four categories: natural resource, unskilled labour, human capital, and technology intensive (Krause (1982):38-42, 91-94). He bases the classification of the manufacturing industry on its natural resource component, value added, and R&D spending. Industries with the highest spending on natural resources relative to value added are classified as natural resource intensive; industries with the lowest value added per worker are classified as unskilled labour intensive; industries with the highest ratio of R&D spending to value added are classified as technology intensive; and industries with relatively low R&D spending to value added ratios compared with technology intensive goods are classified as human capital intensive. The Krause's classification of manufactures is extended into five categories: agricultural, mineral, unskilled labour, skilled labour, and technology intensive (Ariff and Hill (1985):83, 241-242). Their classification is based on spending. Industries with the highest spending on agricultural (mineral) products as raw materials relative to total spending are classified as agricultural (mineral) intensive; industries whose wage earned by skilled labour to total wage is less than 0.4 are defined as unskilled labour intensive; industries whose wage earned by skilled labour to total wage is more than or equal to 0.4 but less than 0.5 are classified as skilled labour intensive; and industries whose compensation of
The 134 manufacturing industries covered in this study are classified into 50 unskilled labour intensive industries and 84 skilled labour intensive industries. The classification of manufactures in most respects is familiar and conclusive. Rubber, paper, iron and steel (primary forms), footwear, textiles, and clothing are classified as unskilled labour intensive. Meanwhile chemicals, machinery, road vehicles, aircrafts, and instruments are classified as skilled labour intensive. The classification of manufactures is outlined in Appendix Table A.5.1.

5.1.2 Proxy for Trade Expansions by Skill

We utilise the two proxies for trade expansions explained in Chapter 3 Section 3.2 which are the ratio of exports (imports) to GDP and the range of exports (imports). To identify if an export (import) expansion is driven by relatively unskilled or skilled labour industries, trade is disaggregated by skill intensity which are explained as follows.

Ratio of exports (imports) by skill to GDP

The first proxy is the widely used proxy of trade expansions which is the ratio of exports (imports) to GDP. \(x_f/gdp\) and \(m_f/gdp\) are the ratio of exports disaggregated by skill intensity to GDP and that of imports disaggregated by skill intensity to GDP, respectively. \(f\) stands for a factor of production which is intensively used in production. It is classified into unskilled labour (lu) and skilled labour (ls). \(xlu/gdp\) and \(xls/gdp\) represent the ratio of unskilled labour intensive exports to GDP and the ratio of skilled labour intensive skilled employees relative to total wage is more than or equal to 0.5 are classified as technology intensive. Another classification of manufactures is based on low, medium, and high technology that is available at OECD (1992) Table Box 14.
exports to GDP. Accordingly, \( mlu/gdp \) and \( mls/gdp \) represent the ratio of unskilled labour intensive imports to GDP and the ratio of skilled labour intensive imports to GDP.

Range of exports (imports) by skill

The second proxy is the range of exports (imports) disaggregated by skill intensity. This proxy is measured by the summation of an index which is based on the share of the value of exports (imports) of each manufacturing industry to the value of exports (imports) of manufactured goods. It is 1 for an industry \( (j) \) if its value of exports \( (x_j) \) relative to exports of manufactured goods \( (\sum x_j) \) is greater than \( \phi \) percent; 0 otherwise. This also applies for the range of imports. It is 1 for an industry if its value of imports \( (m_j) \) relative to imports of manufactured goods \( (\sum m_j) \) is greater than \( \phi \) percent; 0 otherwise. This study justifies the benchmark of the share as much as one percent (\( \phi \) equals 1) considering that there are around 100 active industries in the coverage of 134 manufacturing industries in developing countries. \( x_f^r \) and \( m_f^r \) are the range of exports and that of imports disaggregated by skill intensity which can be formulated as equations 5.1 and 5.2, respectively. \( f \) stands for a factor of production which is intensively used in production.

\[
x_f^r = \sum_{j \in f} I_j \quad I_j = \begin{cases} 1 & \text{if } \frac{x_j}{\sum x_j} \geq \phi \% \\ 0 & \text{if } \frac{x_j}{\sum x_j} < \phi \% \end{cases}
\] (5.1)
5. Skill Intensity of Trade Expansions and Rising Skill Premium

5.2 Estimation Strategy

This section discusses an estimation strategy to examine the effects of exports (imports) disaggregated by skill on the skill premium. Fixed Effect (FE) regression is employed to estimate these effects. We also use Pooled Least Square (PLS) and Random Effect (RE) regressions for comparison purposes. Estimations 5.3 and 5.4 use the first and second proxy of trade expansion methods, respectively.

\[
\omega_{it} = \eta_0 + \eta_1 (xlu/gdp)_{it} + \eta_2 (xls/gdp)_{it} + \eta_3 (mlu/gdp)_{it} \\
+ \eta_4 (mls/gdp)_{it} + e_{it}
\]  

(5.3)

\[m_f^r = \sum_{j \in f} I_j \quad I_j = 1 \text{ if } \frac{m_j}{\sum m_j} \geq \phi \% \]

(5.2)

\[I_j = 0 \text{ if } \frac{m_j}{\sum m_j} < \phi \%\]

\[xlu^r \text{ and } xls^r \text{ are the range of unskilled labour intensive exports and the range of skilled labour intensive exports. Accordingly, } mlu^r \text{ and } mls^r \text{ are the range of unskilled labour intensive imports and the range of skilled labour intensive imports. For example, if the range of unskilled labour intensive exports was 20 types in 1980, it means that there were 20 unskilled labour intensive industries in which the share of the value of exports to the value of total exports of manufactured goods was greater than one percent in that year.}^3\]

3 The comparison between the proxies of trade expansions, the ratio and the range, is discussed in Chapter 3 Section 3.2.
\[ \omega_{it} = n_0 + n_1(xlu^r)_{it} + n_2(xls^r)_{it} + n_3(mlu^r)_{it} + n_4(mls^r)_{it} + \epsilon_{it} \] (5.4)

\( \eta_0 \) and \( \eta_0 \) in estimations 5.3 and 5.4 are the effects that capture unobserved country heterogeneity. The theoretical framework predicts that the skill premium will rise as a result of a decrease in unskilled labour intensive exports or an increase in skilled labour intensive exports. Conversely, import expansions have the opposite effects of export expansions on the skill premium. The skill premium will rise as a result of an increase in unskilled labour intensive imports or a decrease in skilled labour intensive imports.

In estimation 5.3, the skill premium will fall as a result of an increase in the ratio of unskilled labour intensive exports to GDP \((xlu/gdp)\), yet rise in response to an increase in the ratio of skilled labour intensive exports to GDP \((xls/gdp)\). Thus, \( \eta_1 \) is expected to be negative, yet \( \eta_2 \) to be positive. Conversely, an increase in the ratio of unskilled labour intensive imports to GDP \((mlu/gdp)\) and an increase in the ratio of skilled labour intensive imports to GDP \((mls/gdp)\) are expected to have positive and negative effects on the skill premium. Thus, \( \eta_3 \) and \( \eta_4 \) are predicted to be positive and negative, respectively.

Likewise, in estimation 5.4, we expect the effect of the range of unskilled labour intensive exports \((xlu^r)\) on the skill premium, \( n_1 \), to be negative. Whereas the effect of the range of skilled labour intensive exports \((xls^r)\) on the skill premium, \( n_2 \), to be positive. We expect the effect of import expansions on the skill premium to be the opposite of that driven by export expansions, \( n_3 \) and \( n_4 \) are positive and negative, respectively.
5.3 Data

Panel data of 27 developing countries across 134 manufacturing industries from 1980 to 2005 are constructed to test the proposition of whether exports (imports) disaggregated by skill intensity affect the skill premium. Due to missing data, the number of observations is 91,790. The variable definitions and data sources are as follows.

\( \omega \) is the skill premium which is measured by the ratio of the wage of skilled labour to the wage of unskilled labour in the manufacturing industry. Skilled and unskilled labour are defined as non-production and production workers based on the International Standard Classification of Occupations (ISCO), ISCO-1968 and ISCO-1988. Data on this variable are based on the author's calculation. Data on wages by occupation are available in the ILO Yearbook of Labour Statistics (ILO (2005):Table O.1). Data on wages by occupation for Taiwan are from the Labour Survey of Taiwan (National Statistics Office of Taiwan (2007)).

\( x_f/gdp \) and \( m_f/gdp \) are the ratio of the value of exports disaggregated by skill to GDP and that of the value of imports disaggregated by skill to GDP, respectively. \( f \) stands for a factor of production which is intensively used in production. \( xlu/gdp \) and \( xls/gdp \) are the ratio of unskilled labour intensive exports to GDP and the ratio of skilled labour intensive exports to GDP. Accordingly, \( mlu/gdp \) and \( mls/gdp \) are the ratio of unskilled labour intensive imports to GDP and the ratio of skilled labour intensive imports to GDP. Data on these variables are based on the author's calculation. Data on the value of exports (imports) of manufactured goods (3 digit-SITC Revision 2) are from

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\( ^4 \) The detailed definitions of the skill premium, manufacturing industry, developing countries, and proxies of trade expansions are in Chapter 3.
UNCTAD (2005) Table 4.2. Data on GDP are from the World Development Indicators (World Bank (2006)) and data on GDP for Taiwan are from the IMF World Economic Outlook (IMF (2007)).

\( x_f^r \) and \( m_f^r \) are the range of exports disaggregated by skill and the range of imports disaggregated by skill, respectively. The range of exports (imports) is the summation of an index which is based on the share of the value of exports (imports) of each industry to the value of exports (imports) of manufactured goods. \( xlu^r \) and \( xls^r \) are the range of unskilled labour intensive exports and the range of skilled labour intensive exports. Accordingly, \( mlu^r \) and \( mls^r \) are the range of unskilled labour intensive imports and the range of skilled labour intensive imports. Data on these variables are based on the author's calculation. Data on the value of exports (imports) of manufactured goods (3 digit-SITC Revision 2) are from UNCTAD (2005) Table 4.2.

\( i \) denotes country. There are 27 developing countries (I=27).

\( t \) denotes time which is an annual period from 1980 to 2005 (T=26).

5.4 Empirical Result

This section presents panel estimations of 27 developing countries across 134 manufacturing industries from 1980 to 2005 to investigate the effects of exports (imports) disaggregated by skill on the skill premium. The results are estimated by PLS, FE, and RE regressions. The estimation results using the first and second proxies of trade expansions are in Tables 5.1 and 5.2, respectively.

Based on the first proxy method, the rising skill premium in developing countries over the past two decades is affected by the increased skilled labour intensive exports. Meanwhile, based on the second proxy method, the rising
skill premium is affected by the decreased unskilled labour intensive exports, the increased skilled labour intensive exports, and the decreased skilled labour intensive imports. The data summaries of panel regressions using the first and second proxies of trade expansions are in Appendix Tables A.5.2 and A.5.3, respectively. Data on exports (imports) of manufactured goods discussed in the following sections are based on the author’s calculation which are sourced from UNCTAD (2005) Table 4.2.

Based on the first proxy method, Table 5.1-column FE\(^5\) shows that the skill premium in developing countries is affected positively by skilled labour intensive exports. An increase of one percent in the ratio of skilled labour intensive exports to GDP will raise the skill premium by 0.020 points, holding the other variables constant. Compared with the estimation result using aggregated exports (Chapter 4 Table 4.3), it shows that the effect of the ratio of aggregated exports to GDP on the skill premium is 0.016 points which is lower than that of the ratio of skilled labour intensive exports to GDP on the skill premium (Table 5.1-column FE). The lower magnitude of the former relative to the latter could be caused by a (predicted) negative effect of the ratio of unskilled labour intensive exports to GDP on the skill premium. Even though, empirically, the ratio of unskilled labour intensive exports to GDP is not statistically significant in affecting the skill premium, the effect of it still contributes to the effect of the ratio of aggregated exports to GDP on the skill premium.

The significant effect of the ratio of skilled labour intensive exports to GDP on the skill premium is driven by a remarkable expansion in skilled labour intensive exports, noticeably, in Asian countries (e.g. Hong Kong, Malaysia, Malaysia, Indonesia, and Taiwan).

\(^5\) Based on the Breusch-Pagan and Cook-Weisberg tests for heteroscedasticity, \(\chi^2\) is 16.3 which is greater than \(\chi^2\) (4, 5%) that is 9.49. It means that there is a heteroscedasticity problem in PLS estimation.
South Korea, and Taiwan) and in Latin American countries (e.g. Costa Rica and Mexico). They experienced a substantial increase in the ratio of skilled labour intensive exports to GDP from the mid 1980s to 2005.

The value of exports increased in most of the skilled labour intensive industries in Hong Kong, Malaysia, South Korea, and Taiwan. The increased skilled labour intensive exports in Hong Kong were mainly led by the Telecommunications industry (764), the Thermionic, valves, and tubes industry (776), and the Office machine parts industry (759). Likewise, the increased skilled labour intensive exports in Malaysia were also primarily driven by those industries. The other three leading skilled labour intensive exporting industries, the Television, radio receivers, and sound recorders industries (761-763) had experienced a significant increase from 1986 to 1995, but decreased since then. South Korea and Taiwan also experienced a substantial increase in the Telecommunications and sound recording apparatus industries (761-764). Moreover, the expansion in the ratio of skilled labour intensive exports to GDP in South Korea and Taiwan in the 2000s was driven by the Road vehicles industries (781-786).

The increased ratio of skilled labour intensive exports to GDP was also evident in Latin American countries. In Costa Rica, the increased ratio was led by the Dyes and tanning products industry (532) and the Household type electric equipment industry (775). Both were among the top industries which contributed to the significant increase in the ratio of skilled labour intensive exports to GDP from 1986 to 2005. Similarly, in Mexico, the value of skilled labour intensive exports increased in most industries in this sector, most visibly in the Passenger motor vehicles industry (781). From 2001 to 2005, the top skilled labour intensive exporting industries in Mexico, the Telecommunications industry (764) and the Motor vehicle parts and accessories industry
(784), posed a downward trend, while the other skilled labour intensive exporting industries still grew.

Table 5.1-column FE shows that none of the ratio of unskilled labour intensive exports to GDP, that of unskilled labour intensive imports to GDP, or that of skilled labour intensive imports to GDP has a statistically significant effect on the skill premium.

<table>
<thead>
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<th>Dependent variable</th>
<th>PLS</th>
<th>FE</th>
<th>RE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
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<td>1.946*</td>
<td>1.949*</td>
</tr>
<tr>
<td></td>
<td>(31.9)</td>
<td>(36.6)</td>
<td>(10.4)</td>
</tr>
<tr>
<td>XLU/GDP</td>
<td>-0.048*</td>
<td>0.003</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>(-5.08)</td>
<td>(0.40)</td>
<td>(0.09)</td>
</tr>
<tr>
<td>XLS/GDP</td>
<td>0.003</td>
<td>0.020*</td>
<td>0.020*</td>
</tr>
<tr>
<td></td>
<td>(0.44)</td>
<td>(5.02)</td>
<td>(4.92)</td>
</tr>
<tr>
<td>MLU/GDP</td>
<td>0.050*</td>
<td>0.015</td>
<td>0.015</td>
</tr>
<tr>
<td></td>
<td>(3.18)</td>
<td>(1.49)</td>
<td>(1.52)</td>
</tr>
<tr>
<td>MLS/GDP</td>
<td>0.000</td>
<td>-0.005</td>
<td>-0.005</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(-0.81)</td>
<td>(-0.83)</td>
</tr>
<tr>
<td>F(4, 680)</td>
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<td></td>
</tr>
<tr>
<td>F(4, 653)</td>
<td></td>
<td>28.87</td>
<td></td>
</tr>
<tr>
<td>Wald $\chi^2$ (7)</td>
<td></td>
<td></td>
<td>109.5</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.063</td>
<td>0.149</td>
<td>0.149</td>
</tr>
<tr>
<td>Hausman test ($\chi^2$)</td>
<td>9.640</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Prob &gt; $\chi^2$)</td>
<td></td>
<td></td>
<td>(0.04)</td>
</tr>
</tbody>
</table>

Note:
1. The number of observations is 685
2. Based on t-test, (*) shows significant coefficients at 5%
3. Based on the Hausman test, FE is preferred to RE

Based on the second proxy method, Table 5.2-column FE\textsuperscript{6} shows the rising skill premium in developing countries is affected by the decreased unskilled

\textsuperscript{6} Based on the heteroscedasticity test, $\chi^2$ is 19.40 which is higher than $\chi^2(4,5\%)$ that is 9.49. It shows that there is a heteroscedasticity problem in PLS estimation.
labour intensive exports, the increased skilled labour intensive exports, and the decreased skilled labour intensive imports. A decrease of one type of the range of unskilled labour intensive exports will raise the skill premium by 0.017 points, holding the other variables constant. There was a noticeable decrease in the range of unskilled labour intensive exports in Brazil, Costa Rica, Malaysia, Peru, and Taiwan from 1980 to 2005, noticeably in the Textiles industries (651-658) and the Clothing industries (842-848).

Table 5.2-column FE shows that the rising skill premium in developing countries is also affected by the increased skilled labour intensive exports. An increase of one type of the range of skilled labour intensive exports will raise the skill premium by 0.038 points, holding the other variables constant. The positive effect of the range of skilled labour intensive exports on the skill premium in developing countries is mainly triggered by an expansion in the range of skilled labour intensive exports over two decades in Costa Rica, Hong Kong, Malaysia, South Korea, and Taiwan. The expansion in this range mostly occurred in the Telecommunications and sound recording apparatus industries (761-764) and the Road vehicles industries (781-786).

Moreover, Table 5.2-column FE demonstrates that the rising skill premium in developing countries is also affected by the decreased skilled labour intensive imports. A decrease of one type of the range of skilled labour intensive imports will raise the skill premium by 0.039 points, holding the other variables constant. The slightly higher magnitude (in the absolute value) of the effect of the range of skilled labour intensive imports compared with magnitude of the effect of the range of aggregated imports of 0.035 (Chapter 4 Table 4.6) could be explained by an expected positive effect of the range of unskilled labour intensive imports on the skill premium. The range of skilled labour
intensive imports decreased in most Latin American countries, notably Costa Rica, Mexico, and Peru. The main reason for this could be the adoption of import substitution policies in these countries. Latin American countries were producing goods had been previously imported which increases the demand for skilled labour, and eventually raises the skill premium.

