FOREIGN WORKERS IN THAI MANUFACTURING: TRENDS, PATTERNS, AND IMPLICATIONS FOR DOMESTIC WAGES

BY

MR. PARNUPONG SRI-UDOMKAJORN

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF ECONOMICS
(INTERNATIONAL PROGRAM)
FACULTY OF ECONOMICS
THAMMASAT UNIVERSITY
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THESIS

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ENTITLED

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ABSTRACT

This thesis aims to promote a better understanding of the impact of foreign workers on domestic manufacturing wages with reference to Thailand, a country where foreign labor has played a major role in the manufacturing sector since the early 2000's. In our core analysis, two approaches, simulation experiment and econometric analysis, are employed in a complementary manner. The key findings are consistent, and ensure that foreign workers are imported to fill jobs shunned by locals. The simulation experiment suggests that the entry of foreign workers causes depressing pressure on wages only affecting low-skilled Thai workers. Interestingly, the effect turns out to be positive in respect to other types of workers and higher-skilled labor in particular. In our econometric analysis, we find the significant negative impact of foreign worker dependency on real manufacturing wages, both in total and operational remuneration. However, the negative impacts become negligent overtime. Until 2011, we found the positive impact of foreign workers on both total and operational wages. The policy implication for the management of foreign workers in order to promote sustainable development is that facilitating the inflow of foreign workers at present could potentially promote the growth of domestic manufacturing wages instead of preventing such growth.

Keywords: Foreign workers, Wages, Thai manufacturing

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Parnupong Sri-udomkajorn

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

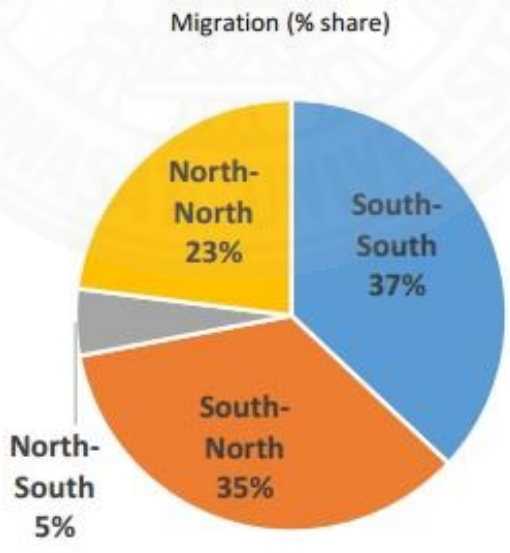
CHAPTER 1
INTRODUCTION

1.1 Statement of the Problem

International migration has become the key driver of ongoing economic globalization. By 2012, there were more than 231.5 million people actively employed in countries outside of their homeland (United Nations, 2013). Interestingly, the predominance of the flow of workers from developing to developed countries (South-North migration) superseded by flows among developing countries (South-South migration). In particular, in 2015, 35 per cent of labor flows was classified as the former, whereas the corresponding figure of the latter reached 37 per cent (Figure 1.1). Most South-South migration occurs within Asia and the Pacific region (Thangavelu, 2012; United Nations, 2013).

Figure 1.1

Migration as a Share of Global Migrant Stock



Sources: World Bank staff calculations based on the Migration and Remittance Factbook 2015, UN Population Division, and national censuses. Definition of the "North" and the "South" in this chart follows UN classification.