Table 5.2: The effects of the range of exports (imports) on skill premium

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>PLS</th>
<th>FE</th>
<th>RE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SKILL PREMIUM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>2.144*</td>
<td>2.882*</td>
<td>2.867*</td>
</tr>
<tr>
<td></td>
<td>(9.08)</td>
<td>(24.3)</td>
<td>(13.3)</td>
</tr>
<tr>
<td>XLU-RANGE</td>
<td>-0.013*</td>
<td>-0.017*</td>
<td>-0.017*</td>
</tr>
<tr>
<td></td>
<td>(-1.34)</td>
<td>(-3.16)</td>
<td>(-3.12)</td>
</tr>
<tr>
<td>XLS-RANGE</td>
<td>0.017*</td>
<td>0.038*</td>
<td>0.037*</td>
</tr>
<tr>
<td></td>
<td>(2.41)</td>
<td>(7.62)</td>
<td>(7.60)</td>
</tr>
<tr>
<td>MLU-RANGE</td>
<td>0.019</td>
<td>-0.010</td>
<td>-0.010</td>
</tr>
<tr>
<td></td>
<td>(1.38)</td>
<td>(-1.34)</td>
<td>(-1.34)</td>
</tr>
<tr>
<td>MLS-RANGE</td>
<td>-0.006*</td>
<td>-0.039*</td>
<td>-0.039*</td>
</tr>
<tr>
<td></td>
<td>(-0.85)</td>
<td>(-9.40)</td>
<td>(-9.38)</td>
</tr>
<tr>
<td>F(4, 680)</td>
<td>2.900</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F(4, 653)</td>
<td></td>
<td>46.90</td>
<td></td>
</tr>
<tr>
<td>Wald $\chi^2$ (7)</td>
<td></td>
<td></td>
<td>185.8</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.017</td>
<td>0.222</td>
<td>0.222</td>
</tr>
<tr>
<td>Hausman test ($\chi^2$)</td>
<td>2.943</td>
<td></td>
<td></td>
</tr>
<tr>
<td>($Prob &gt; \chi^2$)</td>
<td>(0.05)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note:
1. The number of observations is 685
2. Based on t-test, (*) shows significant coefficients at 5%
3. Based on the Hausman test, FE is preferred to RE

5.5 Assessment of Proxy of Trade Expansions

Based on the first proxy (the ratio) method, the rising skill premium in developing countries is affected by the increased skilled labour intensive exports. Meanwhile based on the second proxy (the range) method, the rising skill
premium is affected by the decreased unskilled labour intensive exports, the increased skilled labour intensive exports, and the decreased skilled labour intensive imports. Based on the number of satisfactory variables referred to in the theoretical framework and the value of coefficient of determination\(^7\), the range could explain the effects of trade expansions on the skill premium relatively better than the ratio, due to two main reasons.

First, the range could illustrate the skill intensity of trade expansions better than the ratio. The range could reveal the number of industries (goods), so that we could see if there is an actual expansion in the range of exports. Based on the second proxy, there no domination of one industry over other industries, even though it has a larger share of exports of manufactured goods, as we treat all industries the same, as discussed in Section 5.1.2. An industry is represented by an index which is either 1 or 0.

For example, based on the first proxy, the ratio of skilled labour intensive exports to GDP of Singapore was higher than that of South Korea. The ratio of skilled labour intensive exports to GDP of Singapore increased from 48.44 percent in 1980 to 120.37 percent in 2005. The ratio of skilled labour intensive exports to GDP of South Korea had been 6.39 percent in 1980 and increased to 18.02 percent in 2005. Based on the second proxy, skilled labour intensive exports of Singapore actually decrease as shown by a decrease in its range which fell from 19 types in 1980 to 14 types in 2005. Meanwhile the range of skilled labour intensive exports of South Korea increased from 7 types in 1980 to 16 types in 2005.

Other noticeable examples are Malaysia, the Philippines, and Thailand. These countries experienced a massive increase in the ratio of skilled labour intensive

\(^7\) Coefficient of determination or \(R^2\) shows the proportion or percentage of the total variation in dependent variable explained by the regression model (Gujarati (1995):74-80).
exports to GDP from 9.66, 1.57, and 2.03 percent in 1980 to 66.62, 30.20, and 29.73 percent in 2005, respectively. In fact, the increase was predominantly driven only by one leading exporting industry which was the Thermionic, valves, and tubes industry (776).

Second, since the range could reveal an actual trade expansion, it is relatively more comparable across countries (regardless of the size of the economy or trade) than the ratio. As a result, we could have a more detailed picture of a shift from unskilled labour intensive exports to skilled labour intensive exports or a shift from skilled labour intensive imports to skilled labour intensive exports.

Based on the first proxy, the rising skill premium in developing countries is solely affected by the increased ratio of skilled labour intensive exports to GDP. The dominant effect of the ratio of skilled labour intensive exports to GDP is due to a massive increase in this ratio which could lessen the other potential factors that affect the skill premium. Meanwhile, the empirical results produced by the second proxy confirm that the rising skill premium is affected by the decreased unskilled labour intensive exports, the increased skilled labour intensive exports, and the decreased skilled labour intensive imports. This indicates that there was a shift from unskilled labour intensive exports to skilled labour intensive exports triggered by NICs and SEA countries mostly adopting export orientation policies (Masuyama et al. (1997); Pangestu (2001); Wade (2004)) and a shift from skilled labour intensive imports to skilled labour intensive exports which is mainly driven by Latin American countries adopting import substitution policies (Smith et al. (1994); Borrego et al. (1996); Wise and Roett (2003)).
In our point of view, the range could provide better results than the ratio in explaining the effects of trade expansions on the skill premium since it reveals an actual expansion in trade (i.e. represents an increase in the types of manufactured goods). Nonetheless, despite the comparison of the two proxies for trade expansions, using them both will provide a more complete picture on how trade expansions affect the skill premium.

5.6 Empirical Result in Relation to the HO and SS Theorems

The HO theorem, in a 2x2 setting, predicts that a country will export a good which is produced by intensively using a relatively abundant factor of production. Developing countries, which are generally characterised by an abundance of unskilled labour, are predicted to export relatively unskilled labour intensive goods. Moreover, the SS theorem, in a 2x2 setting, predicts that an increase in the price of a good produced by using a relatively abundant factor of production will increase return for the abundant factor and reduce the return to the other factor. If both theorems apply, the skill premium in developing countries should be decreasing instead of increasing.

Nonetheless, the empirical results demonstrate that the rising skill premium in developing countries from the mid 1980s to 2005 was affected by the expanded exports which were largely driven by skilled labour intensive exports. While the result of a positive effect of an increase in skilled labour intensive exports on the skill premium is consistent with the logical concept derived from the SS theorem, an increase in skilled labour intensive exports in developing countries does not seem to fully support the HO prediction on the trade pattern.

The expanded exports in developing countries from the mid 1980s to 2005 were mainly driven by expansions in skilled labour intensive exports, most
visibly in Costa Rica, South Korea, and Taiwan. In a number of developing countries, it may be true that, as a result of their opening up to international trade, their unskilled labour intensive exports increased. But then, as their industries develop and trade grows, they tend to export more skilled labour intensive goods than unskilled labour intensive goods. Some of the prominent empirical studies on the HO theorem also find that the endowment difference itself is not the best factor in explaining the trade pattern (Leontief (1953); Maskus (1985); Bowen et al. (1987)). The weak prediction of the HO model is mainly driven by the ignorance of the role of technology differences.

There were increases in skilled labour intensive exports in developing countries from the mid 1980s to 2005. Exports from developing to developed countries mainly comprised skilled labour intensive intermediate goods (spare parts or assembling parts) that developed countries used for their final goods instead of unskilled labour intensive goods. In fact, the value of unskilled labour intensive exports such as footwear, textiles, and clothing was surpassed by that of skilled labour intensive exports such as telecommunications, office and automatic data processing machines, and road vehicles (IFC (1990); UNCTAD (2005)). The ratio of unskilled labour intensive exports to exports of manufactured goods fell from 51.30 percent in 1980 to 25.70 percent in 2005, whereas the ratio of skilled labour intensive exports to exports of manufactured goods increased from 48.70 percent to 74.30 percent in the same period (UNCTAD (2005)). Exports of NICs (except Singapore) to the US were mainly skilled labour intensive goods. Similarly not less than 90 percent of skilled labour intensive goods of Mexico and Costa Rica were also designated to the US (OECD (1992); UNCTAD (2005)).
The reason is that it could be the case that developed countries still maintained trade barriers on unskilled labour intensive imports from developing countries to protect their domestic producers and secure jobs for unskilled labour (e.g. Multi Fibre Agreement implemented from 1974 to 2004 had imposed quotas on the quantities of textiles and apparel that developing countries could export to developed countries).
### Table A.5.1: Classification of manufactures

<table>
<thead>
<tr>
<th>Category</th>
<th>SITC Code</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unskilled labour</td>
<td>621</td>
<td>Materials of rubber</td>
</tr>
<tr>
<td></td>
<td>625</td>
<td>Rubber tyres and tyre cases</td>
</tr>
<tr>
<td></td>
<td>628</td>
<td>Articles of rubber</td>
</tr>
<tr>
<td></td>
<td>641</td>
<td>Paper and paperboard</td>
</tr>
<tr>
<td></td>
<td>642</td>
<td>Paper and paperboard (cut)</td>
</tr>
<tr>
<td></td>
<td>651</td>
<td>Textile yarn</td>
</tr>
<tr>
<td></td>
<td>652</td>
<td>Cotton fabrics and woven</td>
</tr>
<tr>
<td></td>
<td>653</td>
<td>Woven man-made fabrics</td>
</tr>
<tr>
<td></td>
<td>654</td>
<td>Other woven textile fabrics</td>
</tr>
<tr>
<td></td>
<td>655</td>
<td>Knitted fabrics</td>
</tr>
<tr>
<td></td>
<td>656</td>
<td>Lace, ribbon, and tulle</td>
</tr>
<tr>
<td></td>
<td>657</td>
<td>Specific textile fabrics</td>
</tr>
<tr>
<td></td>
<td>658</td>
<td>Textile articles</td>
</tr>
<tr>
<td></td>
<td>659</td>
<td>Floor coverings</td>
</tr>
<tr>
<td></td>
<td>664</td>
<td>Glass</td>
</tr>
<tr>
<td></td>
<td>665</td>
<td>Glassware</td>
</tr>
<tr>
<td></td>
<td>666</td>
<td>Pottery</td>
</tr>
<tr>
<td></td>
<td>672</td>
<td>Iron and steel (primary forms)</td>
</tr>
<tr>
<td></td>
<td>673</td>
<td>Iron and steel (shapes)</td>
</tr>
<tr>
<td></td>
<td>674</td>
<td>Iron and steel (plates and sheets)</td>
</tr>
<tr>
<td></td>
<td>675</td>
<td>Iron and steel (hoops and strips)</td>
</tr>
<tr>
<td></td>
<td>676</td>
<td>Railway rails</td>
</tr>
<tr>
<td></td>
<td>677</td>
<td>Iron and steel wire</td>
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<tr>
<td></td>
<td>678</td>
<td>Iron and steel (tubes and pipes)</td>
</tr>
<tr>
<td></td>
<td>679</td>
<td>Iron and steel castings (unworked)</td>
</tr>
<tr>
<td></td>
<td>691</td>
<td>Structures and parts</td>
</tr>
<tr>
<td></td>
<td>692</td>
<td>Metal tanks and boxes</td>
</tr>
<tr>
<td></td>
<td>693</td>
<td>Wire products (non-electric)</td>
</tr>
<tr>
<td></td>
<td>694</td>
<td>Steel, copper nails, and nuts</td>
</tr>
<tr>
<td></td>
<td>695</td>
<td>Tools</td>
</tr>
<tr>
<td></td>
<td>696</td>
<td>Cutlery</td>
</tr>
<tr>
<td></td>
<td>697</td>
<td>Base metal household equipment</td>
</tr>
<tr>
<td></td>
<td>699</td>
<td>Base metal manufactures</td>
</tr>
<tr>
<td></td>
<td>778</td>
<td>Electrical machinery apparatus</td>
</tr>
<tr>
<td></td>
<td>793</td>
<td>Ships, boats, and floating structures</td>
</tr>
<tr>
<td></td>
<td>812</td>
<td>Plumbing, heating, and lightening equipment</td>
</tr>
<tr>
<td></td>
<td>821</td>
<td>Furniture and parts thereof</td>
</tr>
<tr>
<td></td>
<td>831</td>
<td>Travel goods and handbags</td>
</tr>
<tr>
<td></td>
<td>842</td>
<td>Men's outwear</td>
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<tr>
<td></td>
<td>843</td>
<td>Women's outwear</td>
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<tr>
<td></td>
<td>844</td>
<td>Under garments (non-knitted)</td>
</tr>
<tr>
<td></td>
<td>845</td>
<td>Outer garments</td>
</tr>
<tr>
<td></td>
<td>846</td>
<td>Under garments (knitted)</td>
</tr>
<tr>
<td></td>
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<td>Continued ...</td>
</tr>
<tr>
<td>Category</td>
<td>SITC Code</td>
<td>Product</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td></td>
<td>847</td>
<td>Textile clothing accessories</td>
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<tr>
<td></td>
<td>848</td>
<td>Headgear and non-textile clothing</td>
</tr>
<tr>
<td></td>
<td>851</td>
<td>Footwear</td>
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<tr>
<td></td>
<td>893</td>
<td>Articles of plastic</td>
</tr>
<tr>
<td></td>
<td>894</td>
<td>Toys and sporting goods</td>
</tr>
<tr>
<td></td>
<td>895</td>
<td>Office supplies</td>
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<td></td>
<td>899</td>
<td>Other manufactured goods</td>
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<td>Skilled labour</td>
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<td>Hydrocarbons</td>
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<td></td>
<td>512</td>
<td>Alcohols and phenols</td>
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<tr>
<td></td>
<td>513</td>
<td>Carboxylic acids</td>
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<tr>
<td></td>
<td>514</td>
<td>Nitrogen-function compounds</td>
</tr>
<tr>
<td></td>
<td>515</td>
<td>Organic-inorganic compounds</td>
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<tr>
<td></td>
<td>516</td>
<td>Other organic chemicals</td>
</tr>
<tr>
<td></td>
<td>522</td>
<td>Inorganic chemical elements</td>
</tr>
<tr>
<td></td>
<td>523</td>
<td>Other inorganic chemicals</td>
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<td></td>
<td>524</td>
<td>Radioactive materials</td>
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<td>531</td>
<td>Synthetic dyes</td>
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<td>Dyes and tanning products</td>
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<td>Pigments and paints</td>
</tr>
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<td></td>
<td>541</td>
<td>Medical and pharmaceutical products</td>
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<tr>
<td></td>
<td>551</td>
<td>Essentials oils and perfumes</td>
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<td></td>
<td>553</td>
<td>Perfumery and cosmetics</td>
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<tr>
<td></td>
<td>554</td>
<td>Soap and cleansing</td>
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<tr>
<td></td>
<td>562</td>
<td>Fertilisers (manufactured)</td>
</tr>
<tr>
<td></td>
<td>572</td>
<td>Explosives and pyrotechnic products</td>
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<tr>
<td></td>
<td>582</td>
<td>Condensation products</td>
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<tr>
<td></td>
<td>583</td>
<td>Polymerisation products</td>
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<tr>
<td></td>
<td>584</td>
<td>Cellulose and its derivatives</td>
</tr>
<tr>
<td></td>
<td>585</td>
<td>Plastic materials</td>
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<tr>
<td></td>
<td>591</td>
<td>Pesticides and disinfectants</td>
</tr>
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<td></td>
<td>592</td>
<td>Starch, inulin, and gluten</td>
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<td>Miscellaneous chemical products</td>
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<td>711</td>
<td>Steam boilers and parts</td>
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<td>712</td>
<td>Steam engines and turbines</td>
</tr>
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<td>713</td>
<td>Internal combustion piston engines</td>
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<tr>
<td></td>
<td>714</td>
<td>Engines and motors</td>
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<td></td>
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<td>Rotating electric plants</td>
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<tr>
<td></td>
<td>718</td>
<td>Other power generating machinery</td>
</tr>
<tr>
<td></td>
<td>721</td>
<td>Agriculture machinery excluding tractors</td>
</tr>
<tr>
<td></td>
<td>722</td>
<td>Tractors</td>
</tr>
<tr>
<td></td>
<td>723</td>
<td>Civil engineering machinery</td>
</tr>
<tr>
<td></td>
<td>724</td>
<td>Textile and leather machinery</td>
</tr>
<tr>
<td></td>
<td>725</td>
<td>Paper mill machinery</td>
</tr>
<tr>
<td></td>
<td>726</td>
<td>Print and bookbind machinery</td>
</tr>
<tr>
<td></td>
<td>727</td>
<td>Food machinery</td>
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<tr>
<td></td>
<td>728</td>
<td>Machinery for specific industries</td>
</tr>
<tr>
<td></td>
<td>736</td>
<td>Metal working machinery tools</td>
</tr>
<tr>
<td></td>
<td>737</td>
<td>Metal working machinery</td>
</tr>
<tr>
<td></td>
<td>741</td>
<td>Heating and cooling equipment</td>
</tr>
</tbody>
</table>

Continued ...
## 5. Skill Intensity of Trade Expansions and Rising Skill Premium

<table>
<thead>
<tr>
<th>Category</th>
<th>SITC Code</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>742</td>
<td>Pumps for liquids</td>
<td></td>
</tr>
<tr>
<td>743</td>
<td>Pumps and centrifuges</td>
<td></td>
</tr>
<tr>
<td>744</td>
<td>Mechanical handling equipment</td>
<td></td>
</tr>
<tr>
<td>745</td>
<td>Non-electric machinery</td>
<td></td>
</tr>
<tr>
<td>749</td>
<td>Non-electric machinery parts</td>
<td></td>
</tr>
<tr>
<td>751</td>
<td>Office machines</td>
<td></td>
</tr>
<tr>
<td>752</td>
<td>Automatic data processing equipment</td>
<td></td>
</tr>
<tr>
<td>759</td>
<td>Office machine parts</td>
<td></td>
</tr>
<tr>
<td>761</td>
<td>Television receivers</td>
<td></td>
</tr>
<tr>
<td>762</td>
<td>Radio-broadcast receivers</td>
<td></td>
</tr>
<tr>
<td>763</td>
<td>Sound recorders and phonographs</td>
<td></td>
</tr>
<tr>
<td>764</td>
<td>Telecommunications</td>
<td></td>
</tr>
<tr>
<td>771</td>
<td>Electrical power machinery</td>
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</tr>
<tr>
<td>772</td>
<td>Switch gears</td>
<td></td>
</tr>
<tr>
<td>773</td>
<td>Electricity distributing equipment</td>
<td></td>
</tr>
<tr>
<td>774</td>
<td>Electro-medical and X-ray equipment</td>
<td></td>
</tr>
<tr>
<td>775</td>
<td>Household type electric equipment</td>
<td></td>
</tr>
<tr>
<td>776</td>
<td>Thermionic, valves, and tubes</td>
<td></td>
</tr>
<tr>
<td>781</td>
<td>Passenger motor vehicles</td>
<td></td>
</tr>
<tr>
<td>782</td>
<td>Lorries and specific motor vehicles</td>
<td></td>
</tr>
<tr>
<td>783</td>
<td>Road motor vehicles</td>
<td></td>
</tr>
<tr>
<td>784</td>
<td>Motor vehicle parts and accessories</td>
<td></td>
</tr>
<tr>
<td>785</td>
<td>Cycles</td>
<td></td>
</tr>
<tr>
<td>786</td>
<td>Trailers and non-motor vehicles</td>
<td></td>
</tr>
<tr>
<td>791</td>
<td>Railway vehicles</td>
<td></td>
</tr>
<tr>
<td>792</td>
<td>Aircrafts</td>
<td></td>
</tr>
<tr>
<td>861</td>
<td>Photo instruments</td>
<td></td>
</tr>
<tr>
<td>862</td>
<td>Cinema supplies</td>
<td></td>
</tr>
<tr>
<td>863</td>
<td>Movies</td>
<td></td>
</tr>
<tr>
<td>871</td>
<td>Optical instruments</td>
<td></td>
</tr>
<tr>
<td>872</td>
<td>Medical instruments</td>
<td></td>
</tr>
<tr>
<td>873</td>
<td>Meters and counters</td>
<td></td>
</tr>
<tr>
<td>874</td>
<td>Measuring and controlling instruments</td>
<td></td>
</tr>
<tr>
<td>881</td>
<td>Photography apparatus and equipment</td>
<td></td>
</tr>
<tr>
<td>882</td>
<td>Photography and cinema supplies</td>
<td></td>
</tr>
<tr>
<td>883</td>
<td>Developed cinema films</td>
<td></td>
</tr>
<tr>
<td>884</td>
<td>Optical goods</td>
<td></td>
</tr>
<tr>
<td>885</td>
<td>Watches and clocks</td>
<td></td>
</tr>
<tr>
<td>892</td>
<td>Printed matters</td>
<td></td>
</tr>
<tr>
<td>896</td>
<td>Works of art</td>
<td></td>
</tr>
<tr>
<td>897</td>
<td>Jewelry</td>
<td></td>
</tr>
<tr>
<td>898</td>
<td>Musical instruments</td>
<td></td>
</tr>
</tbody>
</table>

Note:
The classification of manufactures is based on the ratio of skilled to unskilled labour employed in an industry. The industries whose ratio of skilled to unskilled labour is more than or equal to unity are classified as skilled labour intensive industries; otherwise, the industries are classified as unskilled labour intensive industries. The classification is based on Wood (1994), Wood and Mayer (1998), and UNCTAD (2002). The code of manufactures is based on 3 digit-SITC Revision 2.
Table A.5.2: Data summary — panel estimation based on the ratio

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>SKILL PREMIUM</td>
<td>2.209</td>
<td>0.971</td>
<td>1.000</td>
<td>6.170</td>
</tr>
<tr>
<td>XLU</td>
<td>8.11e+09</td>
<td>1.49e+10</td>
<td>8.75e+05</td>
<td>8.56e+10</td>
</tr>
<tr>
<td>XLS</td>
<td>1.54e+10</td>
<td>3.13e+10</td>
<td>2.67e+06</td>
<td>2.26e+10</td>
</tr>
<tr>
<td>MLU</td>
<td>6.60e+09</td>
<td>1.22e+10</td>
<td>7.43e+07</td>
<td>8.40e+10</td>
</tr>
<tr>
<td>MLS</td>
<td>1.73e+10</td>
<td>3.05e+10</td>
<td>9.77e+07</td>
<td>2.59e+11</td>
</tr>
<tr>
<td>XLU/GDP</td>
<td>7.375</td>
<td>10.35</td>
<td>0.007</td>
<td>57.64</td>
</tr>
<tr>
<td>XLS/GDP</td>
<td>10.71</td>
<td>20.21</td>
<td>0.042</td>
<td>120.4</td>
</tr>
<tr>
<td>MLU/GDP</td>
<td>7.409</td>
<td>8.323</td>
<td>0.421</td>
<td>47.22</td>
</tr>
<tr>
<td>MLS/GDP</td>
<td>16.70</td>
<td>17.81</td>
<td>1.505</td>
<td>100.3</td>
</tr>
</tbody>
</table>

Note:
This study covers 134 manufacturing industries (J=134) in each of 27 developing countries (I=27) from 1980 to 2005 (T=26). Due to the limited data on wages by occupation for certain countries in certain years, the numbers of observations are IT=685 and JIT=91,790.

Table A.5.3: Data summary — panel estimation based on the range

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>SKILL PREMIUM</td>
<td>2.209</td>
<td>0.971</td>
<td>1.000</td>
<td>6.170</td>
</tr>
<tr>
<td>XLU-RANGE</td>
<td>11.02</td>
<td>4.343</td>
<td>1.000</td>
<td>23.00</td>
</tr>
<tr>
<td>XLS-RANGE</td>
<td>10.39</td>
<td>5.495</td>
<td>1.000</td>
<td>27.00</td>
</tr>
<tr>
<td>MLU-RANGE</td>
<td>8.195</td>
<td>3.085</td>
<td>1.000</td>
<td>19.00</td>
</tr>
<tr>
<td>MLS-RANGE</td>
<td>20.07</td>
<td>5.340</td>
<td>7.000</td>
<td>34.00</td>
</tr>
</tbody>
</table>

Note:
This study covers 134 manufacturing industries (J=134) in each of 27 developing countries (I=27) from 1980 to 2005 (T=26). Due to the limited data on wages by occupation for certain countries in certain years, the numbers of observations are IT=685 and JIT=91,790.
Chapter 6

Country by Country Analysis
The previous chapter shows that if an export expansion occurs at the edge of the export margin (i.e. an expansion in relatively skilled labour intensive exports), it will raise the skill premium; otherwise, if an export expansion is driven by unskilled labour intensive goods, it may reduce the skill premium. Meanwhile, the effects of import expansions on the skill premium are the opposite to those of export expansions. This chapter presents a country by country analysis of the effects of trade expansions disaggregated by skill on the skill premium. To test whether export (import) expansions affect the skill premium in most or only in relatively open countries, we conduct time series estimations of 27 developing countries from 1980 to 2005. Moreover, we analyse if there is a different pattern of the effects of unskilled labour and skilled labour intensive exports (imports) on the skill premium between more open and less open countries.¹

The results are discussed in more detail in the following sections. Section 6.1 explains a time series estimation strategy. Section 6.2 defines variables and discusses the data sources. Section 6.3 presents empirical results based on the two proxies of trade expansions, the ratio of exports (imports) to GDP and the range of exports (imports). It also presents a country by country analysis. Section 6.4 draws concluding remarks.

6.1 Estimation Strategy

Time series Ordinary Least Square (OLS) estimations are used to analyse the effects of trade expansions on the skill premium in each country. We use the two proxies of trade expansions: first, the ratio of exports (imports) to GDP, and Sachs-Warner's and Wacziarg-Welch's commencement year of trade liberalisation (Sachs and Warner (1995); Wacziarg and Welch (2003)), and Sachs-Warner's and Wacziarg-Welch's commencement year of trade liberalisation (Sachs and Warner (1995); Wacziarg and Welch (2003)).

¹ The justification of more and less open countries towards trade is based on import tariffs on manufactured goods (Easterly and Sewadeh (2000); UNCTAD (2005):Table 8.4; Ng (2006)) and Sachs-Warner's and Wacziarg-Welch's commencement year of trade liberalisation (Sachs and Warner (1995); Wacziarg and Welch (2003)).
GDP, $x_{f/gdp}$ and $m_{f/gdp}$, and second, the range of exports (imports), $x_{fr}$ and $m_{fr}$. Estimations 6.1 and 6.2 use the first and second proxy of trade expansion methods, respectively. To validate the long run relationship among the variables in time series analysis, we also conduct cointegration tests.\(^2\)

\[
\omega_t = \kappa_0 + \kappa_1 (x_{lu/gdp})_t + \kappa_2 (x_{ls/gdp})_t + \kappa_3 (m_{lu/gdp})_t + \kappa_4 (m_{ls/gdp})_t + \varepsilon_t \tag{6.1}
\]

\[
\omega_t = k_0 + k_1 (x_{lu'})_t + k_2 (x_{ls'})_t + k_3 (m_{lu'})_t + k_4 (m_{ls'})_t + \varepsilon_t \tag{6.2}
\]

$\kappa_0$ and $k_0$ in estimations 6.1 and 6.2 are the effects that capture unobserved industry heterogeneity. The skill premium may decline as a result of an increase in unskilled labour intensive exports, yet will rise in response to an increase in skilled labour intensive exports. Therefore, from estimations 6.1 and 6.2, we expect $\kappa_1$ and $k_1$ to be negative, while $\kappa_2$ and $k_2$ are predicted to be positive. The effects of import expansions on the skill premium are the opposite to those of export expansions. The skill premium may increase in response to an increase in unskilled labour intensive imports, but may decrease as a result of an increase in skilled labour intensive imports. $\kappa_3$ and $k_3$ in estimations 6.1 and 6.2 are expected to be positive, while $\kappa_4$ and $k_4$ are predicted to be negative.

6.2 Data

The hypothesis is tested in each of the 27 developing countries from 1980 to 2005. We limit our discussion of the effects of export (import) expansions on

\(^2\) For the explanation of the cointegration test, see Griffiths et al. (1992) pp.700-702.
the skill premium to the manufacturing industry which covers 134 manufacturing industries classified into 50 unskilled labour intensive industries and 84 skilled labour intensive industries.\(^3\) Due to some missing data, the number of observations is 91,790. The variable definitions and data sources are as follows.

\(\omega\) is the skill premium which is measured by the ratio of the wage of skilled labour to the wage of unskilled labour in the manufacturing industry. Skilled and unskilled labour are non-production and production workers based on International Standard Classification of Occupations (ISCO), ISCO-1968 and ISCO-1988. Data on this variable are based on the author's calculation. Data on wages by occupation are available in the ILO Yearbook of Labour Statistics 2005 (ILO (2005):Table O.1). Data on wages by occupation for Taiwan are from the Labour Survey of Taiwan (National Statistics Office of Taiwan (2007)).

\(\frac{x_{lu}}{gdp}\) and \(\frac{x_{ls}}{gdp}\) are the ratio of the value of unskilled labour intensive exports to GDP and that of the value of skilled labour intensive exports to GDP. Accordingly, \(\frac{m_{lu}}{gdp}\) and \(\frac{m_{ls}}{gdp}\) are the ratio of the value of unskilled labour intensive imports to GDP and that of the value of skilled labour intensive imports to GDP. Data on exports (imports) disaggregated by skill are based on the author's calculation. Data on the value of exports (imports) of manufactured goods (3 digit-SITC Revision 2) are from UNCTAD (2005) Table 4.2. Data on GDP are from the World Development Indicators (World Bank (2006)) and data on GDP for Taiwan are from the IMF World Economic Outlook (IMF (2007)).

\(x_{lu}^r\) and \(x_{ls}^r\) are the range of unskilled labour intensive exports and that of skilled labour intensive exports. Accordingly, \(m_{lu}^r\) and \(m_{ls}^r\) are the range of

\(^3\) The detailed definitions of the skill premium, manufacturing industry, developing countries, and proxies for trade expansions are in Chapter 3.
unskilled labour intensive imports and that of skilled labour intensive imports. Data on the range of exports (imports) disaggregated by skill are based on the author’s calculation. Data on the value of exports (imports) of manufactured goods (3 digit-SITC Revision 2) are from UNCTAD (2005) Table 4.2.

t denotes time which is an annual period from 1980 to 2005 (T=26).

6.3 Country by Country Analysis

The empirical country by country analysis supports the hypothesis that trade expansions affect the skill premium in the predicted way, as discussed in the theoretical framework. Based on the first proxy, 7 out of the 27 developing countries support the hypothesis that the rising skill premium is affected by the lowered ratio of unskilled labour intensive exports to GDP and 17 out of the 27 developing countries support the hypothesis that the rising skill premium is affected by the increased ratio of skilled labour intensive exports to GDP. Similarly, based on the second proxy, 8 out of the 27 developing countries support the hypothesis that the rising skill premium is affected by the narrowed range of unskilled labour intensive exports and 12 out of the 27 developing countries support the hypothesis that the rising skill premium is affected by the expanded range of skilled labour intensive exports. In comparison, based on both proxies, the effects of imports on the skill premium are supported at moderate levels.

Only Indonesia, Jordan, and Pakistan show an unexpected result of a positive correlation between unskilled labour intensive exports and skill premium. A low wage policy adopted by these countries may explain the unexpected result. A low wage policy to attract Foreign Direct Investment (FDI) may suppress wages of unskilled labour which results in a rising skill premium in
these countries. So, even though they experienced rising unskilled labour intensive exports, they did not experience an increased wage of unskilled labour. As a result, their skill premium still increased. Moreover, Pakistan was still considered as an unreformed economy to trade, therefore the hypothesis may not apply.

The effects of exports (imports) disaggregated by skill on the skill premium produced by the first and the second proxy for trade expansion methods are respectively in Tables 6.1 and 6.2 presented at the end of this chapter. Data on exports (imports) discussed in the following sections are based on the author’s calculation which are sourced from UNCTAD (2005) Table 4.2, unless they are quoted from other references. The ratio of exports (imports) to GDP and range of exports (imports) are in Appendix Figures A.6.1 and A.6.2, respectively.

6.3.1 Time Series Analysis —the Ratio

Table 6.1-column $xlu/gdp$ illustrates that 7 out of the 27 developing countries confirm that the rising skill premium is affected by the decreased ratio of unskilled labour intensive exports to GDP. A decrease in this ratio will lower demand for unskilled labour which in turn will raise the skill premium. This hypothesis is supported by Algeria, Argentina, China, Honduras, India, Mexico, and Uruguay. The ratio of unskilled labour intensive exports to GDP in these countries decreased from the mid 1980s to 2005.

However, certain lower middle income countries, Indonesia, Jordan, and Pakistan, show an unpredicted result. They exhibit that the increased ratio of unskilled labour intensive exports to GDP raises the skill premium. The explanation for the unexpected result of Jordan and Indonesia is the implementation
of low wage policies by these countries to attract FDI. Ariff and Hill (1985:41) assert that generous incentives provided by some of the export oriented as well as host of FDI countries are typically in the form of imposing low wage regimes and restricting labour union activities to attract FDI in export production. Additionally, the unexpected result of Pakistan could be explained by the fact that Pakistan was still considered to be an unreformed economy to trade (Sachs and Warner (1995); Wacziarg and Welch (2003)). Therefore, our hypothesis may not apply. Thus, even though Indonesia, Jordan, and Pakistan experienced an increase in the ratio of unskilled labour intensive exports to GDP from 1980 to 2005, which would be expected to raise the wage of unskilled labour and thus reduce the skill premium, the skill premium in these countries in fact increased over this period.

Table 6.1 Effects of ratio of exports (imports) to GDP by skill on skill premium

Meanwhile, the expanded ratio of skilled labour intensive exports to GDP significantly raises the skill premium. Table 6.1-column xls/gdp shows that 17 out of the 27 developing countries (Argentina, Brazil, China, Costa Rica, Honduras, Hong Kong, India, Jordan, Malaysia, Mexico, the Philippines, Singapore, South Korea, Sri Lanka, Taiwan, Thailand, and Uruguay) confirm that the rising skill premium is affected by the increased ratio of skilled labour intensive exports to GDP. None shows an unexpected result of the effects of the ratio of skilled labour intensive exports to GDP on the skill premium.

The significant increase in the ratio of skilled labour intensive exports to GDP in developing countries from the mid 1980s to 2005 was generally led by the Telecommunications and sound recording apparatus industries (761-764) and
the Road vehicles industries (781-786). The expanded ratio of skilled labour intensive exports to GDP increased demand for skilled labour which eventually raised the skill premium over that period.

While the positive effects of the ratio of skilled labour intensive exports to GDP on the skill premium in Costa Rica, Hong Kong, Malaysia, Mexico, Singapore, South Korea, and Taiwan are convincing, and the effects of this ratio on the skill premium in Argentina, Brazil, China, Jordan, the Philippines, Thailand, and Uruguay are reasonable, the positive effects of this ratio on the skill premium in Honduras, India, and Sri Lanka can be slightly questionable. Unlike the other developing countries whose the significant increase in the ratio of skilled labour intensive exports to GDP mainly driven by telecommunications and road vehicles, the increase in this ratio in Honduras, India, and Sri Lanka was stimulated by a range of industries. The increase in the ratio of skilled labour intensive exports to GDP in Honduras from 1996 to 2005 was primarily driven by the Soap and cleansing industry (554), the increase in this ratio in India from the late 1980s to 2005 was predominantly driven by the Medical and pharmaceutical products industry (541) and the Jewelry industry (897), and the increase in this ratio in Sri Lanka was largely caused by the Aircrafts industry (792) which was growing from 2001 to 2005.

Table 6.1 also shows that the rising skill premium in developing countries is also affected by import expansions. Columns \( mlu/gdp \) and \( mls/gdp \) illustrate a moderate support for the hypothesis that imports affect the skill premium. 4 out of the 27 developing countries (El Salvador, Mexico, Nicaragua, and Peru) support the hypothesis that an increase in the ratio of unskilled labour intensive imports to GDP will raise the skill premium. 5 out of the 27 developing countries (Nicaragua, Peru, Singapore, South Korea, and Taiwan) support the
hypothesis that a decrease in the ratio of skilled labour intensive imports to GDP will raise the skill premium.

6.3.2 Time Series Analysis – the Range

The estimation results based on the second proxy method are similar to those based on the first proxy method. Based on the second proxy, Table 6.2 illustrates that the rising skill premium in developing countries is firmly affected by the narrowed range of unskilled labour intensive exports and the expanded range of skilled labour intensive exports. Moreover, imports also shape the skill premium, as predicted in the theoretical framework. Meanwhile a decrease in the range of unskilled labour intensive imports will reduce the skill premium, a decrease in the range of skilled labour intensive imports will raise it.

The slightly different results produced by the first proxy from those produced by the second proxy are the former shows that the rising skill premium is predominantly affected by the increased skilled labour intensive exports, while the latter illustrates that the rising skill premium is affected by the expanded skilled labour intensive exports which are driven by a resource shift either from unskilled labour intensive exports or from skilled labour intensive imports.

Table 6.2 Effects of range of exports (imports) by skill on skill premium

Table 6.2-column $x_{ulr}$ illustrates that 8 out of the 27 developing countries (Algeria, Brazil, Costa Rica, Malaysia, Mauritius, Peru, Taiwan, and Thailand) confirm that the rising skill premium is affected by the narrowed range of unskilled labour intensive exports. The logic of this result is that a decrease in the range of unskilled labour intensive exports will reduce demand for unskilled
labour and that will automatically reduce the wage of unskilled labour which will eventually raise the skill premium. The textile and clothing industries, which had been the top exporting industries in developing countries during the 1970s, were among those industries whose share of exports to total exports of manufactured goods decreased most from the mid 1980s to 2005.

Similar to the estimation results based on the first proxy method, Indonesia and Pakistan show an unexpected positive effect of the range of unskilled labour intensive exports on the skill premium (based on the second proxy method, the range of unskilled labour intensive exports is insignificant in affecting the skill premium in Jordan). Even though Indonesia and Pakistan experienced a broadening range of unskilled labour intensive exports, both experienced a rising skill premium. The range of unskilled labour intensive exports expanded in Indonesia and Pakistan, mainly in the Clothing industries (842-848). As discussed earlier, Pakistan was still considered as an unreformed economy to trade until 2003, therefore, the hypothesis may not apply. In the case of Indonesia, a low wage policy in the export oriented regime could be one explanation for the restrained wage of unskilled labour.

Table 6.2-column xls shows that 12 out of the 27 developing countries (China, Costa Rica, Guatemala, Honduras, Hong Kong, Malaysia, the Philippines, South Korea, Taiwan, Thailand, Uruguay, and Venezuela) support the hypothesis that the rising skill premium is affected by the expanded range of skilled labour intensive exports. The expanded range of skilled labour intensive exports in developing countries was led by various industries including Chemicals (511-516, 533, and 541), Office machines and automatic data processing equipment (751, 752, and 759), Telecommunications and sound recording apparatus (761-764), Electrical machinery (771-776), and Road vehicles (781-786).
The predictions of the effects of skilled labour intensive exports on the skill premium produced by both proxy for trade expansion methods are similar. The rising skill premium in countries like China, Costa Rica, Honduras, Hong Kong, Malaysia, the Philippines, South Korea, Taiwan, Thailand, and Uruguay is unequivocally affected by the expanded skilled labour intensive exports (Table 6.1-column xls/gdp and Table 6.2-column xlsr).