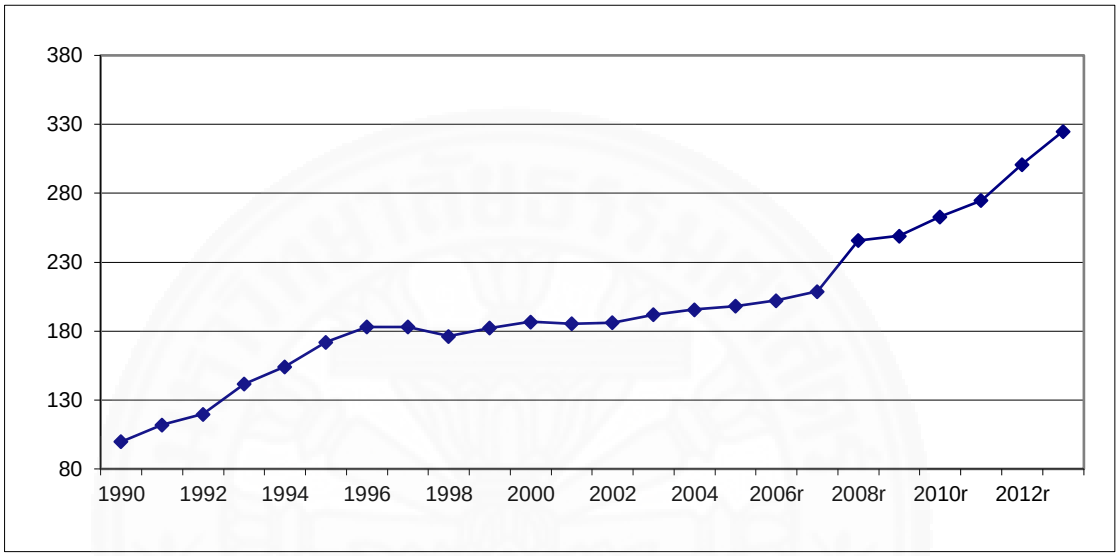
Within Asia and the Pacific region, Thailand ranked fifth in receiving more than 3. 72 million migrant workers, largely dominated by unskilled workers from neighboring countries (United Nations, 2013). The corresponding figure reported by the Foreign Workers Administration (OFWA), Department of Employment, Ministry of Labor, revealed the existence of 1.45 million legal migrant workers in 2015, principally comprising unskilled Myanmar workers (i.e. 86 per cent of the total). This is grossly underestimated. Such a large volume of immigrant workers is largely to be expected as Thailand is located at the center of the Indochinese Peninsula sharing long common borders with much lower per-capita-income neighboring countries. The common border allows workers to cross lines relatively easily to capitalize on vast income differences. In the foreseeable future, such income gaps will continue although a catching up process has kicked in over the past decade. In particular, the economic modernization of Laos and Cambodia started in the late 1990s and the early 2000s. Until 2011, Myanmar showed a clear sign of political transition from a military dictatorship to a more democratic society. Even though these three economies experienced high growth during the past decade, this was largely due to such a low base point. In previous year, income per capita stood at 1,812, 1,159, and 1,203 USD for Laos, Cambodia and Myanmar, respectively. This is far below that of Thailand (5,816 USD) leading to a considerable push influencing these workers to seek better wages in Thailand.

Another important feature of the Thai economy lies in the fact that it is an aging society. The sector of the population aged over 65 has gained in relative importance to the total population, increasing from 6.8 per cent in 1994 to 14.9 per cent in 2014. It is expected to reach 17 per cent in 2020. This implies that a labor shortage in Thailand would present long-term structural challenges. In theory, when a country experiences severe labor shortage, two additional options are available for firms to cope with the problem in addition to importing workers from aboard. They include exporting capital through direct investment abroad and capital deepening (substituting labor with capital) (Athukorala and Manning, 1998; Athukorala and Devadason, 2012; Hill, 2015). Drawing from a survey of clothing factories in Thailand, Kohpaiboon and Jongwanich (2016) found that these three options are not mutually exclusive. Firms use them simultaneously to cope with any labor shortage. All in all, importing foreign workers

will remain an ongoing challenge in Thailand as increasing wages continue regardless of preferences towards foreign workers from neighboring countries (see Figure 1.2).

Figure 1.2

Real Wage Index in Thailand



Sources: Employment compensation is collected from the National Income Account, National Economic and Social Development Board (NESDB), and data for employed workers from Key Indicators for Asia and the Pacific 2013, Asian Development Bank (ADB) [1].