Furthermore, based on the second proxy, imports also play a reasonable role in affecting the skill premium. The rising skill premium in developing countries is affected by the broadened range of unskilled labour intensive imports and the narrowed range of skilled labour intensive imports. Table 6.2-column mlur illustrates that the rising skill premium is affected by the narrowed range of unskilled labour intensive imports. This result is moderately supported by 5 out of the 27 developing countries (Egypt, Mexico, Nicaragua, Sri Lanka, and Taiwan). The range of unskilled labour intensive imports in these countries had decreased from 1980 to 1983-1984, but had slightly increased until the mid 1990s. It then decreased in 2005. The narrowed range of unskilled labour intensive imports in these countries in the early 1980s had been led by the Ships, boats, and floating structures industry (793), the increase in this range in the later periods was triggered by Paper and paperboard industries (641-642) and the Articles of plastic industry (893). Only Pakistan shows an unpredicted result of the expanded range of unskilled labour intensive imports reducing the skill premium.

Table 6.2-column mlsr illustrates that the rising skill premium is affected by the decreased range of skilled labour intensive imports. 9 out of the 27 developing countries (Costa Rica, Mexico, Nicaragua, Peru, Singapore, South Korea, Sri Lanka, Uruguay, and Venezuela) support this argument, and none
shows an unpredicted result. Latin American countries, which adopted import substitution policies, significantly reduced the range of skilled labour intensive imports such as Chemical elements and compounds (511-516), Industrial electric machinery (721-728), General industrial machinery (741-749), and Road vehicles (781-786).

The following sections discuss in detail the effects of export (import) expansions on the skill premium in each country. To simplify the discussion, the 27 developing countries are grouped into four: NICs, SEA-4, Big 5-Latin American, and other developing countries. While the rising skill premium in NICs is strongly correlated with the increased skilled labour intensive exports, the rising skill premium in other developing countries is driven by a combination of the decreased unskilled labour intensive exports, the expanded skilled labour intensive exports, and/or the decreased skilled labour intensive imports.

6.3.3 Newly Industrialised Countries (NICs)

The NICs consisting of Hong Kong, Singapore, South Korea, and Taiwan demonstrate that the rising skill premium in this region is largely caused by the expanded skilled labour intensive exports. The exports of NICs, except exports of Singapore, essentially consisted of manufactured goods, while their imports mostly consisted of capital goods and semi-finished goods (OECD (1992):222). From the mid 1980s to 2005, the emerging Asian countries experienced a shift from unskilled labour intensive exports to skilled labour intensive exports (Damuri et al. (2006)) which was the main driving force in raising demand for skilled labour and the skill premium in this region.
Hong Kong was considered to be the most open of the developing countries with average nominal tariffs of zero on manufactured goods from 1980 to 2005 (Easterly and Sewadeh (2000); UNCTAD (2005): Table 8.4; Ng (2006)). As a result of open economy and export oriented policies, Hong Kong's ratio of exports of manufactured goods to GDP increased dramatically from 60.28 percent in 1980 to 128.45 percent in 2005 with 95.73 percent of the increase in exports of manufactured goods driven by skilled labour intensive exports. The ratio of skilled labour intensive exports to GDP increased by 57.72 percent which brought it from 24.01 percent in 1980 to 81.71 percent in 2005. The ratio of skilled labour intensive exports to GDP in Hong Kong increased along with a broadening in the range of skilled labour intensive exports which more than doubled from 7 types in 1980 to 15 types in 2005.

The substantial increase in skilled labour intensive exports in Hong Kong from the mid 1980s to 2005 was led by the Telecommunications industry (764), the Thermionic, valves, and tubes industry (776), and the Office machines parts industry (759). The contribution of these leading skilled labour intensive exports to total exports of manufactured goods increased from 6.81 percent in 1980 to 27.93 percent in 2005.

The increased skilled labour intensive exports in Hong Kong occurred along with a rising skill premium. The skill premium in Hong Kong increased from 2.300 in 1980 to 2.770 in 2005. Based on the first and second proxies, the rising skill premium in Hong Kong is affected by the expanded skilled labour intensive exports. An increase of one percent in the ratio of skilled labour intensive exports to GDP (one type of the range of skilled labour intensive exports) will raise the skill premium by 0.0003 points (0.042 points), holding
the other variables constant (Table 6.1-column $xls/gdp$ and Table 6.2-column $xls^*$).

This finding is consistent with a study by Ho et al. (2005) which asserts that an export expansion raises the skill premium in Hong Kong. They use the ratio of total exports, with and without re-exports, to GDP as the proxy for export expansions and the ratio of the wage of a university graduate to the wage of a primary school graduate as the proxy for the skill premium. There are no such exports (imports) disaggregated by skill in their study, but their results show that the increased ratio of total exports to GDP raises the skill premium in Hong Kong.

**Singapore**

Similar to Hong Kong, Singapore was also considered to be relatively open. Singapore had implemented import tariffs on manufactured goods at a range between 0.30 to 0.40 percent from 1985 to 1997 and zero percent since then to 2005 (Easterly and Sewadeh (2000); UNCTAD (2005):Table 8.4; Ng (2006)) which resulted in expanding exports. While the ratio of imports to GDP stabilised at 106.02 percent from 1980 to 2005 with only slight fluctuations in-between, the ratio of exports to GDP almost doubled over the same period from 68.06 percent in 1980 to 131.47 percent in 2005.

The increased ratio of exports to GDP was credited to skilled labour intensive exports. While the ratio of unskilled labour intensive exports to GDP declined from 19.62 percent in 1980 to 11.09 in 2005, the ratio of skilled labour intensive exports to GDP rocketed from 48.44 percent in 1980 to 120.37 percent in 2005. The massive increase in the ratio of skilled labour intensive exports to GDP from the mid 1980s to 2005 was largely driven by two main industries,
the Thermionic, valves, and tubes industry (776) and the Automatic data processing equipment industry (752).

The skill premium in Singapore had been relatively stable between 1985 and 1994 at an average of 2.058, but it increased from 2.089 in 1994 to 2.390 in 2005. Due to data on wages by occupation for Singapore only being available from 1985 to 2005, we limit our discussion to this period.

Based on the first proxy, the rising skill premium in Singapore is affected by the increased ratio of skilled labour intensive exports to GDP. An increase of one percent in the ratio of skilled labour intensive exports to GDP will raise the skill premium by 0.008 points, holding the other variables constant (Table 6.1-column xls/gdp). Moreover, based on the first proxy, the rising skill premium in Singapore is also affected by the decreased ratio of skilled labour intensive imports to GDP. A decrease of one percent in the ratio of skilled labour intensive imports to GDP will raise the skill premium by 0.010 points, holding the other variables constant (Table 6.1-column mls/gdp). The ratio of skilled labour intensive imports to GDP had risen from 56.05 percent in 1985 to 90.53 percent in 1990 and slightly fluctuated between 1991 and 2005 with an average of 91.67 percent. Most of the skilled labour intensive importing industries decreased from 1993 to 2005.

Singapore was one of countries which had a noticeable expansion in the ratio of skilled labour intensive exports to GDP but not in the range of skilled labour intensive exports. The range of skilled labour intensive exports, in fact, shrank from 21 types in 1985 to 14 types in 2005. The reason could be that Singapore was a city country which concentrated on the services sector and formed itself as a financial district. Therefore, even though Singapore experienced an increase in its ratio of skilled labour intensive exports to GDP, the range of
skilled labour intensive exports did not expand. This phenomenon could explain the insignificant effect of the range of skilled labour intensive exports on the skill premium in Singapore (Table 6.2-column xls$^r$). The decreased range of skilled labour intensive exports was caused by the Television receivers industry (761), the Radio-broadcast receivers industry (762), the Household type electric equipment industry (775), and the Pumps and centrifuges industry (743).

Based on the second proxy, the rising skill premium in Singapore is solely affected by the decreased range of skilled labour intensive imports. A decrease of one type of the range of skilled labour intensive imports will raise the skill premium by 0.034 points, holding the other variables constant (Table 6.2-column mls$^r$). The range of skilled labour intensive imports in Singapore gradually decreased from 23 types in 1985 to 14 types in 2005. The narrowed range of skilled labour intensive imports was driven by the Television and radio receivers industries (761-762), the Internal combustion piston engines industry (713), the General industrial machinery industries (741-749), the Electricity distributing equipment industry (773), and the Road vehicles industries (781-786).

South Korea

South Korea was one of the most impressive economies of modern capitalism (OECD (2000); Wade (2004)). Korea earned an international reputation of a successful exporter of skilled labour intensive goods such as microchip and electronics. Even though it was one of countries had hit most by the 1997 Asian economic crisis, but its economy recovered from the crisis quickly (OECD (2000)). The 1997 economic crisis had caused unemployment rates increasing from 2.60 percent in 1997 to 7.80 percent in 1998 (TEPAV (2009)), average
wages falling by 2.5 percent (OECD (2000)), and the skill premium rising by 15.50 percent over the same period.4

Unlike Hong Kong and Singapore, which had experienced a rising skill premium as their exports had expanded, South Korea had experienced the opposite in the 1980s. The skill premium in South Korea had been falling during those years even though its trade had been expanding. The government had repressed wages, restricted labour unions, and controlled the span of the skill premium in the public and private sectors from 1977 to 1987 (Park and Lee (1995); Park and Lee (1996)). The skill premium in South Korea had decreased from 2.989 in 1980 to 1.719 in 1991. However, from 1991, the skill premium then increased to 3.100 in 2005.

The rising skill premium in South Korea is affected by the expanded skilled labour intensive exports, based on the first and second proxies. An increase of one percent in the ratio of skilled labour intensive exports to GDP (one type of skilled labour intensive exports) will raise the skill premium by 0.263 (0.093) points, holding the other variables constant (Table 6.1-column xls/gdp and Table 6.2-column xls*). Most of the skilled labour intensive exporting industries expanded from the mid 1980s to 2005. The ratio of skilled labour intensive exports to GDP increased from 6.33 percent in 1980 to 18.02 percent in 2005. The leading industry in skilled labour intensive exports in South Korea, the Thermionic, valves, and tubes industry (776), remained very strong from 1980 until 2005. The expansion in the ratio of skilled labour intensive exports to GDP from the late 1990s to 2005 was led by the Telecommunications industry (764) and the Passenger motor vehicles industry (781).

4 Average incomes of the poorest 20 percent of households had declined by over 8 percent while average incomes of the richest 20 percent of households increased somewhat (OECD (2000)).
The increased ratio of skilled labour intensive exports to GDP occurred with a broadening in its range. The Chemical industries (511-516), the Condensation and polymerisation products industries (582-583), and the Office and automatic data processing machines industries (751-752 and 759) expanded the range of skilled labour intensive exports from 7 types in 1980 to 16 types in 2005.5

South Korea shifted its industrial concentration from unskilled labour intensive to skilled labour intensive. There are two factors that stimulate the South Korean success story in the chemicals and heavy manufacturing industries. The first factor is the emergence of chaebol-type conglomerates with domestic capital supported by a rapid accumulation of investments starting from the mid 1960s. The second factor is South Korea's position as a late comer to the chemicals and heavy manufacturing industries which has advantaged South Korea in terms of technology (Takahashi (1997)).

Furthermore, based on both proxies, the rising skill premium in South Korea is also affected by the decreased skilled labour intensive imports. A decrease of one percent in the ratio of skilled labour intensive imports to GDP (one type of the range of skilled labour imports) will raise the skill premium by 0.268 points (0.226 points), holding the other variables constant (Table 6.1-column $mls/gdp$ and Table 6.2-column $mls^r$). The decreased range of skilled labour intensive imports was caused by the Chemical elements and compounds industries (511-516), the Textile and leather machinery industry (724), and the Radio-broadcast receivers industry (762).

5 The range of skilled labour intensive exports was always higher than that of unskilled labour intensive exports in South Korea from 1995 to 2005. The decreased range of unskilled labour intensive exports from the mid 1980s to 2005 was driven by most of the unskilled labour intensive exporting industries, particularly, the Travel goods and handbags industry (831), the Clothing industries (842-848), the Footwear industry (851), and the Toys and sporting goods industry (894).
Taiwan

Taiwan adopted an export orientation policy starting from the 1970s like the other NICs (Takahashi (1997); Wade (2004)). In terms of trade expansion and industrialisation, Taiwan was often compared with South Korea. Both were considered to be governed free markets. The difference between them is that while the South Korean economy was mainly supported by chaebol, the Taiwanese economy was largely supported by small and medium enterprises (Wade (2004)). As Taiwan's trade expanded, its skill premium also rose from 1.571 in 1987 to 1.680 in 2005. Due to data on wages by occupation for Taiwan only being available from 1987 to 2005, we limit our discussion to this period.

Like Hong Kong and South Korea, the rising skill premium in Taiwan is also affected by the expanded skilled labour intensive exports, based on both proxies. An increase of one percent in the ratio of skilled labour intensive exports to GDP (one type of the range of skilled labour intensive exports) will raise the skill premium by 0.009 (0.008) points, holding the other variables constant (Table 6.1-column xls/gdp and Table 6.2-column xlsr). The ratio of skilled labour intensive exports to GDP increased from 9.07 percent in 1980 to 32.93 percent in 2005 which was led by the Telecommunications industry (764), the Thermionic, valves, and tubes industry (776), and the Passenger motor vehicles industry (781). Exports of the leading exporting industry (industry 776) decreased from 2002 to 2005, while exports of industries 764 and 781 continued to grow strongly. The increase in this ratio occurred with an expansion in its range. The range of skilled labour intensive exports expanded from 9 types in 1987 to 15 types in 2005. The increase in this range was driven by the Carboxylic acids industry (513), the Pigments and paints industry (533), and the Optical instruments industry (871).
Based on the second proxy, the rising skill premium in Taiwan is also affected by the decreased range of unskilled labour intensive exports. A decrease of one range of unskilled labour intensive exports will raise the skill premium by 0.015 points, holding the other variables constant (Table 6.2-column xltur). This range contracted from 15 types in 1987 to 8 types in 2005. The decrease in this range was mainly driven by the Textile industries (651-658), the Travel goods and handbags industry (831), and the Clothing industries (842-848).

6.3.4 South East Asian-4 (SEA-4)

The SEA-4 consisting of Indonesia, Malaysia, the Philippines, and Thailand were an example of how rapid economic development could reduce absolute poverty and the skill premium. However, starting from the mid 1980s, the trends reversed, particularly in the late 1990s (Pangestu (2001)). Our empirical results show that the rising skill premium in the SEA-4 is affected by trade expansions. While the rising skill premium in the NICs is determined by the expanded skilled labour intensive exports, the rising skill premium in the SEA-4 is affected by a combination of the decreased unskilled labour intensive exports and the expanded skilled labour intensive exports. Only Indonesia shows an unpredicted result.

The SEA-4, except Indonesia, had experienced a relatively low skill premium among developing countries in the early 1980s when their skill premium had ranged between 1.460 and 1.830. The SEA-4 experienced a rising skill premium over the last two decades, obviously after their commencement of gradual reductions in import tariffs in the mid or late 1980s. As they liberalised their trade, trade bolstered in this region and their skill premiums also increased.
Indonesia

Despite the pessimistic view of the Indonesian economic development in the early of its development in 1960s, the economy grew remarkably well in the following three decades. The growing economy was accompanied by equally rapid structural change. Agriculture's share of GDP in the 1990s had been less than one third of that of the mid 1960s. Indonesia was also exposed to international trade and shifted from commodity exports to manufactures (Hill (2000)). The increased exports of manufactured goods were dominantly contributed by unskilled labour intensive exports. The contribution of unskilled labour intensive exports to exports of manufactured goods had increased from 47.82 percent in 1980 to 82.62 in 1991, but gradually decreased to 53.56 percent in 2005.

The Indonesian economy had grown at an average of 7 percent from 1980 to 1995. Indonesia was the country hardest hit by the crisis. The economy shrank by 13.7 percent in 1998 (World Bank (2006)) and there was a slow economic recovery. The crisis had caused unemployment rates increasing to around 15-20 percent in the major cities and average wages falling by 20-30 percent from 1997 to 1998 (Manning (1998)), but there had been no such visible evidence which kind of labour hit most by the crisis. The skill premium, in fact, had decreased from 3.152 in 1997 to 3.028 in 1998.

Among the SEA-4, Indonesia is the only country that illustrates an unexpected result of the effects of trade expansions on the skill premium. Contrary to the predictions of the theoretical framework, Indonesia experienced a rising skill premium even though its unskilled labour intensive exports expanded, based on both proxies. An increase of one percent in the ratio of unskilled labour intensive exports to GDP (one type of the range of unskilled labour
intensive imports) will raise the skill premium by 0.049 (0.239) points, holding
the other variables constant (Table 6.1-column $xl u/gdp$ and Table 6.2-column $xl u^r$). This unexpected effect of unskilled labour intensive exports on the skill
premium in Indonesia can probably be attributed to the implementation of a
low wage policy for the purpose of attracting foreign investment. Ariff and
Hill (1985:41) assert that export oriented countries offer generous incentives to
promote exports and attract FDI. Developing countries, hosts of FDI, impress
foreign investors by low wages of unskilled labour. Furthermore, Limqueco
(1983) claims that the export oriented industrialisation in the SEA countries
has been achieved by labour force exploitation.

Indonesia implemented a minimum wage policy in all provinces starting from
the early 1970s (Rama (1996):4). The drawback of this policy is that it is often
used by the private sector as a standard wage instead of a minimum wage
(Ing et al. (2004)). Moreover, the minimum wage was only adjusted based
on the inflation rate, and the minimum wage policy had only been reviewed
in 1993 and 1998 (Rama (1996):4-6) and in 2003 (Asian Development Bank
(2005)). That is why the wage of unskilled labour in Indonesia had remained
low starting from the 1970s with the monthly wage ranging between USD
32.80 in East Java to USD 73.60 in Jakarta in 2003 (Asian Development Bank
(2005)).

Therefore, even though the ratio of unskilled labour intensive exports to GDP
and the range of unskilled labour intensive exports escalated (i.e. the former
increased from 0.25 percent in 1980 to 6.60 percent in 2005 and the latter also
increased from 6 types in 1980 to 14 types in 2005), the wage of unskilled labour
remained low, and thus the skill premium increasing instead of decreasing. It
Malaysia

Similar to Indonesia, Malaysia posed a consistent and remarkable economic growth of an average of 7 percent in 1980s and 1990s (World Bank (2006)). Starting in the 1970s, Malaysia began to imitate the NICs and committed itself to a transition from being an agriculturally based economy to a manufacturing based economy. With Japanese investment, heavy industries flourished and in a matter of years, Malaysian exports became the country's primary growth engine. As Malaysian exports expanded, its skill premium also widened. The skill premium in Malaysia increased from 1.830 in 1980 to 3.230 in 2005 with significant increases between 1990 and 1993.

Based on the first proxy, the rising skill premium in Malaysia is solely affected by the expanded skilled labour intensive exports. An increase of one percent in the ratio of skilled labour intensive exports to GDP will raise the skill premium by 0.016 points, holding the other variables constant (Table 6.1-column xls/gdp). The ratio of skilled labour intensive exports to GDP increased dramatically from 6.50 percent in 1980 to 66.62 percent in 2005. This massive increase brought the ratio of exports of manufactured goods to GDP from 8.83 percent in 1980 to 76.36 percent in 2005. The top exporting industry in Malaysia from 1980 to 2005 was always the Thermionic, valves, and tubes industry (776). The other top skilled labour intensive exporting industries such as the Automatic data processing equipment industry (752) and the Telecommunications industry (764) also significantly grew over the same period. The former's contribution to exports of manufactured goods increased from 0.01 percent in 1980 to 10.70 percent in 2005 and the latter's contribution to exports of manufactured goods also increased from 2.39 percent to 5.26 percent over the same period.
Likewise, based on the second proxy, the rising skill premium in Malaysia is also affected by the expanded skilled labour intensive exports. An increase of one type of the range of skilled labour intensive exports will raise the skill premium by 0.097 points, holding the other variables constant (Table 6.2-column $x\overline{l}\delta^r$). The increased range of skilled labour intensive exports was predominantly driven by the Automatic data processing equipment industries (752-759) and the Telecommunications and sound recording industries (761-764).

In addition, based on the second proxy, the rising skill premium in Malaysia is also affected by the decreased unskilled labour intensive exports. A decrease of one type of the range of unskilled labour intensive exports will raise the skill premium by 0.097 points, holding the other variables constant (Table 6.2-column $x\overline{l}u^r$). The range of unskilled labour intensive exports in Malaysia decreased from 8 types in 1980 to 2 types in 2005, noticeably in the Textiles industries (651-658). The unskilled labour intensive exporting industries which remained strong until the mid 2000s are the Electrical machinery apparatus industry (778) and the Furniture and parts thereof industry (821).

The Philippines

The Philippines had not shown any visible economic growth in the early 1980s. It had experienced economic downward trends from 1982 to 1986, with an economic turmoil in 1984 (World Bank (2006)). After the economic crisis, the government had taken a big step to boost its economic growth by promoting exports. The Philippines had implemented a series of economic reforms since then (Intal and Llanto (1998):1-8). The reforms had resulted in significant increases in exports and overall economic growth. The Philippine economy had recovered during the 1986-1990 period with an average economic growth of 3.26 percent (World Bank (2006)). The ratio of exports to GDP had increased
from 4.47 percent in 1986 to 6.42 in 1990, and that of imports to GDP had also increased from 7.87 percent to 15.27 over the same period.

Compared with the other SEA-4 countries, the Philippines experienced the lowest increment in skill premium. The skill premium in the Philippines only increased from 1.460 in 1980 to 2.461 in 2005. The rising skill premium is affected by the increased skilled labour intensive exports, based on both proxies.

Based on the first proxy, an increase of one percent in the ratio of skilled labour intensive exports to GDP in the Philippines will raise the skill premium by 0.015 points, holding the other variables constant (Table 6.2-column $x_{ls/gdp}$). The ratio of exports to GDP in the Philippines increased substantially from 3.60 percent in 1984 to 35.74 percent in 2005, with a big leap of almost 10 percent in 1995-1996. More than 90 percent of the increase in the ratio of exports of manufactured goods to GDP from 1984 to 2005 was due to skilled labour intensive exports. The ratio of unskilled labour intensive exports to GDP increased from 1.86 percent in 1984 to 5.54 percent in 2005 and the ratio of skilled labour intensive exports to GDP even increased more from 1.73 percent in 1984 to 30.20 percent in 2005. This translated to a rise in the value of total exports of manufactured goods from USD 0.55 billion in 1984 to USD 29.71 billion in 2005.

The massive increase in the ratio of skilled labour intensive exports to GDP in the Philippines was predominantly driven by the telecommunications and semiconductors industries, particularly the Thermionic, valves, and tubes industry (776). The value of exports of this industry dramatically increased from USD 0.45 million in 1980 to 14.59 billion in 2005, and contributed around 41.50 percent to the value of exports of manufactured goods in 2005. The other growing skilled labour intensive exporting industries were the Automatic data process-
ing equipment industry (752) and the Office machines parts industry (759) which accounted for 10.85 percent and 7.29 percent of the value of exports of manufactured goods in 2005, respectively.\(^6\)

Based on the second proxy, the rising skill premium in the Philippines is also affected by the increased skilled labour intensive exports. An increase of one type of the range of skilled labour intensive exports will raise the skill premium by 0.080 points, holding the other variables constant (Table 6.2-column xls\(^7\)). The range of skilled labour intensive exports had increased from 7 types in 1984 to 10 types in 1995 but slightly decreased to 8 types in 2005. Similar to Malaysia, the increased ratio of skilled labour intensive exports to GDP in the Philippines also occurred along with an expansion in its range. While the range of exports of the Chemicals industries (511-516) decreased over the years, the range of exports of the Office machines and automatic data processing equipment industries (751-759), the Telecommunications and sound recording apparatus industries (761-764), and the Electrical machinery industries (771-776) broadened.

**Thailand**

Thailand had been one of the world’s highest economic growth countries with an average of 7.88 percent annually from 1980 to 1996. Nonetheless, it had experienced a crisis in 1997-1998 due to large Non-Performing Loans (NPLs) which had been as mainly driven by an implicit guarantee embodied in a fixed exchange rate system and weakness in financial system. The growth had contracted by 1.91 percent and 11.31 percent in 1997 and 1998, respectively (World Bank (2006)).

\(^6\) There is a concern that the Electronics industry could be classified as unskilled labour intensive in developing countries, particularly the Philippines, as the proportion of skilled labour to unskilled labour is less than unity (Balisacan and Hill (2004):219-253).

The Thai economy shifted from a mainly agricultural base to an industrial base. The contribution of the agricultural sector to GDP decreased from 23.50 percent in 1980 to 10.10 percent in 2005, while the contribution of the manufacturing sector increased from 29.30 percent to 44.55 percent during the same period (World Bank (2006)). The shift in the economy from agriculture to industry was supported by open economy and export orientation policies. Thailand was considered to be the most open economy in the SEA region as it significantly reduced tariffs (Easterly and Sewadeh (2000); UNCTAD (2005): Table 8.4; Ng (2006)), non-tariff barriers, and quantitative restrictions (Krueger (1983); Wacziarg and Welch (2003)).

The substantial development in electronics and telecommunications, noticeably starting from 1987, had sharpened the movement from unskilled labour intensive industries (footwear and textiles) to skilled labour intensive industries (telecommunications and electronics) which had resulted in a significant rise in the skill premium between 1992 and 1996 in Thailand (Phongpaichit and Sarntisart (2000)). This assertion is supported by the empirical findings of our study.

Among the SEA-4, Thailand experienced the highest increase in the skill premium as much as 86 percent which raised it from 1.510 in 1980 to 2.810 in 2005. Like Malaysia and the Philippines, Thailand had faced a relatively low skill premium among developing countries in the early 1980s. Thailand had experienced a moderate yet continuous increase in the skill premium starting from 1990 with significant hikes between 1992 and 1993 which had increased it by 0.626 and 0.498 points, respectively, and had caused it to reach 2.398 in 1994. The skill premium kept rising since then and reached 2.810 in 2005.
Based on the first proxy, the rising skill premium in Thailand is affected by the increased skilled labour intensive exports. An increase of one percent in the ratio of skilled labour intensive exports to GDP will raise the skill premium by 0.026 points, holding the other variables constant (Table 6.1-column xls/gdp). The ratio of skilled labour intensive exports significantly increased with an average increase of 14.10 percent annually from 1.50 percent in 1980 to 29.70 percent in 2005. The significant increase in this ratio, noticeably starting from 1987, was driven by the Office machine parts industry (759), the Thermionic, valves, and tubes industry (776), and the Automatic data processing equipment industry (752).

Similarly, based on the second proxy, the rising skill premium in Thailand is also affected by the increased skilled labour intensive exports. An increase of one type of the range of skilled labour intensive exports will raise the skill premium by 0.052 points, holding the other variables constant (Table 6.2-column xls/gdp). The increase in the ratio of skilled labour intensive exports to GDP in Thailand occurred along with an expansion in its range. The range of skilled labour intensive exports expanded from 4 types in 1980 to 21 types in 2005. The increase in this range was predominantly driven by a booming electric machinery industry since the 1990s such as the Rotating electric plants industry (716), the Electric power machinery industry (771), and the Switch gears industry (772).

Additionally, based on the second proxy, the rising skill premium in Thailand is also affected by the decreased unskilled labour intensive exports. A decrease of one type of the range of unskilled labour intensive exports will raise the skill premium by 0.043 points, holding the other variables constant (Table 6.2-column xlu\). The range of unskilled labour exports gradually contracted over
the period from 18 types in 1980 to 9 types in 2005. The decrease in this range was driven by the Textile industries (651-658).

Meanwhile, neither unskilled labour intensive imports nor skilled labour intensive imports play a role in determining the skill premium in Thailand, based on both proxies.

6.3.5 Latin American Countries

Similar to the story of the rising skill premium in Asia, as Latin America's trade expanded, the skill premium also increased. Latin American countries faced even a higher increase in the skill premium than that of Asian countries. Latin American countries also support the hypothesis that export (import) expansions significantly affect the skill premium as predicted.

This section discusses the effects of trade expansions on the skill premium in the Big 5-Latin American countries which are Argentina, Brazil, Costa Rica, Mexico, and Venezuela.

**Argentina**

The Argentine economy had experienced hard times during the military government that lasted from 1976 to 1983 and for some time afterwards. The political transition from military dictatorship to democracy had come first with the 1983 election, but had not been accompanied by significant economic reforms (Corradi (2003)). High debt interest payments, tax evasion, and capital flights had placed its balance of payments in crisis and caused Argentina to face stagflation from 1975 to 1990 (Lewis (1990)).

The urgency of the inflationary crisis that had exploded in 1989 made market
reforms more politically acceptable (Corradi (2003)). In the early 1990s, the government had implemented a series of economic policies to remedy the effects of the ongoing economic crises. Strong leadership and political parties had committed to political liberalisation and economic opening. The government had implemented tight monetary policy, trade liberalisation, privatisation, and a pegged exchange rate system. As a result, exports of manufactured goods had expanded by 24 percent from 1991 to 1993 (UNCTAD (2005):Table 4.2) and GDP grew by 25 percent over the same period (World Bank (2006)).

Concurrent with its improvement, however, the Argentine economy had been affected by a series of crises, most notably the 1994 Mexican economic turmoil, the 1997 Asian economic crisis, and the overvalued Argentine peso that offset the benefits of the improved economy. The late external shocks and overvalued peso had dragged the Argentine economy down into another economic crisis. It had crumbled slowly from 1995 until its collapse in 2002 (Daseking et al. (2004)).

Fortunately, Argentina benefited from its diversified and segmented industrial base. Additionally, the 2000s administration was consistent with tight fiscal and monetary policy. The government also implemented an import substitution policy as well as promoting exports (Daseking et al. (2004)). The effective heavy taxes and increasing exports improved the Argentine economy. While the value of Argentina’s imports of manufactured goods had decreased from USD 16.91 billion in 1995 to 7.29 billion in 2002, the value of its exports of manufactured goods had remained stable at USD 6.05 billion in 1995 and USD 6.06 billion in 2002. The value of exports of manufactured goods contin-

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8 The import substitution policy was largely adopted by Latin American countries from the 1930s until the late 1980s (Borrego et al. (1996)): 
ted to rise and was at USD 8.88 billion in 2005. The increase in exports of manufactured goods was driven by both unskilled labour intensive and skilled labour intensive exports.

The increase in unskilled and skilled labour intensive exports in Argentina affects its skill premium. Based on the first proxy, an increase of one percent in the ratio of skilled labour intensive exports to GDP will raise the skill premium by 0.458 points, holding the other variables constant (Table 6.1-column xls/gdp). The skill premium in Argentina gradually increased from 1.370 in 1980 to 2.300 in 2005. The ratio of skilled labour intensive exports to GDP increased at the same pace and trend as the skill premium. This ratio gradually had increased from 1.27 percent in 1980 to 2.16 percent in 2001. It then had hiked to 3.88 and 4.06 percent in 2002 and 2003, respectively, but then slightly decreased to 3.55 percent in 2005. The increase in the ratio of skilled labour intensive exports to GDP in Argentina from 2000 to 2005 was predominantly led by the Passenger and goods vehicles industries (781-782). The other growing industries which also contributed to the increase in the ratio of skilled labour exports to GDP were the Medical and pharmaceutical products industry (541) and the Polymerisation products industry (583).

While an increase in skilled labour intensive exports raises the skill premium, an increase in unskilled labour intensive exports counterbalances it, based on the first proxy. An increase of one percent in the ratio of unskilled labour intensive exports to GDP will reduce the skill premium by 0.258 points (Table 6.1-column xlu/gdp). The ratio of unskilled labour intensive exports to GDP had decreased from 0.65 percent in 1980 to 0.43 percent in 1994, and then increased to 1.30 percent in 2005. The increase in this ratio discouraged the skill premium from rising further. Argentina was among the Latin American
countries which experienced a relatively low increase in the skill premium. The growing unskilled labour intensive exports from 1980 to 2005 was driven by the Rubber tyres and tyre cases industry (625), the Paper and paperboard (cut) industry (642), the Textile yarn industry (651), and the Furniture and parts thereof industry (821).

Based on the second proxy, neither exports nor imports have a significant effect on the skill premium in Argentina (Table 6.2).

**Brazil**

Brazil was the largest economy in Latin America, based on 2005 price GDP. The total exports and imports contributed around one fourth to the economy, whereas the manufacturing itself played relatively a moderate role in the economy. The ratio of total exports and imports of goods and services to GDP steadily increased from 20.10 percent in 1980 to 27.35 percent in 2005. Meanwhile, the ratio of total exports and imports of manufactured goods to GDP averaged at 8.27 percent from 1980 to 2005 (World Bank (2006)). Its major trading partners are the US, Argentina, and China.9

Brazil had emphasised import substitution industrialisation, had reduced its dependency on imports and encouraged production and exports of the light and heavy industries (Krueger (1983):33-37). Nonetheless, its trade improvement had been countered by the regional downward economic trends in the early 1990s. Brazil had been among the countries affected by the 1994 Mexican economic turmoil. The ratio of exports of manufactured goods to GDP had

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9 The shares of exports of goods and services from Brazil to the US, Argentina, and China to its total exports of goods and services were 15.81, 9.02, and 6.73 percent in 2005, respectively. Meanwhile, its share of imports of goods and services from the US, China, and Argentina to its total imports of goods and services were 15.72, 10.51, and 8.61 percent in 2005, respectively (UNCTAD (2005):Table 3.1).
6. Country by Country Analysis

decreased from 4.36 percent in 1980 to 2.67 percent in 1996. It then had improved to 5.98 percent in 2003 and slightly decreased to 4.16 percent in 2005. The increase in the ratio of exports of manufactured goods to GDP was mainly stimulated by skilled labour intensive exports.

The ratio of skilled labour intensive exports to GDP had been 2.42 percent in 1980, had fluctuated in the range of 1.51 to 2.80 percent between 1980 and 1995, and then had increased to 3.89 in 2003. The increase in the ratio of skilled labour intensive exports to GDP was mainly attributed to the growth in the light and heavy manufacturing industries including Motor vehicle parts and accessories (784), Internal combustion piston engines (713), Aircrafts (792), Passenger motor vehicles (781), and Telecommunications (764). The increase in the ratio of skilled labour intensive exports to GDP affects the skill premium in Brazil. Based on the first proxy, an increase of one percent in the ratio of skilled labour intensive exports to GDP will raise the skill premium by 0.186 points, holding the other variables constant (Table 6.1-column xls/gdp).

Meanwhile, based on the second proxy, the rising skill premium in Brazil is affected by the decreased unskilled labour intensive exports. A decrease of one type of the range of unskilled labour intensive exports will raise the skill premium by 0.448 points, holding the other variables constant (Table 6.2-column xlu*). The decrease in the range of unskilled labour intensive exports from 1980 to 2005 was driven by the Textile yarn industry (651), the Cotton fabrics and woven industry (652), and the Textile articles industry (658).
Costa Rica

Among Latin American countries, Costa Rica was considered to be economically and politically stable. It experienced relatively consistent and positive economic growth from 1980 to 2005, except 1981-1982 and 1991, with an average of 3.88 percent annually (World Bank (2006)). The economic growth had been significantly supported by exports of manufactured goods with remarkable increases between 1997 and 1999. Its exports of manufactured goods had grown 149.62, 66.07, and 58.85 percent annually in these respective years. The increase in exports of manufactured goods had been predominantly driven by skilled labour intensive exports. In the 2000s, electronics, pharmaceuticals, and software development become the prime industries.

Costa Rica was one of the Latin American countries which experienced a relatively high increase in the skill premium. It had started with the lowest skill premium among the Latin American countries with a level of 1.163 in 1980. Since then the skill premium increased by 83.57 percent which placed it at 2.135 in 2005.

Based on the first proxy, the rising skill premium in Costa Rica is correlated to the increased skilled labour intensive exports. An increase of one percent in the ratio of skilled labour intensive exports to GDP will increase the skill premium by 0.039 points, holding the other variables constant (Table 6.1-column xls/gdp). There was a visible shift from unskilled labour intensive exports to skilled labour intensive exports in Costa Rica over the last two and a half decades. While the contribution of unskilled labour intensive exports to exports of manufactured goods decreased from 50.47 percent in 1980 to 27.91 percent in 2005, the contribution of skilled labour intensive exports to exports of manufactured goods increased from 49.53 percent to 73.09 percent.
over the same period. The ratio of skilled labour intensive exports to GDP rose significantly from 1.37 percent in 1980 to 13.20 percent in 2005.

The increase in exports of office machine parts and medical and pharmaceutical products contributed to the increase in the ratio of skilled labour intensive exports to GDP. This increase was triggered by the decision of Intel's microprocessor and GlaxoSmithKline's pharmaceutical to invest (Hill (2002)).

Hill further argues that there are at least three key factors that delivered the increase in skilled labour intensive exports in Costa Rica. The first one is the decision of multinational companies such as Intel and GlaxoSmithKline to invest due to trade and investment liberalisation, as discussed earlier. The second one is Costa Rica's political stability and geographical proximity to the US. The last one is a highly educated workforce and good education system relative to other Latin American countries.

Based on the second proxy, the rising skill premium in Costa Rica is affected not only by the increased skilled labour intensive exports, but also by the decreased unskilled labour intensive exports and the decreased skilled labour intensive imports. A decrease of one type of the range of unskilled labour intensive exports will raise the skill premium by 0.068 points (Table 6.2-column xlu\(^r\)). The range of unskilled labour intensive exports fell from 11 types in 1980 to 8 types in 2005. The fall in this range was caused by the Furniture and parts thereof industry (821), the Footwear industry (851), and the Toys and sporting goods industry (894).