Importing foreign workers potentially results in various economic impacts on labor importing countries like Thailand. As argued in Thangavelu (2012) there are three possible effects, i. e. wage impacts, technology adoption, and productivity. Among them, the impact on wage is particularly important because of two reasons. Firstly, the other two effects are triggered by changes in domestic wages. How much domestic wages respond to the entry of these foreign workers constitutes the critical starting point in assessing the impact. Secondly, wage represents the explicit less

[1] Real wage represents the ratio between (real) employment compensation and employed workers, converted to a 1990 index (1990 = 100).

controversial measurable variable. In theory, importing foreign workers potentially puts pressure on wages in labor importing countries (henceforth referred to as domestic wages for brevity). The negative effect on domestic wages is magnified with blue-collar workers when foreign labor is dominated by unskilled employees. Clearly, this benefits firm owners as a result of allowing a larger pool of workers. This could worsen any existing income inequality problems. The pressure on domestic wages may alter any upgrading effort firms might have and ultimately constitute a slowdown in productivity.

Nonetheless, the existence of pressure on domestic wage is predicated on the assumption that foreign and native workers are perfect substitute. The opportunity cost of importing foreign workers lies in job losses of native laborers. This assumption is rather restrictive in circumstances where the labor market is tightening. In such a labor market (i.e. excess demand), native workers can choose jobs. Certain undesirable jobs may be shunned by them. Foreign workers may serve to fill such a void in these undesirable jobs. In this circumstance, the effect on wages would not necessarily be negative. The counter-factual outcome without these foreign workers would be output loss in certain sectors.

This becomes increasingly policy relevant when economic cooperation in Southeast Asian economies is strengthening. One consequence is to accommodate the movement of workers among member countries. In addition, exporting workers abroad on a temporary basic is widely regarded as representing a short-term economic cushion for low-income countries in the region where business opportunities remain under developed. Hence, many international organizations including the Association of Southeast Asian Nations (ASEAN), Economic Research Institute of East Asia and ASEAN (ERIA) invest tremendous effort in laying down foundations to facilitate such labor movement.

Despite the inherent immense policy relevance, there has not been a systematic analysis assessing the economic impact of foreign workers on manufacturing wages in Thailand so far. Therefore, our objective is is to examine the effects of foreign workers on domestic wages using Thailand as the case study. Due to the increasing importance of foreign workers in Thai manufacturing (Pitayanon, 2001), this sector is selected as the center of our focus. The sample of foreign workers in the

study predominately comprises unskilled laborers as they represent the most controversial variable in the development process.

1.2 Objectives of the Study

1. To review migration policy in Thailand over the past two decades.
2. To analyze trends and patterns connected with foreign workers in Thailand with emphasis on unskilled workers from neighboring countries.
3. To examine the effects of these workers on domestic wages, both in the case of overall and manufacturing wages.
4. To provide policy inferences concerning the flow of foreign workers in order to promote sustainable development.

1.3 Scope of the Study

The thesis focuses on unskilled workers from three neighboring countries. Myanmar, Laos and Cambodia, which account for more than 80 percent of the total number of foreign workers in Thailand. Most of the secondary data used in this thesis is from the Office of Foreign Workers Administration records between 1986 and 2013. However, data concerning illegal workers in Thailand is not available.

1.4 Organization of the Study

The thesis is organized as follows. Chapter 2 discusses the literature review, forwarding a theoretical explanation of international migration; especially concerning effects on wages, the present classification regarding types of international migration, and past empirical research studies. Chapter 3 provides a summary of migration policy and patterns in Thailand, while Chapter 4 describes the data and methodologies employed. The first source of data was the Labor Force Survey in Thailand, while the second was the Thai Industrial Census. This chapter provides an overview of each database and related applications, composed of data and variable creation, the model,

and estimation methods. The next chapter, the core of this study, exhibits two models. The first is a simulation experiment of the effects of immigration on the Thai wage structure, followed by an econometric analysis of the determinants of real wages in Thai manufacturing exploiting an industry-level data set. The in depth investigation takes place in this chapter, explaining estimations as an aspect of the impact of immigrant dependence in general and specific cases. The last chapter, Chapter 6, wraps up the study by drawing conclusions from the results and providing policy implications.