An increase of one type of the range of skilled labour intensive exports will raise the skill premium by 0.106 points, holding the other variables constant (Table 6.2-column xls\(^r\)). The range of skilled labour intensive exports had

\(^{10}\) Outside of California, the Intel company had facilities in China, Costa Rica, Malaysia, Mexico, Israel, Ireland, India, the Philippines, Russia, and Vietnam internationally.
decreased from 8 types in 1980 to 6 types in 1982 driven by industrial electric machinery (particularly 723 and 726). It then had increased to an average of 11 types from 1983 to 2002, and decreased to 8 types in 2005. The expanded range of skilled labour intensive exports from the mid 1980s to 2002 had been led by products of giant companies such as the microchip manufacturer Intel and the pharmaceutical company GlaxoSmithKline. The increased range of skilled labour intensive exports in that period had been driven by the Medical and pharmaceutical products industry (541), the Office and automatic data processing machines industries (751-752 and 759), the Electrical machinery industries (771-776), and the Medical instruments industry (872).

In addition, the rising skill premium in Costa Rica is also influenced by the narrowed range of skilled labour intensive imports. A decrease of one type of the range of skilled labour intensive imports will raise the skill premium by 0.037 points, holding the other variables constant (Table 6.2-column mls'). The range of skilled labour intensive imports gradually decreased from 26 types in 1980 to 15 types in 2005. The decrease was caused by the Organic-inorganic compounds industry (515), the Other inorganic chemicals industry (523), the Miscellaneous chemical products industry (598), the Internal combustion piston engines industry (713), the Textile and leather machinery industry (724), the Mechanical handling equipment industry (744), the Non-electrical machinery industry (745), the Electrical power machinery industry (771), and the Printed matters industry (892).

**Mexico**

Mexico was considered to be a free mixed economy. After the Mexican peso crisis in 1994, the economy made an impressive recovery. The governments significantly improved the Mexican economy, noticeably by expanding trade.
The growing trade in Mexico was claimed to be stimulated by Free Trade Agreements (FTAs) between Mexico and other countries. Mexico implemented 12 FTAs with over 40 countries including the US and Canada, the EU, Japan, El Salvador, Honduras, and Guatemala (Borrego et al. (1996)). Trade between Mexico and the US and Canada substantially increased. Its exports to the US and Canada almost tripled in 2005 from the year of the implementation of the North American Free Trade Agreement (NAFTA) in 1994. In 2005, almost 90 percent of Mexican exports flow to the US and Canada (UNCTAD (2005):Table 3.1).

Nevertheless, the increased trade and improved GDP in Mexico did not solve wage gap issues. Mexico faced a rise of more than 60 percent in the skill premium from 2.000 in 1980 to 3.180 in 2005. Similar to the other Latin American countries, Mexico also supports our hypothesis that export and import expansions affect the skill premium to a certain degree.

Based on the first proxy, the rising skill premium in Mexico is affected by the decreased unskilled labour intensive exports, the increased skilled labour intensive exports as well as the increased unskilled labour intensive imports. A decrease of one percent in the ratio of unskilled labour intensive exports to GDP will raise the skill premium by 0.618 points, holding the other variables constant (Table 6.1-column $xlu/gdp$). Meanwhile, an increase of one percent in the ratio of unskilled labour intensive imports to GDP will raise the skill premium by 0.313 points, holding the other variables constant (Table 6.1-column $mlu/gdp$).

An increase of one percent in the ratio of skilled labour intensive exports to GDP will raise the skill premium by 0.195 points, holding the other variables constant (Table 6.1-column $xls/gdp$). The ratio of skilled labour intensive
exports to GDP has increased from 3.20 percent in 1980 to 8.22 percent in 1994. It then soared by 7.40 percent to 15.62 percent in 1995 and gradually increased to around 17.04 percent in 2000. From 2001 to 2005, the top two skilled labour intensive exporting industries, the Passenger motor vehicles industry (781) and the Telecommunications industry (764) posed a decreasing trend, while the other skilled labour intensive exporting industries still grew.

However, based on the second proxy of trade method, the skill premium in Mexico is affected by imports, not exports. An increase of one type of unskilled labour intensive imports will increase the skill premium by 0.074 points, holding the other variables constant (Table 6.2-column \textit{mlu}^r). The range of unskilled labour intensive exports had decreased from 9 types in 1980 to 4 types in 1987 and then slightly increased to 6 types in 2005. While the narrowed range of unskilled labour intensive imports in the early 1980s had been driven by the Iron and steel industries (672-679) and the Ships, boats, and floating structures industry (793), the expanded range of unskilled labour intensive imports from 1987 to 2005 was led by the Paper and paperboard industries (641-642) and the Woven man-made fabrics industry (653).

Moreover, based on the second proxy, the rising skill premium in Mexico is also affected by the decreased skilled labour intensive imports. A fall of one type of skilled labour intensive imports will raise the skill premium by 0.123 points, holding the other variables constant (Table 6.2-column \textit{mls}^r). The range of skilled labour intensive imports fell since the late 1980s from 29 types in 1980 to 17 types in 2005. The contracted range of skilled labour intensive imports was led by the Chemical elements and compounds industries (511-516), the Industrial electric machinery industries (721-728), and the General industrial machinery industries (741-749).
Venezuela

Venezuela had been a mixed economy in terms of the degree of openness to trade. It had been still considered to be an unreformed economy based on exchange rate restrictions in the early 2000s (Sachs and Warner (1995); Wacziarg and Welch (2003)), but in terms of tariff, Venezuela gradually lowered its tariffs on manufactured goods from 26.00 percent in 1980 to 12.40 percent in 2005 (Easterly and Sewadeh (2000); UNCTAD (2005):Table 8.4; Ng (2006)). The contribution of total exports and imports of manufactured goods to the economy was still relatively lower than that of the other big Latin American countries. Venezuela largely relied on exports of petroleum and its derivative products which accounted for about a quarter of its GDP from 1980 to 2005 (World Bank (2006)). Almost 75 percent of the value of total exports of goods and services was driven by petroleum and its derivative products, while the contribution of exports of manufactured goods to total exports of goods and services was less than 15 percent over the same period (UNCTAD (2005):Table 4.2).

The ratio of exports of manufactured goods to GDP had decreased sharply from 6.91 percent in 1980 to 0.23 percent in 1983. This had been primarily the result of slumped world oil prices between 1981 and 1983. The ratio then gradually had increased from 0.23 percent in 1983 to 3.53 percent in 1996. The collapse of oil prices in 1997-1998 and the politically motivated petroleum sector sabotage in 2002-2003 (The US Energy Information Administration (2008b)) negatively affected exports of manufactured goods, and caused the ratio of exports of manufactured goods to GDP to slip to 1.90 percent in 2005. Both the ratio of unskilled labour intensive exports to GDP and that of skilled labour intensive exports to GDP fell from 2.40 percent in 1980 to 0.66 percent in 2005.
and 4.50 percent to 1.24 percent over the same period, respectively. Likewise, the ratio of unskilled labour intensive imports to GDP and that of skilled labour intensive imports to GDP have also fell from 1980 to 2005. The ratio of imports of manufactured goods slipped from 13.94 percent in 1980 to 6.10 percent in 2005. Based on the first proxy, neither exports nor imports have an effect in determining the skill premium in Venezuela (Table 6.1).

The skill premium in Venezuela had gradually increased from 1.640 in 1980 to 2.170 in 1990. It then further had escalated to 2.910 in 1997 and slightly decreased to 2.700 in 2005. Based on the second proxy, the rising skill premium in Venezuela is affected by the expanded range of skilled labour intensive exports. An increase of one type of skilled labour intensive exports will raise the skill premium by 0.060 points, holding the other variables constant (Table 6.2-column $xls^r$). Even though the ratio of skilled labour intensive exports to GDP remains very small, if we examine its range, it increased from 11 types in 1980 to 14 types in 2005. The expansion in this range was caused by the chemicals industries, noticeably the Alcohols and phenols industry (512), the Other organic chemicals industry (516), the Other inorganic chemicals industry (523), and the Medicinal and pharmaceutical products industry (541) which was triggered by regional improvement in this sector.

Moreover, based on the second proxy, the rising skill premium in Venezuela is also affected by the decreased range of skilled labour intensive imports. A decrease of one type of skilled labour intensive imports will raise the skill premium by 0.049 points, holding the other variables constant (Table 6.2-column $mls^r$). Venezuela reduced its range of skilled labour intensive imports, particularly from 1985 to the early 2000s. As a result, the range of skilled labour intensive imports contracted from 30 types in 1985 to 21 types in 2005.
The narrowed range of skilled labour intensive imports was mainly caused by the Hydrocarbons industry (511), the Nitrogen-function compounds industry (514), the Fertiliser (manufactured) industry (562), the Textile and leather machinery industry (724), the Metal working machinery tools industries (736-737), the Mechanical handling equipment industry (744), and the Non-electric machinery industry (745).

6.3.6 Other Developing Countries

Other Asian Countries

China

China had implemented comprehensive economic reforms including land, industrialisation, investment and trade reforms from 1978 to the early 1980s. By 1984, China's collective ownership had been largely diminished and private ownership was acknowledged in the following year (Perry and Wong (1985)). Even though China had been considered as an unreformed economy until 1994 (Wacziarg and Welch (2003)), its tariffs on manufactured goods were gradually reduced from 49.50 percent in 1980 to 9.00 percent in 2005 (Easterly and Sewadeh (2000); UNCTAD (2005):Table 8.4; Ng (2006)). As a result, the ratio of total exports and imports of manufactured goods to GDP had doubled from 15.55 percent in 1980 to 32.39 percent in 2003, but decreased to 22.09 percent in 2005.

The increase in this ratio from 1980 to 2003 had been driven by the increased exports of manufactured goods. The ratio of exports of manufactured goods to GDP had increased from 7.53 percent in 1980 to 13.99 in 2003 yet slightly decreased to 12.57 in 2005, while the ratio of imports of manufactured goods to
GDP had risen from 8.02 percent in 1980 to 18.41 percent in 2003 but dropped to 9.53 percent in 2005. In 2005, China was considered to be one of the fastest growing trade countries along with Brazil, Russia, and India.

The increased ratio of exports to GDP started in 1986 was predominantly driven by the increased skilled labour intensive exports. There was a shift from unskilled labour intensive exports to skilled labour intensive exports starting in the 1986. The contribution of skilled labour intensive exports to exports of manufactured goods almost doubled in two decades from 45.96 percent in 1986 to 80.96 percent in 2005. The ratio of skilled labour exports to GDP dramatically increased from 1.12 percent in 1986 to 10.09 percent in 2005. The shift from unskilled labour intensive exports to skilled labour intensive exports was translated into the rising skill premium in the following years. The skill premium gradually increased from 1.003 in 1986 to 1.850 in 2005 with a forecast of a continuous rise in the coming decades as its skilled labour intensive exports were predicted to keep growing.

Based on the first proxy, the skill premium in China is affected by the decreased unskilled labour intensive exports and the increased skilled labour intensive exports. A fall of one percent in the ratio of unskilled labour intensive exports to GDP will raise the skill premium by 0.346 points, holding the other variables constant (Table 6.1-column xlu/gdp). The ratio of unskilled labour intensive exports to GDP had decreased from 2.50 percent in 1980 to 1.32 percent in 1986, but then had gone up to 3.95 percent in 1996 due to a series of economic reforms in privatisation, industrialisation, investment, and trade. It then fell to 2.48 percent in 2005. The decreased ratio of unskilled labour intensive exports to GDP after 1996 was driven by the Toys and sporting goods industry (894) and the Textile clothing accessories industry (847).
An increase of one percent in the ratio of skilled labour intensive exports to GDP will raise the skill premium by 0.131 points, holding the other variables constant (Table 6.1-column xls/gdp). The ratio of skilled labour intensive exports to GDP doubled from 5.03 percent in 1980 to 10.09 percent in 2005. The increased ratio of skilled labour intensive exports to GDP was mainly driven by the Thermionic, valves, and tubes industry (776) and the Telecommunications industry (764), remarkably since 1986. The former and the latter contributed to exports of manufactured goods by 23.84 percent and 9.08 percent in 2005, respectively.

Based on the second proxy, the rising skill premium in China is solely affected by the expanded skilled labour intensive exports. An increase of one type of the range of skilled labour intensive exports will raise the skill premium by 0.042 points, holding the other variables constant (Table 6.2-column xls*). The range of skilled labour intensive exports had doubled from 10 types in 1980 to 20 types in 1987, had slightly decreased to 15 types in 1991, and then averaged at 19 types from 1992 to 2005. The substantial shift towards skilled labour intensive exports since 1992 was led by the Rotating electric plants industry (716), the Office machine parts industry (759), the Thermionic, valves, and tubes industry (776), and the Aircrafts industry (792).

The pattern of China's exports disaggregated by skill was similar to that of its imports. Nonetheless, neither unskilled labour intensive imports nor skilled labour intensive imports have a significant effect on determining the skill premium in China (Tables 6.1 and 6.2).
India

Since its early development until the late 1980s to 2005, India was considered to be a heavily government interventionist country. India’s increasing economic self-reliance was largely backed by government involvement in most of its main economic sectors. There were large state owned companies as well as heavy subsidies for goods ranging from rice and oil to ink and paper. Approximately 30 percent of the government expenses were delivered to subsidies and other transfers from 1980 to 2005 (World Bank (2006): Percentage of subsidies and other transfers to the government expenses). As a semi-socialist economy, India also maintained relatively equal compensation across labour. In the 1980s, it had been among countries which had experienced the lowest skill premium including China, Mauritius, Pakistan, and Sri Lanka. The skill premium in India had been relatively stable at around 1.190 in the 1980s and even had fallen slightly to 1.163 in 1990.

From 1990 to the early 2000s, in the wake of a severe balance of payment crisis, India adopted a series of economic reforms in trade and investment (Ahluwalia (2002)). As a result, the ratio of total exports and imports of manufactured goods to GDP increased from 5.91 percent in 1990 to 8.08 percent in 2005. The ratio of exports of manufactured goods to GDP alone increased from 2.80 percent in 1990 to 4.49 percent in 2005. As India’s trade expanded, the skill premium also rose from 1.182 in 1991 to 1.430 in 2005.

Based on the first proxy, the rising skill premium in India is affected by the decreased unskilled labour intensive exports and the increased skilled labour intensive exports. A reduction of one percent in the ratio of unskilled labour intensive exports to GDP will raise the skill premium by 0.105 points, holding the other variables constant (Table 6.1-column $xlu/gdp$). Meanwhile, an
increase of one percent in the ratio of skilled labour intensive exports to GDP will raise the skill premium by 0.186 points, holding the other variables constant (Table 6.1-column \( \frac{xls}{gdp} \)). The most significant increase in skilled labour intensive exports in India was driven by the Medical and pharmaceutical products industry (541) and the Jewelry industry (897). The former and the latter increased from USD 109.30 million in 1980 to USD 1.76 billion in 2005 and from USD 16.52 million in 1980 to USD 1.44 billion in 2005, respectively. Both contributed to exports of manufactured goods in 2005 as much as 6.02 and 5.01 percent, respectively. The other growing skilled labour intensive exports were the Other organic chemicals industry (516), the Synthetic dyes industry (531), the Motor vehicles and the Cycles industries (784-785), the Telecommunications industry (764), and the Electrical machinery apparatus industry (778).

Based on the second proxy, neither exports nor imports play a role in determining the skill premium in India. The range of exports and that of imports only slightly changed which means that exports and imports in India did not actually expand. The range of unskilled labour intensive exports and that of skilled labour intensive exports were stable at 17 and 9 types, respectively, from 1991 to 2005. Likewise, the range of unskilled labour intensive imports and that of skilled labour intensive imports sluggishly moved from 7 to 5 types and from 24 to 28 types, respectively, from 1991 to 2005.

Jordan

Jordan was a relatively small and unreformed country with limited natural resources and classified by the World Bank as a lower middle income country in 2005 (World Bank (2008b)). Nevertheless, Jordan was advantaged by a high proportion of skilled labour relative to that of other countries in the region
The services industries, information technology and tourism, dominate the Jordanian economy. Even though exports were not the main growth driving forces, Jordan became more open and reliant on exports over the 2000s. The ratio of exports of manufactured goods to GDP gradually increased from 6.36 percent in 1980 to 16.30 percent in 2005 with big jumps in 1988-1989 and 2000-2001. At the same time, its dependency on imports decreased. The ratio of imports of manufactured goods to GDP decreased from 47.05 percent in 1980 to 28.34 percent in 2005.

The increased ratio of exports of manufactured goods to GDP from 1980 to 2005 was largely stimulated by the Medical and pharmaceutical products industry (541) and the particular increase from 2000 to 2005 was significantly driven by the Clothing industries (842-844). The exports of clothing and textiles from Jordan to the US shot up 2,000 percent from 2000 to 2005, following the introduction of the US-Jordan FTA in which qualifying exports produced in the Qualifying Industrial Zone (QIZ) from Jordan entered the US at tariff and quota free (Bolle et al. (2006)).

The increase in unskilled labour intensive exports and skilled labour intensive exports in Jordan had significant effects on the skill premium which gradually rose from 2.440 in 1980 to 2.810 in 2005. Nonetheless, unlike other developing countries which show a negative correlation between unskilled labour intensive exports and the skill premium as predicted in the theoretical framework, Jordan shows an unexpected result of the effects of unskilled labour intensive exports on the skill premium. An increase of one percent in the ratio of unskilled labour intensive exports to GDP will raise the skill premium by 0.013 points, holding the other variables constant (Table 6.1-column xlu/gdp). In addition, based on the first proxy, an increase of one percent in the ratio of
skilled labour intensive exports to GDP will raise the skill premium by 0.011 points, holding the other variables constant (Table 6.1-column $\frac{xls}{gdp}$).

A reasonable explanation for the unexpected result of the positive correlation between unskilled labour intensive exports and the skill premium could be a policy of restrained wages of unskilled labour. The wage of unskilled labour remained low in Jordan even though its unskilled labour intensive exports expanded. It is widely argued that a developing country implements a low wage policy to increase its exports by attracting FDI in export oriented manufactures (Ariff and Hill (1985):41). Moreover, it is argued that the increase in Jordan’s exports was due to sweatshop conditions in its export oriented manufacturing sector (Clark (2008)).

Based on the second proxy, neither exports nor imports have a significant effect on the Jordanian skill premium (Table 6.2).

**Pakistan**

The structure of the Pakistan economy changed from a mainly agricultural base to a strong services base with a growing manufacturing sector. In 2005, the agricultural sector accounted for 20.20 percent of the GDP, whereas the services sector accounted for 53.15 percent of the GDP (IMF (2007)). At the same time, Pakistan maintained development of its manufacturing sector. In doing so, significant foreign investments were attracted and made in several areas, notably telecommunications. Other major industries included software, road vehicles, cement, fertiliser, steel, ship building, and aircrafts.

Despite the development in the skilled labour intensive manufactures, its exports was still dominated by unskilled labour intensive goods. The ratio of exports of manufactured goods to GDP in Pakistan increased from 5.81 percent
in 1980 to 9.07 percent in 2005 which was mainly accredited to a substantial increase in unskilled labour intensive exports led by the textile industries. The ratio of unskilled labour intensive exports to GDP gradually escalated from 5.21 percent in 1980 to 8.33 percent in 2005.

Though Pakistan experienced an increase in the ratio of unskilled labour intensive exports to GDP, it did not experience a lower skill premium. The increase in unskilled labour intensive exports, particularly from 1988 to 2005 occurred in conjunction with the rising skill premium. The skill premium in Pakistan had been relatively low, at an average of 1.173 from 1980 to 1987, but then increased to 1.390 in 2005.

Similar to Jordan and Indonesia, Pakistan also demonstrates an unexpected result in the correlation between trade expansions and the skill premium. The rising skill premium in Pakistan is affected by the increased unskilled labour intensive exports which contradicts our hypothesis. An increase of one percent in the ratio of unskilled labour intensive exports to GDP will raise the skill premium by 0.038 points, holding the other variables constant (Table 6.1-column \(\frac{xlu}{gdp}\)). Similar results are produced by the estimation using the second proxy. An increase of one type of the range of unskilled labour intensive exports will raise the skill premium by 0.045 points, holding the other variables constant (Table 6.2-column \(xlur\)). The unexpected positive correlation between unskilled labour exports and the skill premium could be related to the fact that Pakistan was still considered as an unreformed economy to trade, based on the tariffs implemented on manufactured goods which was higher than 55 percent in 1990-1999 (Sachs and Warner (1995); Wacziarg and Welch (2003)), therefore the hypothesis may not apply.
**Sri Lanka**

In 1977, the United National Party (UNP) government in Sri Lanka had began incorporating privatisation, deregulation, and promotion of private enterprises which had been strongly supported by the IMF's economic stabilisation program (Jayalath (1992)). Sri Lanka’s GDP had grown at an average annual rate of 5.50 percent during the early 1990s until a drought and a deteriorating security situation had lowered the growth to 3.80 percent in 1996. The economy had rebounded between 1997 and 2000 with an average growth of 5.32 percent (World Bank (2006)). In 2001, Sri Lanka had experienced its first economic recession, as a result of budgetary problems, the global slowdown, and continuing civil strife. However, the ups and downs in the economic growth of Sri Lanka did not significantly affect its export performances. While exports of agricultural products remained important, Sri Lanka moved steadily towards an industrialised economy with the development of food processing, textiles, telecommunications, and finance. The increase in exports raised the skill premium in Sri Lanka.

Like India and Pakistan, Sri Lanka had also adopted a policy of relatively equal wages across labour since its early development until the mid 1990s. Its skill premium had been relatively equal from 1980 to 1994 at a stable level of 1.100. It then gradually rose to 1.154 in 2005.

Based on the first proxy, an increase of one percent in the ratio of skilled labour intensive exports to GDP will raise the skill premium by 0.036 points, holding the other variables constant (Table 6.1-column $x/lss/gdp$). The ratio of skilled labour intensive exports to GDP had increased from 0.32 percent in 1980 to 1.23 percent in 1995, then had risen to 2.19 percent in 2001 and were stable at an average of 1.60 percent since then to 2005.
Based on the second proxy method, the rising skill premium in Sri Lanka is affected by the increased range of unskilled labour intensive imports and the decreased range of skilled labour intensive imports. An increase of one type of the range of unskilled labour intensive imports will raise the skill premium by 0.009 points, holding the other variables constant (Table 6.2-column $xlur$). The range of unskilled labour intensive imports in Sri Lanka remained stable at 11 types from 1980 to 2005. There was simply a shift in the concentration of unskilled labour intensive imports from the Iron and steel industries (672-679) to the Textiles industries (651-658).

A decrease of one type of skilled labour intensive imports will raise the skill premium by 0.003 points, holding the other variables constant (Table 6.2-column $xlsr$). The range of skilled labour intensive imports plunged from 21 types in 1980 to 9 types in 2005. The contraction in this range was caused by the Civil engineering machinery industry (723), the General industrial machinery industries (741 and 744), the Television and radio-broadcast receivers industries (761-762), and the Road motor vehicles industries (783-784).

**Other Latin American Countries**

**El Salvador**

El Salvador was among the 27 developing countries that experienced the highest increase in the skill premium with a rise of 80 percent from 1.210 in 1980 to 2.177 in 2005. The skill premium in El Salvador had gradually increased from 1.210 in 1980 to 1.480 in 1996. It then rose at a higher pace from around 1.500 in the late 1990s to 2.177 in 2005.

Based on the first proxy, the rising skill premium in El Salvador is solely affected by the increased unskilled labour intensive imports. An increase of
one percent in the ratio of unskilled labour intensive imports to GDP will raise the skill premium by 0.233 points, holding the other variables constant (Table 6.1-column \( mlu/gdp \)). The ratio of unskilled labour intensive imports to GDP had fallen from 6.28 percent in 1980 to 3.41 percent in 1991, then had rebounded to 6.53 percent in 2001, but slightly decreased to 5.08 percent in 2005. The increased ratio of unskilled labour intensive imports to GDP was largely been stimulated by the Paper and paperboard industry (641), the Articles of plastic industry (893), the Iron and steel (primary forms) industry (672), the Iron and steel (plates and sheet) industry (674), and the Electrical machinery apparatus industry (778).

Based on the second proxy, neither exports nor imports play a significant role in determining the skill premium in El Salvador (Table 6.2).

**Guatemala**

Guatemala’s GDP per capita based on purchasing power parity was USD 3,997 in 2005 (World Bank (2006)), however, this country still faced many social problems and was among the ten poorest countries in Latin America (IMF (2007)). The distribution of income remained highly unequal with approximately 29 percent of the population living below the poverty line and just over 400,000 or 3.22 percent unemployed (Espínola et al. (2005)). The agricultural sector was still dominant in the economy. It accounted for about a quarter of GDP while the industrial sector represented around 19 percent of GDP in 2005 (World Bank (2006)).

Compared with the other Latin American countries, Guatemala experienced a relatively low increase in the ratio of exports of manufactured goods to GDP and that of imports of manufactured goods to GDP. The ratio of exports
of manufactured goods to GDP increased from 1.74 percent in 1980 to 3.70 percent in 2005, while the ratio of imports of manufactured goods to GDP decreased from 16.24 percent in 1980 to 14.03 percent in 2005. Unlike the other Latin American countries which had a long history of trade agreements with the US, Guatemala just recently agreed on a FTA with the US in early 2005 (Office of the US Trade Representative (2008)).

The increased ratio of exports of manufactured goods to GDP from 1980 to 2005 was driven by both unskilled and skilled labour intensive exports. Both ratios of unskilled labour intensive exports and skilled labour intensive exports posed similar trends from 1980 to 2005. The ratios had increased between 1980 and 1988, had sharply decreased in 1989 and had rebounded in 1990. The ratios then had gradually increased until 2002, yet slightly decreased between 2003 and 2005. The ratio of unskilled labour intensive exports to GDP slightly increased from 1.16 percent in 1980 to 1.58 percent in 2005 and the ratio of skilled labour intensive exports to GDP increased from 1.74 percent to 3.70 percent during the same period. Textiles were the country’s main manufactured exports of manufactured goods.

Based on the first proxy, neither exports nor import have a significant effect on the skill premium in Guatemala (Table 6.1).

Based on the second proxy, the rising skill premium in Guatemala is affected by the expanded skilled labour intensive exports. An increase of one type of the range of skilled labour intensive exports will raise the skill premium by 0.014 points, holding the other variables constant (Table 6.2-column xls7). The range of skilled labour intensive exports has enlarged from 6 types in 1980 to 10 types in 2005. The increase in this range was delivered by the Alcohols and phenols industry (512), the Pigments and paints industry (533),
the Perfumery and cosmetics industry (553), the Soap and cleansing industry (554), and the Heating and cooling equipment industry (741).

Honduras

The Honduras economy grew at an average of 4.65 percent annually from 2000 to 2005, making it one of the countries with the highest growth in Latin America during that period. Honduras experienced positive growth most of the time which averaged 3.23 percent from 1980 to 2005 (World Bank (2005)). Only in certain years, Honduras had experienced economic slowdowns with negative growth, similar to many other Latin American countries that had experienced economic slowdowns due to falling world oil prices between 1982 and 1983, the 1994 Mexican economic crisis, and the 1997-1999 economic downturns. The positive economic growth in Honduras was significantly stimulated by increases in exports.

The benefits of economic growth, however, were not well distributed as approximately 50 percent of the population still remained below the poverty line in 2005 (World Bank (2008a)).11 The high inequality in Honduras was also reflected in its skill premium which was more than doubled from 1.770 in 1980 to 3.830 in 2005.

Based on the first proxy, the rising skill premium in Honduras is affected by the decreased unskilled labour intensive exports and the increased skilled labour intensive exports. A fall of one percent in the ratio of unskilled labour intensive exports to GDP will raise the skill premium by 0.354 points, holding the other variables constant (Table 6.1-column xlu/gdp). Whereas an increase

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11 Honduras was declared as one of the Heavily Indebted Poor Countries by the World Bank and the International Monetary Fund which made it eligible for debt relief in 2005 (World Bank (2008a)).
of one percent in the ratio of skilled labour intensive exports to GDP will raise the skill premium by 1.057 points, holding the other variables constant (Table 6.1-column xls/gdp).

The ratio of unskilled labour intensive exports to GDP decreased from 2.46 percent in 1980 to 1.97 percent in 2005. The fall in this ratio was caused by the Steel, copper nails, and nuts industry (694), primarily since 1998. Meanwhile, the ratio of skilled labour intensive exports to GDP increased from 0.91 percent in 1980 to 1.52 percent in 2005. Similar to Guatemala, the increased ratio of skilled labour intensive exports to GDP in Honduras was led by the chemicals industries, particularly the Soap and cleansing industry (554).

The increased ratio of skilled labour intensive exports to GDP occurred with an expansion in its range from 2 types in 1980 to 9 types in 2005. Based on the second proxy, an increase of one type of the range of skilled labour intensive exports will raise the skill premium in Honduras by 0.209 points, holding the other variables constant (Table 6.2-column xls'). The expanded range of skilled labour intensive exports was predominantly driven by the Pigments and paints industry (533), the Medical and pharmaceutical products industry (541), the Soap and cleansing industry (554), the Polymerisation products industry (583), and the Electricity distributing equipment industry (773).

Nicaragua

Nicaragua had experienced a few economic fluctuations driven either by political instability or by economic shocks. It had experienced internal conflicts between the two leading political parties, the Sandinistas and Contras, in the early 1980s and also had had to face an imposed trade embargo by the US from 1985 to 1990 (Bureau of Western Hemisphere Affairs (2008)). The country was
still recovering and continued to implement further reforms on which aid from the IMF is conditional. Nicaragua was primarily an agricultural country, but the manufacturing and services sectors grew significantly in the 2000s (World Bank (2006)). While a boom in the services sector was predominantly driven by the banking industry, an expansion in the manufacturing industry was mainly led by textiles, paper, and plastics. As exports of manufactured goods expanded in Nicaragua, the skill premium also increased. The skill premium increased from 3.450 in 1980 to an average of 3.625 from 2001 to 2005.

Based on the first proxy, the rising skill premium in Nicaragua is affected by the increased unskilled labour imports and the decreased skilled labour intensive imports. An increase of one percent in the ratio of unskilled labour intensive imports to GDP will raise the skill premium by 0.089 points, holding the other variables constant (Table 6.1-column $mlu/gdp$). The ratio of unskilled labour intensive imports to GDP increased from 4.05 percent in 1987 to 8.12 percent in 2005. It had decreased from 9.31 percent in 1980 to 4.05 percent in 1987, had climbed to 10.36 percent in 1999, but slightly slipped to 8.12 percent in 2005. A decrease of one percent in the ratio of skilled labour intensive imports to GDP will raise the skill premium by 0.015 points, holding the other variables constant (Table 6.1-column $mls/gdp$). The ratio of skilled labour intensive imports to GDP in Nicaragua decreased from 20.73 percent in 1980 to 16.70 percent in 2005. The decrease in this ratio was predominantly driven by the Passenger and goods motor vehicles industries (781-782).

Likewise, based on the second proxy, the rising skill premium in Nicaragua is also affected by both the increased unskilled labour intensive imports and the decreased skilled labour intensive imports. An increase of one type of the range of unskilled labour intensive imports will raise the skill premium by
0.033 points, holding the other variables constant (Table 6.2-column \textit{mlur}). The range of unskilled labour intensive imports had decreased from 12 types in 1980 to 5 types in 1985 but then increased to 11 types in 2005. The decrease in the range of unskilled labour intensive imports in the early 1980s had been driven by the Paper and paperboard (cut) industry (642), the Furniture and parts thereof industry (821), the Men's outwear industry (842), the Footwear industry (851), and the Articles of plastic industry (893). However, the imports of these goods increased again since 1987 to 2005.

A decrease of one type of skilled labour intensive imports will raise the skill premium by 0.028 points, holding the other variables constant (Table 6.2-column \textit{mlsr}). The range of skilled labour intensive imports posed a decreasing trend from 1980 to 2005. From 1987 to 1987, it had increased from 18 to 24 types, but then steadily decreased to 17 types in 2005. The increment in the range of skilled labour intensive imports in the early 1980s had been brought about by the Chemical elements and compounds industries (511-516) which then decreased from 1987 to 2005. Meanwhile, the decrease in this range since the mid 1980s to 2005 was caused by the Internal combustion piston engines industry (713), the Tractors industry (722), the Textile and leather machinery industry (724), the Machinery for specific industries industry (728), the Pumps and mechanical handling equipment industries (742-744), and the Motor vehicle parts and accessories industry (784).

\textit{Peru}

Peru was considered to be a centralised economy as certain economic policies including foreign companies expropriation, state owned companies formation, and an economic planning system had been implemented from the late 1960s to 1970s (Thorp and Bertram (1978):318-319). During the 1980s, Peru had
faced a considerable external debt, hyperinflation, and political instability. The economy had started to recover under the Fujimori administration. The liberal Fujimori government (1990-2000) had implemented a sequence of economic reforms including trade liberalisation, privatisation of most state owned companies, and encouraging FDI (Tanaka (2003)).

Trade played a moderate role in the economy. The total exports and imports of manufactured goods averaged 10.95 percent of GDP from 1980 to 2005. Peru’s main trading partners were the US, China, Brazil, and Chile (UNC-TAD (2005):Table 3.1). The ratio of exports of manufactured goods to GDP decreased from 2.42 percent in 1980 to 1.80 percent in 2005 with a slight flux between 1988 and 1990. The ratio of imports of manufactured goods to GDP also slightly decreased from 8.94 percent in 1980 to 8.62 percent in 2005 as there had been a significant fluctuation between 1982 and 1995.

Based on both proxies, trade shows a significant correlation in affecting the skill premium in Peru. The skill premium rose from 3.400 in 1980 to 5.800 in 2005 with a significant rise of 0.719 in 1988 when the ratio of exports to GDP and that of imports to GDP had increased by 1.57 and 4.16 percent, respectively.

Based on the first proxy, the rising skill premium in Peru is significantly affected by the increased unskilled labour intensive imports and the decreased skilled labour intensive imports. An increase of one percent in the ratio of unskilled labour intensive imports to GDP will raise the skill premium by 1.699 points, holding the other variables constant (Table 6.1-column mlu/gdp). The increased ratio of unskilled labour intensive imports to GDP was led by the Paper and paperboard industry (641), the Iron and steel (plate and sheet) industry (674), and the Rubber tyres and tyre cases industry (625). A decrease
of one percent in the ratio of skilled labour intensive imports to GDP will raise
the skill premium by 0.541 points, holding the other variables constant (Table
6.1-column mls/gdp). The decreased ratio of skilled labour intensive imports
to GDP starting from the late 1990s to 2005 was mostly driven by the Telecommu-
nications industry (764), the Passenger motor vehicles industry (781), and
the Lorries and specific motor vehicles industry (782).

Based on the second proxy, the rising skill premium in Peru is affected by the
decreased unskilled labour intensive exports and the decreased skilled labour
intensive imports. A decrease of one type of the range of unskilled labour
intensive exports will raise the skill premium by 0.246 points, holding the
other variables constant (Table 6.2-column xlu). A decrease of one type of
the range of skilled labour intensive imports will raise the skill premium by
0.214 points, holding the other variables constant (Table 6.2-column mls).
The range of skilled labour intensive imports slightly decreased from 26 types
in 1980 to 22 types in 2005 which was driven by the Chemicals industries (511-
516, 523, and 531), the Mechanical handling equipment industry (744), and
the Non-electric machinery industry (745).

Uruguay

Uruguay was considered to be a middle free economy in the region in 2005.
It significantly reduced tariffs on manufactured goods from 47.00 percent in
1980 to 9.50 percent in 2005 with an average of 14.70 percent from 1990 to
2005 (Ng (2006); UNCTAD (2005):Table 8.4). Like other Latin American
countries, Uruguay also adopted an import substitution policy which resulted
in its decreased dependency on imports (Smith et al. (1994)). As the result, the
ratio of imports of manufactured goods to GDP decreased from 13.50 percent
in 1980 to 11.97 percent in 2005. At the same time, the skill premium increased
from 1.220 in 1980 to 2.350 in 2005 with a significant rise of 0.444 points in 1987.

Based on the first proxy, the rising skill premium in Uruguay is affected by the decreased unskilled labour intensive exports and the increased skilled labour intensive exports. It indicates that there is a shift from unskilled labour intensive exports to skilled labour intensive exports. A decrease of one percent in the ratio of unskilled labour intensive exports to GDP will raise the skill premium by 0.117 points, holding the other variables constant (Table 6.1-column \( x_{lu}/gdp \)). A rise of one percent in the ratio of skilled labour intensive exports to GDP will raise the skill premium by 0.403 points, holding the other variables constant (Table 6.1-column \( x_{ls}/gdp \)).

Based on the second proxy, the rising skill premium is affected by the expanded skilled labour intensive exports and the decreased skilled labour intensive imports. It illustrates that there is a shift from skilled labour intensive imports to skilled labour intensive exports. An increase of one type of skilled labour intensive exports will raise the skill premium by 0.067 points, holding the other variables constant (Table 6.2-column \( x_{ls}^r \)). The expanded range of skilled labour intensive exports, from 4 types in 1980 to 10 types in 2005, was driven by the Medical and pharmaceutical products industry (541), the Polymerisation products industry (583), and the Road vehicles industries (781-786). Meanwhile, a decrease of one type of skilled labour intensive imports will raise the skill premium by 0.057, holding the other variables constant (Table 6.2-column \( m_{ls}^r \)). The range of skilled labour intensive imports decreased from 28 types in 1980 to 22 types in 2005 which was caused by the Alcohols and the Carboxylic acids industries (512 and 513), the Textile and leather machinery industry (724), and the Mechanical handling equipment industry (744).
African Countries

Algeria

The Algerian economy had grown at an average of 3.85 percent annually in the early 1980s, but had fallen to zero in 1986 and even had contracted further between 1987 and 1994 (World Bank (2006)). The improved economic growth and overall economy in the mid 1990s had been partly due to a series of economic reforms supported by the IMF and debt rescheduling from the Paris Club (Nashashibi and Féler (1998)). The Algerian economy grew at an average of 4.76 percent annually and maintained its ratio of external debt to Gross National Income (GNI) at 32.50 percent between 2000 and 2005 (World Bank (2006)).

The industrial sector dominantly contributed to GDP at an average of 55 percent, while the services and agricultural sectors contributed around 35 and 10 percent, respectively, from 1980 to 2005 (World Bank (2006)). The backbone of the Algerian economy is the oil and gas sector which contributed around 98 percent to the total exports of goods and services or 30 percent to GDP from 1980 to 2005 (The US Energy Information Administration (2008a)). Meanwhile exports of manufactured goods only contributed less than one percent to GDP from 1980 to 2005.