CHAPTER 2
ANALYTICAL FRAMEWORK

This chapter seeks to lay down analytical framework used in the thesis with emphasis on the effects of immigration on the wages of the labor-importing country. The chapter begins with a discussion of migration motivation (Section 2.1), followed by outlining the economic consequences of migration (Section 2.2). This chapter is not intended to comprehensively discuss the economic consequences when workers move across borders. Instead, it provide a brief discussion about the benefits and costs associated with migration in both labor exporting and importing countries. Section 2.3 presents the theoretical model developed by Bratsberg et al. (2004) in order to demonstrate the effects on wages. Section 2.4 presents empirical evidence of the effects on wages in labor importing countries. The key inferences of the chapter are drawn in the final section.

2.1 Migration Motivation

Traditionally, wage differences among countries are the prime motive for workers moving between countries. Nonetheless, in reality there are other factors involved, such as cost of living differences, transaction costs related to labor mobility and government policy (Lewis, 1954; Stark and Levhari, 1982). As argued in Borjas (1990), workers will calculate the expected net return regarding migration in which all costs and benefits related to such migration are taken into consideration. This can be expressed in Equation 2.1;

$$NPVB = \sum_{t=1}^{T} \frac{B_t}{(1+r)^t} - C \qquad (2.1)$$

Where

$NPVB$ = the net present value of benefits

B_t = the augmented utility received from switching jobs

T = the length of time (yearly unit) working at a new job

r = the discount rate

C = the decreased utility from migration itself (both direct and indirect)

$\sum$ = a summation of yearly discounted net benefits over a period from year 1 to year T

Thus, workers decide to migrate if the net present values of benefits are greater than zero. According to the equation (2.1), the major factors determining the net present values of benefits are the gains from switching jobs (B_t) and the losses from switching jobs (C). Therefore, the factors determining the gains and losses from switching jobs determine mobility decisions.

There are many factors affecting the labor decision, which can be classified into two main categories, namely *push and pull factors*. The former refers to factors largely taking place in labor exporting countries, whereas the latter concerns those in importing nations. Table 2.1 provides a summary of the push and pull factors affecting mobility decisions.

When push factors are concerned, they are related to economic and social situations in labor exporting countries. High poverty, low job opportunities, political conflicts, and/ racism always play a key role in pushing workers to seek employment abroad. Pull factors refer to better working and living conditions in labor importing countries. Another key pull factor involves migration networks. It would be very difficult to be the first group working abroad. Nonetheless, when the first group is established, this could induce more workers from the same exporting countries to follow their lead. Hence, a network is set up. Migration networks furnish prospective migrants with information about economic conditions in labor-importing countries, assist in directing the immigration process, and offer support in obtaining housing and finding a job. The better the migration networks migrant workers connect with, the larger the flow of immigrants moving becomes. Zhao (2003) studied the determinants of labor movement in China using a household survey in 1999, and found that increasing in the number of migrants with at least four-year experience by a figure of

one increased the probability of migration concerning the remaining workers in their household by 0.21 percent.

As reflected in many empirical studies (Naskoteen and Zimmer, 1980; Kennan and Walker, 2003), better conditions are reflected by higher wages. Although better conditions are often associated with a higher cost of living (referred to as a "cliff" in Lewis (1954)), differences in wages must be adequate to make the net presented value of benefits (Equation 2.1) positive. For example, Naskoteen and Zimmer (1980) found that a ten-percentage increase in the wage differential between the U.S. and an immigrant's country of origin increases the flow of immigration by about seven percent. Despite a much smaller magnitude, similar evidence is also revealed in Kennan and Walker (2003).

Table 2.1

Detailed Push-Pull Factors Concerning Labor Movement

	Push factors	**Pull factors**
Economic and demographic	Poverty Unemployment Low wages High fertility rates Lack of basic health & education	Prospect of higher wages Potential for improved standard of living Personal or professional development
Political	Conflict, insecurity, violence Poor governance Corruption	Safety and security Political freedom
Social and culture	Discrimination based on ethnicity, gender, religion, and the like Geography	Migration network Ethnic (diaspora migration) homeland Freedom from discrimination

Source: World Bank report on migration and remittances, 2007.

2.2 Economic Consequences of International Migration

To illustrate the economic consequences, we begin with the short-run static analysis developed in Bhagwati et al. (1998) based on the specific factor model

demonstrated in Figure 2.1. High and low wage countries are represented. Labor markets are assumed to be perfectly competitive so that wages paid are equal to the value of marginal products of labor. Let (w_0^a) be the wage in country 1 in the absence of immigration, and (O_1L_1) represents initial labor supply. The total labor endowment is (O_1O_2) distributed between two countries. For labor market in country 2, the initial equilibrium exists with initial wages (w_2^b) and (O_2L_1) signifying initial labor supply. The demand for labor in country 1 is represented by (D_{L1}), while (D_{L2}) exhibits the same information for country 2. The total output in each country is shown by the areas under demands curve at the given wage levels. The rectangle $(w_0^aAO_1L_1)$ represents country 1's initial total wage bill, and the rectangle $(w_2^bCO_2L_1)$ represents country 2's initial wage bill.

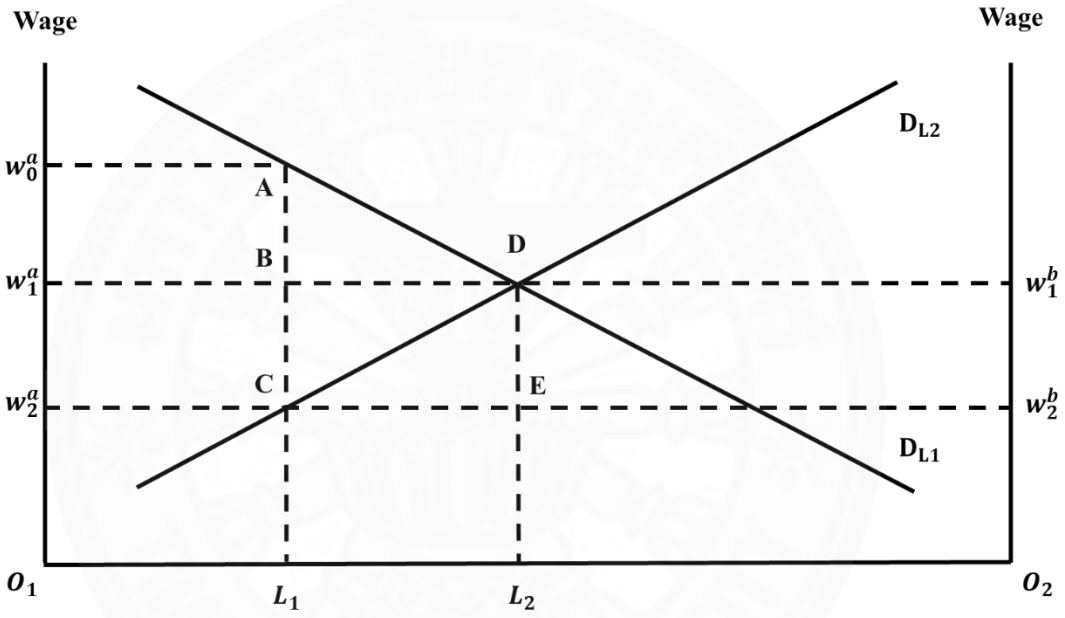
When migrant workers arrive, (L_1L_2) workers would move from country 2 to country 1 corresponding to the differential in wages until the wages in 2 regions are equated at point (D), where $(w_1^a=w_1^b)$. According to the new equilibrium, the out-migration decreases total output in labor-exporting country; by a trapezoid (DCL_2L_1), meanwhile the in-migration increases total output in labor-importing country; by a trapezoid (ADL_1L_2). Thus, global gains from this phenomenon would be reflected in a triangle (ADC), and please note that the migrant's gains would comprise a rectangle $(BDCE)$.

However, native workers in country 1 would lose by the decreasing wage rate from A to B, represented by rectangle $(w_0^aAw_1^aB)$. Conversely, native workers in country 2 would gain by the raising wage rate from (w_2^b) to (w_1^b), represented by rectangle $(w_1^bDw_2^bE)$. Hence, native workers in country 1 lose, and native workers in country 2 gain. Precisely, the other factors of production in labor-importing country, or the income of capitalists, increase as in the trapezoid $(w_0^aADw_1^a)$, and the other factors of production in labor-exporting country, or the income of capitalists, decrease by the trapezoid $(w_1^bDCw_2^b)$.