Based on both proxies, the rising skill premium in Algeria is affected by the decreased unskilled labour intensive exports. The skill premium in Algeria rose from 1.560 in 1980 to 1.680 in 2005. A decrease of one percent in the ratio of unskilled labour intensive exports to GDP (one type of the range of unskilled labour intensive exports) will raise the skill premium by 0.799 (0.024) points, holding the other variables constant (Table 6.1-column xlu/gdp and Table 6.2-
column \( xlu^* \)). The decrease in unskilled labour intensive exports from 1990 to 2005 was affected by the Iron and steel (tubes and pipes) industry (678), the Footwear industry (851), and the Plumbing, heating, and lightening equipment industry (812).

The effects of the skill premium in the manufacturing industry on the overall skill premium in the economy may not be substantial. Nevertheless, the overpowering nature of the oil and gas sector does not lessen the validation of the results that the rising skill premium in the manufacturing sector in Algeria is affected by trade expansions.

**Egypt**

The Egyptian economy depended mainly on agriculture, oil and gas, and tourism. The role of trade of manufactured goods to the economy itself decreased over the years even though the value of total exports and imports of manufactured goods increased. The ratio of exports of manufactured goods to GDP decreased from 15.80 percent in 1980 to 7.86 percent in 2005 and the ratio of imports of manufactured goods to GDP also decreased from 13.50 percent in 1980 to 4.52 percent in 2005. The decreased ratios of export of manufactured goods to GDP occurred along with the narrowed range of exports of manufactured goods which contracted by 4 types from 34 types in 1980 to 30 types in 2005. Both the range of unskilled labour intensive exports and that of skilled labour intensive exports contracted over that period. Similarly, the range of imports of manufactured goods also fell from 35 types in 1980 to 32 types in 2005.

Based on the first proxy, neither exports nor imports have a significant effect on the skill premium in Egypt. Based on the second proxy, the rising skill pre-
mium in Egypt is affected by the increased unskilled labour intensive imports. An increase of one type of the range of unskilled labour intensive imports will raise the skill premium by 0.074 points, holding the other variables constant (Table 6.2-column $mlu^r$). The skill premium rose from 1.357 in 1980 to 1.970 in 2005 with a noticeable increase between 1989 and 1998.

The range of unskilled labour intensive imports had decreased from 9 types in 1980 to 3 types in 1982 and then gradually broadened to 7 types in 2005. The narrowed range of unskilled labour intensive imports from 1980 to 1982 was driven by the Cotton fabrics and woven industry (652), the Ships, boats, and floating structures industry (793), the Floor coverings industry (695) and the Furniture and parts thereof industry (821). Meanwhile, the increase in this range from the early 1990s to 2005 was mainly determined by the Articles of plastic industry (893) and the Textiles industries (651-658).

**Mauritius**

From independence in 1968, the Mauritian economy had grown at an average of 5.42 percent annually for a decade which had motivated it to shift from being a low income and agriculturally based economy to a middle income and diversified economy with growing manufacturing and services sectors (World Bank (2006)). The shift in the economy from agriculture to services was supported by human resource development. Mauritius is among those African countries which had a high proportion of skilled labour to total employment in the industrial sector. The ratio of skilled workers to total employment increased from 5.60 percent in 1980 to 15.89 percent in 2005 (ILO (2006): Table 2.C).
The relatively high supply of skilled labour maintained the skill premium in Mauritius at low levels. Mauritius is among those developing countries that had had a relatively equal skill premium in the 1980s and had experienced the lowest increase in it. The skill premium only slightly rose from 1.028 in 1993 to 1.195 in 2005. The rising skill premium from 1993 to 2005 occurred along with the decreased unskilled labour intensive exports as reflected by a downward trend in the range of unskilled labour intensive exports from 10 types in 1980 to 7 types in 2005.

Based on the first proxy, neither exports nor imports have a significant effect on the skill premium in Mauritius (Table 6.1). Based on the second proxy, the rising skill premium is affected by the narrowed range of unskilled labour intensive exports. A decrease of one type of unskilled labour intensive exports will raise the skill premium by 0.030 points, holding the other variables constant (Table 6.2-column xlu*). The range of unskilled labour intensive exports contracted from 10 types in 1980 to 7 types in 2005. The decrease in this range was driven by the Clothing industries (842-848) and the Toys and sporting goods industry (894).

6.4 Conclusion

In contrast to sustained development in East Asia during the early 1980s, a number of Latin American countries (notably Argentina, Brazil, and Mexico) had experienced high levels of debt, hyperinflation, stagnant economic growth, and collapse of economic development based upon import substitution (Smith

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12 Even though the ratio of unskilled labour intensive exports to GDP in Mauritius increased from 8.67 percent in 1980 to 21.56 percent in 2005, the increase was attributed largely to a particular leading unskilled labour intensive industry group, the Clothing industries (842-846), most noticeably from the beginning of the 1990s. The share of most unskilled labour intensive exports to exports of manufactured goods was relatively stable from 1980 to 2005.
et al. (1994); Borrego et al. (1996); Wise and Roett (2003)). There is a consensus that the key factors driving the success of development in East Asia, which were not present in Latin America, are rapid accumulation of investment supported by high saving and export orientation policies with relatively selective and highly protected industry (Lin (1989); Glover (1992); Borrego et al. (1996); Masuyama et al. (1997)).

Even though Latin American countries adopted different trade policies and experienced different economic development from Asian countries, most experienced the rising skill premium as their trade expanded, similar to Asian Countries. Latin American countries even faced a relatively higher increase in the skill premium compared with that of Asian countries. The results of the effects of trade expansions on the skill premium could reflect the different trade policies adopted by these regions. While certain Asian countries illustrate that there was a shift from unskilled labour intensive exports to skilled labour intensive exports, a number of Latin American countries demonstrate that there was a shift from skilled labour intensive imports to skilled labour intensive exports.

Meanwhile, other developing countries show mixed results in that the rising skill premium is affected by the decreased unskilled labour intensive exports, the expanded skilled labour intensive exports, the increased unskilled labour intensive imports, the decreased skilled labour intensive imports, or a combination of these variables. Only Indonesia, Jordan, and Pakistan show an unexpected result of a positive correlation between unskilled labour intensive

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13 The contrast between East Asia and Latin America on industrial protection is that while East Asia targeted certain industries to be protected as well as implemented export orientation policies, Latin America ended up with generalised protection. It is argued that if everyone gets an incentive, then no one gets an effective incentive (Tower (1986) as quoted in Glover (1992):54).
exports and the skill premium. A low wage policy to attract FDI in Indonesia and Jordan may suppress the wage of unskilled labour and result in a rising skill premium in these countries. So even though they experienced increased unskilled labour intensive exports, they still experienced a rising skill premium. Pakistan was still considered to be an unreformed economy, and therefore, our hypothesis may not apply.

In conclusion, trade affects demand for factors of production (unskilled and skilled labour) which will in turn affect the skill premium. Trade has significant effects on the skill premium regardless of the size of trade or economy, trade orientation, or stage of development. As trade expands, there will be a shift from unskilled labour intensive production to skilled labour intensive production. In fact, trade expansion in developing countries from the mid 1980s to 2005 was dominated by skilled labour intensive exports. Based on the first proxy for trade expansion, the ratio of skilled labour intensive exports (e.g. telecommunications, office and automatic data processing machines, and road vehicles) to exports of manufactured goods increased from 48.70 percent in 1980 to 74.30 percent in 2005. Meanwhile, the ratio of unskilled labour intensive exports (e.g. footwear, textiles, and clothing) to exports of manufactured goods decreased from 51.30 percent to 25.70 percent over the same period. Based on the second proxy for trade expansion, the average range of skilled labour intensive exports of the 27 developing countries increased from 8 types in 1980 to 12 types in 2005, while the average range of unskilled labour intensive exports decreased from 11 types to 9 types over the same period.

NICs and SEA-4 show that relatively more open country tends to have a higher increase in the skill premium. Taiwan and Hong Kong, relatively more open countries in NICs, show higher increases in the skill premium compared
with other countries in that region. The skill premiums in Taiwan and Hong Kong increased by 30 percent and 21 percent, respectively, from 1980 to 2005. Likewise, Thailand, the most open country in SEA-4, also posed the highest increase in skill premium compared with other countries in that region. The skill premium in Thailand increased by 86 percent from 1980 to 2005. Meanwhile, the tendency of experiencing a higher increase in the skill premium as a country becomes more open to trade is not visibly present in Latin American and other developing countries. The reason could be other economic external forces such as an implementation of particular wages policy. For example, China, India, Pakistan, Mauritius, and Sri Lanka had implemented a relatively equal wages policy in the early 1980s. As a result, their skill premiums were relatively equal and grew very little.
Table 6.1: Effects of ratio of exports (imports) by skill to GDP on skill premium

<table>
<thead>
<tr>
<th>Country</th>
<th>19.3</th>
<th>2.01</th>
<th>2.25</th>
<th>1.77</th>
<th>0.253</th>
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<tbody>
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<td>0.458</td>
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<td>1.21</td>
<td>-1.23</td>
</tr>
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<td>0.186</td>
<td>0.676</td>
<td>1.19</td>
<td>-1.67</td>
</tr>
<tr>
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<td>0.131</td>
<td>0.083</td>
<td>0.041</td>
<td>-1.16</td>
</tr>
<tr>
<td>China</td>
<td>1.21</td>
<td>0.093</td>
<td>0.030</td>
<td>0.063</td>
<td>0.023</td>
<td>-1.67</td>
</tr>
<tr>
<td>Costa Rica</td>
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<td>0.014</td>
<td>-0.12</td>
<td>-1.25</td>
</tr>
<tr>
<td>Egypt</td>
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<td>0.153</td>
<td>0.233</td>
<td>-0.092</td>
<td>-1.66</td>
</tr>
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<td>0.020</td>
<td>0.009</td>
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<td>-2.16</td>
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<td>-0.064</td>
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<td>0.013</td>
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<td>0.185*</td>
<td>-0.115</td>
<td>0.020</td>
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<td>-0.039</td>
<td>-0.299</td>
<td>0.025</td>
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<td>0.514</td>
</tr>
<tr>
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<td>0.185*</td>
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<td>-1.50</td>
</tr>
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<td>0.042</td>
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<td>-0.024</td>
<td>-0.006</td>
<td>12.36</td>
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<td>-0.015**</td>
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<td>-0.010*</td>
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<td>0.266</td>
<td>-0.235</td>
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<td>-1.51</td>
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</tbody>
</table>

Based on t-test, (*) estimated coefficients are significant at 5%
Based on t-test, (**) estimated coefficients are significant at 10%
DF-column: based on the Dickey Fuller unit root test, (*) estimations are cointegrated at 5%
The number of observations is 91,790.
Table 6.2: Effects of range of exports (imports) by skill on skill premium

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<td>$xlu'_{t}$</td>
<td>$xls'_{t}$</td>
<td>$mlu'_{t}$</td>
<td>$mls'_{t}$</td>
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<td>South Korea</td>
<td>3.879*</td>
<td>0.000</td>
<td>0.014</td>
<td>0.000</td>
<td>12.51</td>
<td>0.323</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>1.067*</td>
<td>0.000</td>
<td>0.007</td>
<td>0.000</td>
<td>16.41</td>
<td>0.758</td>
</tr>
<tr>
<td>Taiwan</td>
<td>1.659*</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>10.77</td>
<td>0.755</td>
</tr>
<tr>
<td>Thailand</td>
<td>2.867*</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>90.33</td>
<td>0.945</td>
</tr>
<tr>
<td>Uruguay</td>
<td>2.105*</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>12.04</td>
<td>0.696</td>
</tr>
<tr>
<td>Venezuela</td>
<td>2.392*</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>8.118</td>
<td>0.607</td>
</tr>
</tbody>
</table>

Based on t-test, (*) estimated coefficients are significant at 5%
Based on t-test, (**) estimated coefficients are significant at 10%
DF-column: based on the Dickey Fuller unit root test, (*) estimations are cointegrated at 5%
The number of observations is 91,790.
Appendix 6

Figure A.6.1: Ratio of exports (imports) by skill to GDP in developing countries, 1980-2005

Continued ...
Note:
(1) Y-axis is the ratio of the value of exports (imports) of manufactured goods to GDP. \(xlu/gdp\) and \(xls/gdp\) are the ratio of unskilled labour intensive exports to GDP and the ratio of skilled labour intensive exports to GDP. Accordingly, \(mlu/gdp\) and \(mls/gdp\) are the ratio of unskilled labour intensive imports to GDP and the ratio of skilled labour intensive imports to GDP.
(2) Source: author's calculation. Data on the value of exports (imports) of manufactured goods are from UNCTAD (2005) Table 4.2. Data on GDP are from the World Development Indicators (World Bank (2006)) and data on GDP for Taiwan are from the IMF World Economic Outlook (IMF (2007)).
Figure A.6.2: Range of exports (imports) by skill in developing countries, 1980-2005

Continued ...
Note:
(1) Y-axis is the range of exports (imports) of manufactured goods. \(xlu^*\) and \(xls^*\) are the range of unskilled labour intensive exports and the range of skilled labour intensive exports. Accordingly, \(mlu^*\) and \(mls^*\) are the range of unskilled labour intensive imports and the range of skilled labour intensive imports.
(2) Source: author's calculation. Data on the value of exports (imports) of manufactured goods are from UNCTAD (2005) Table 4.2.
Chapter 7

Conclusion
7.1 Conclusion

By using the North-South trade framework and a continuum good model with two factors of production which are skilled and unskilled labour, the theoretical framework predicts that trade expansions driven by tariff reductions and technological catch-up affect the skill premium. It illustrates that the skill premium may rise if the range of the traded goods in which an export expansion occurs to be greater than the range of the traded goods in which imports expand.

We use two proxies for trade expansions. First, a widely used proxy for trade expansions which is the ratio of exports (imports) to GDP. Second, we introduces a new proxy for trade expansions which is the range of exports (imports). The main distinguishing aspect of the latter is that it can illustrate changes in the categories or types of goods traded which enables it to show actual changes in trade expansions and therefore is comparable across countries.

We later on classify trade expansions by skill which enables us to observe more detail in which category trade expansions occur. So far, it is widely assumed that export expansions in developing countries are expansions in unskilled labour intensive good exports, and therefore, are expected to increase demand for unskilled labour which eventually lowers the skill premium in developing countries. The basic argument in our study is that export expansions might occur in the range of skilled labour intensive goods in which case the skill premium will be increasing instead of decreasing.

Our findings show that while tariff reductions do not necessarily increase imports, the expanded exports are significantly affected by technological catch-up. It confirms that the rising skill premium in developing countries is affected
by an increase in skilled labour intensive exports which is driven by a resource shift either from unskilled labour intensive exports or from skilled labour intensive imports.

Exports from developing to developed countries from the mid 1980s to 2005 mainly comprised skilled labour intensive intermediate goods (spare parts or assembling parts) that developed countries used for their final goods instead of unskilled labour intensive goods. The value and the range of exports of unskilled labour intensive exports such as footwear, textiles, and clothing were surpassed by those of skilled labour intensive exports such as telecommunications, office and automatic data processing machines, and road vehicles. The reason could be that developed countries still maintained trade barriers on unskilled labour intensive imports from developing countries to protect their domestic producers and secure jobs for unskilled labour (e.g. The Multi Fibre Arrangement had governed the world trade in textiles and garments from 1974 through 2004, imposing quotas on the quantities of textiles and apparel that developing countries could export to developed countries).

The findings support the logical concept derived from the Stolper-Samuelson (SS) theorem, but does not seem to fully support the Heckscher-Ohlin (HO) theorem. The weak prediction of the HO model is mainly caused by the ignorance of the role of technological differences.

Furthermore, the country analyses explain in more detail how the rising skill premium in developing countries affected by trade expansions which are caused by a shift from unskilled labour intensive exports to skilled labour intensive exports or a shift from skilled labour intensive imports to skilled labour intensive exports. The first phenomenon represents trade expansions in Asian countries which mostly adopted an export orientation policy. The second phenomenon
represents the condition in Latin American countries which generally adopted an import substitution policy. NICs and SEA-4 show that a relatively more open country tends to have higher increase in the skill premium, but Latin American and other developing countries do not show this tendency. A relatively equal wages policy implemented in certain developing countries may curtail the effects of trade expansions on the skill premium.

7.2 Shortcoming

There are a number of aspects of this analysis that might be revisited in future studies and here we touch on a couple of these points. First, in the theoretical framework, we assume that the quantity of labour is fixed and labour is immobile across countries. But in reality, labour is mobile. Since skilled labour is more educated and skilled than unskilled labour, it will be relatively more flexible and mobile. The mobility of skilled labour enables it to bid its wages at a higher proportion than the bid of the wages of unskilled labour and thus allows skilled labour to move to its optimal wages (optimal wages are wages paid equal to market value of labour productivity). As a result, the skill premium is rising due to the relatively higher proportion of the increased wage of skilled labour relative to that of the wage of unskilled labour.

We predict that the effects of labour mobility on the skill premium in developing countries would be quite small, therefore, we assume that there is no labour mobility in the theoretical framework. Nonetheless, an issue of labour mobility (particularly in countries with high portions of migrant labour such as Singapore, Hong Kong, and Mexico) and that labour migration may affect the skill premium to a certain extent.
Suppose there is a model which incorporates labour mobility, it could produce better predictions of the effects of trade expansions on the skill premium. We expect that the model which incorporates labour mobility with an assumption that skilled labour is relatively more mobile than unskilled labour will produce the magnitude of the effects of trade on the skill premium which is higher than that outlined in our theoretical framework. Nonetheless, the sign of the magnitude will be the same as that of our study. Additionally, the empirical results of the model with and without the assumption of labour mobility will be the same since we use data on wages in the labour market which are a result of supply and demand of labour. This also applies if we use two factors of production, capital and labour, instead of skilled and unskilled labour.

Second, as discussed in the study coverage, trade theory is largely silent in measuring skilled and unskilled labour. Some studies on this issue assert that wages by education could be the best proxy for wages of skilled and unskilled labour. However, data on wages by education across countries are very limited. In fact, the skill premium produced by wages by education shows the same trends and magnitudes as the one produced by wages by occupation in certain developing countries such as Hong Kong, Indonesia, the Philippines, South Korea, and Taiwan. Empirical studies using data on wages by education will not change the results that trade expansions, to some degree, affect the skill premium in developing countries. Perhaps studies using data on wages by education may produce better magnitudes of the effects of trade expansions on the skill premium.

Last, aggregating exports and imports from Southern and Northern countries is also one of the limitations of this study, and disaggregation could a topic for future research.
7.3 The Way Ahead

Despite positive effects of trade expansions to an economy, trade may bring a potentially negative effect such as a rising skill premium. In the early stage of development, might it be better to have a bigger cake with unevenly divided slices than a smaller cake cut into equal but tiny pieces?

An increase in the skill premium up to certain levels could be an incentive for individuals to be more educated and more skilled. Future studies could usefully consider welfare implications of the effects of trade expansions on the skill premium and how governments might best react in terms of human capital policy.
References


REFERENCES 185