Interestingly, one factor determining the gains and losses of a labor-importing country is that of the difference between native worker losses ($w_0^a A w_1^a B$) and "immigrant surplus[1]" (ABD). Assuming that migrant workers own no capital in country 1, the benefit exists when "immigrant surplus" is greater than native worker losses.

Figure 2.1

The Neoclassical Economic Impacts of Migration.



Source: Developed by the author from Ruist and Bigsten (2013).

Note that the static analysis discussed above is based on assumptions that the nature of the labor supply should satisfy the undifferentiated characteristic and be fully substitutable with native workers, and the factors of production other than labor are immobile.

As the number of workers in labor exporting countries moves to work in another country, *ceteris paribus*, their wages increase. For example, Mishra (2007)

[1] Borjas (2015) explained that this surplus exists because of at least two reasons: the relative imbalance of the labor supply, and the better infrastructure in labor-importing countries, which increases the marginal product of workers in this region.

examined the correlation between changes in wages and emigration to United States in the case of Mexican people over the period 1970-2000, and found that a one percent increase in emigration from Mexico to the U.S. increases wages in Mexico by about 0.4 percent. In addition, Aydemir and Borjas (2006) found similar evidence with a slightly higher elasticity, i.e. 0.56. This also inflates cost of production and lowers aggregate output.

Note that the (opportunity) cost in terms of output loss from sending workers abroad is based on the assumption that employment in the labor exporting countries is approaching the full employment level. Moving a worker implies output loss. If the country is experiencing a high rate of unemployment and the marginal product of labor is approaching zero, moving these workers would not be associated with output loss. This is at the core of Lewis's model (Douglas, 2014).

Besides, there exists a positive impact of emigration in various ways. Usually, these workers send money home to their families, remittances. This could be associated with benefit in terms of economic development. Remittances may help reduce the credit constraint faced by households, allowing entrepreneurial activity and private investment to increase (Yang, 2008; Woodruff and Zenteno, 2004). Over and above physical investments, remittances could also help finance education and health, which are key variables in promoting (long-term) economic growth. Second, remittances could help improve a country's creditworthiness, enhancing its access to international capital markets. The World Bank (2005) notes that country credit ratings by major international institutions are positively affected by the magnitude of remittance flows into that country. This is another way to increase both physical and human capital investment, and promote (long-term) economic growth.[2] The flows could offset the loss of income. For example, Migrant workers employ remittances as a tool to help their families in their homeland. Based on the experience of Mexico, Mishra (2007) found that remittances from these workers are larger than the diminishing contributions to home country GDP.

In addition, as migration becomes more a spatial phenomenon, this raises a migrant- return possibility in migrant- sending countries. Such returning migrants

[2] See the recent empirical analysis in Jongwanich and Kohpaiboon (2016)

potentially bring back ideas, entrepreneurship, and new skills from abroad to help improve productivity and job creation homeland. Positively, they can acquire new skills and return to assist in developing their hometown via higher human capital. On the other hand, when these workers fail to return or decide to leave on a permanent basis, this obstructs the development process via lowering labor productivity, so-called "brain drain[3]".

Moreover, immigrant knowledge and associations concerning their homeland lower the transaction costs associated with international trade. Head et al. (1998) studied immigration in Canada using a gravity model of trade and immigration, and found that a 10% increase in Canada's immigration population engenders a 1% increase in exports and a 3% increase in imports. Based on the concept of incomplete information across countries, migrant workers have deep knowledge regarding their home economies. Foreign trade enforces costs beyond those only connected with domestic transactions. Exporters have to find access to distribution channels in unusual environments. Meanwhile, importers also seek a trustable source of supply. These actions somehow require knowledge of local traditions, laws and business practices. Thus, remittances, migration-return possibility, and trade creation potentially offset the labor-market impact of emigration. In labor importing countries, workers hold down domestic wages. This affects the process of technological advancement. When migrants are skilled, they are potentially be complementary to native workers. This may insert new skills and boost the current level of technology in labor-importing countries. Such a positive effect is supported by a number of empirical studies (e.g. Stephan and Levin, 2001; Chellaraj et al., 2008; Hunt and Gauthier-Loiselle, 2010; and Nathan, 2014). In particular, Nathan (2014) studied the UK between 1978 and 2007 and claimed that highly skilled immigrants tend to be employed in workplaces where positive spillover effects from immigrants to locals exist, using a number of patents as a proxy for innovation. Hunt and Gauthier-Loiselle (2010) also found evidence of positive impacts

[3] The brain drain is a perceivable word in the modern literature on international migration. As the main idea, it deals with the issue those skilled and educated workers who create positive externalities to the origin move from their homeland.

of skilled immigrants in the United States between 1940 and 2000, highlighting that they increased per capita patenting without lessening native patenting.

It becomes much more controversial when migrants are unskilled and their move is solely driven by the development gap between exporting and importing countries. In theory, the impacts of immigration on labor productivity are ambiguous. On the one hand, unskilled immigrants might be a factor behind diminishing a firms' incentive to innovate, motivating them to rely on cheap labor, and developing firms' production patterns to be more labor-intensive (Thangavelu, 2012). The negative impacts of unskilled immigrants on their destination country are widely found in many empirical studies. Lewis (2005) studied the U.S. manufacturing sector and pointed out that the level of technology adoption is negatively influenced by the employment unskilled labor. With increasing unskilled labor, firm owners tend to adjust their plants in order to be compatible with major workers. Thangavelu (2010) studied this issue within the Singaporean manufacturing sector and confirmed the same results founded in Lewis's study.

Interestingly, Llull (2008) employed a panel data analysis of 24 Organization for Economic Co-operation and Development (OECD) countries and discovered the opposite effect of immigration, as they could perform with an efficiency rate of only 66.67 percent compared to native workers. The explanation is that migrant workers face several difficulties. Firstly, the language barrier makes an uncomfortable working environment. Secondly, legal limitations concerning the duration of work permits counteract long-term benefits for both migrant employers and immigrants. Employers invest less in migrant workers because they know that at some point they will return to their hometown. Employees also think the same way, suspecting that they will put less effort into work. Lastly, possible discriminatory treatment in the workplace decreases work motivation. Quispe-Agnoli and Zavodny (2002) used world-level data, and indicated that countries that absorbed a bigger share of immigrants tend to experience a slower growth rate regarding labor productivity.

On the other hand, immigration potentially has no effect on productivity in the case of full capital adjustment. The capital-labor ratio at the aggregate level entirely recovers from immigration shocks when influxes of immigrants are predictable.

Some studies find no significant impact of immigration on productivity. Ortega and Peri (2009) found that immigration directly has an effect on firm's investments, but has no effect on Total Factor Productivity (TFP). At the manufacturing level, Paserman (2009) pointed out that there is no significant relationship between the share of foreign workers and firm productivity. Interestingly, Kohpaiboon et al. (2012) studied the Thai clothing industry, employing in- depth interview, and found no negative impact of immigration on productivity because Thai clothing firms are labor-intensive. The degree of labor and capital substitution is limited. Thus, employing foreign workers at the desired level turns to have a positive impact.

2.3 Theoretical Model: The Effects of Migration on Wages in Labor-importing Countries

The structural framework of wage impact of immigration in this study derived from Bratsberg et al. (2014). It begins with a simple model of the competitive labor market: aggregate output (Y_t) is produced utilizing a production function that uses only a heterogeous labor input[4] (L_t). The aggregate production function holds the characteristics of a nested form, and CES production technology. The total product depends on labor (L_t) and total factor productivity (A_t):

$$Y_t = A_t L_t^{\alpha} \tag{2.2}$$

Total labor (L_t) holds a composite form of different skill levels aggregated by a nested CES technology (Borjas, 1990; Ottaviano and Peri, 2012; Lathapipat 2014). α is the income share of labor. At the top level, the aggregation has (E) levels of education (L_{kt}):

[4] The capital input is ignored here because there is no important complementary intuition on native wages from adding this factor. See the full CES aggregated production function (K, L) in Appendix A.

$$L_t = \left[\sum_{k=1}^{K} \theta_{kt} L_{kt}^{\rho} \right]^{\frac{1}{\rho}} \quad (2.3)$$

Where θ_{kt} is the relative efficiency of education in level k and L_{kt} is the amount of workers who have education level k in year t. Note that the substitution parameter, $\rho = 1 - \sigma_K^{-1}$, where σ_K represents the elasticity of substitution between labor with different levels of education. Then, labor input in a single education level also takes a CES combination of (J) experience levels,

$$L_{kt} = \left[\sum_{j=1}^{J} \theta_{kj} L_{kjt}^{\tau} \right]^{\frac{1}{\tau}} \quad (2.4)$$

Where θ_{kj} is the relative efficiency of experience in level j for the same level of education. L_{kjt} here is the amount of workers who has education level k and experience j in year t. Note that the substitution parameter, $\tau = 1 - \sigma_J^{-1}$, where σ_J represents the elasticity of substitution between labor with the different levels of experience. Lastly, labor input in a single experience and single education level takes a composite CES form of native (N_{kjt}) and immigrant (M_{kjt}) workers,

$$L_{kjt} = \left[\theta_{Nkj} N_{kjt}^{\lambda} + \theta_{Mkj} M_{kjt}^{\lambda} \right]^{\frac{1}{\lambda}} \quad (2.5)$$

Where θ_{Nkj} is the relative efficiency of native workers within experience level j and the same level of education k. While θ_{Mkj} stands for the case of migrant workers. Note that the substitution parameter, $\lambda = 1 - \sigma_M^{-1}$, where σ_M represents the elasticity of substitution between native and immigrant workers under the same education and experience level (k,j).

In a competitive market, profit maximization must hold the first-order condition that the price of input in real term is equal to its marginal product. The case for native workers is shown below,

$$\ln(w_{Nkjt})=q_{kt}+\ln(\theta_{kj})+\ln(\theta_{Nkj})+(\sigma_M^{-1}-\sigma_J^{-1})\ln(L_{kjt})-\sigma_M^{-1}\ln(N_{kjt}) \quad (2.6)$$

Note that $q_{kt}=\ln(\alpha Y_t L_t^{\rho}\theta_{kt}L_{kt}^{\rho-\tau})$, this study focuses on the effects of immigration on wages. Thus, the direct partial native wage effect from an influx of migrant workers can be expressed by the following equation, while holding the native workers, aggregate supplies (q_{kt}), and capital constant;

$$\left.\frac{\partial\ln(w_{Nkjt})}{\partial\ln(M_{kjt})}\right|_{L_t,L_{kt}}=(\sigma_M^{-1}-\sigma_J^{-1})\eta_{kjt} \quad (2.7)$$

Note that $\eta_{kjt}=\dfrac{d\ln(L_{kjt})}{d\ln(M_{kjt})}$ is the immigrant share of the wage bill in group (k,j) in year t[5].

The implication which can be drawn from the equation (2.7) is that the native wage effect from immigration would be negative when the within-group (σ_M) dominates the cross-group substitution (σ_J). Otherwise, it is a case of imperfect within-group substitution, where the negative effect is reduced by the lower elasticity of substitution between native workers and immigrants. At some point, the effect is reversed when the cross-group (σ_J) dominates the within-group substitution (σ_M). For simplicity, we delineate those situations into two following scenarios:

The first scenario concerns situations when its effect is negative. The degree of substitution between migrant and native workers is more than the degree among different-experience workers. For example, it is the case that Myanmar workers

[5] See the calculation in Manacorda et al. (2012).

are more similar to Thai workers compared with one-year and two-year experienced workers. Secondly, concerns scenarios when its effect is positive. This is the case when differences in experience matter more than nationality issues.

Finally, the first-order condition that the price of input in real term equals its marginal product is written as;

$$\ln(w_{Mkjt})=q_{kt}+\ln(\theta_{kj})+\ln(\theta_{Mkj})+(\sigma_M^{-1}-\sigma_J^{-1})\ln(L_{kjt})-\sigma_M^{-1}\ln(M_{kjt}) \quad (2.8)$$

In addition, the immigrants wage responses to an influx of migrant workers by;

$$\left.\frac{\partial \ln(w_{Mkjt})}{\partial \ln(M_{kjt})}\right|_{L_t, L_{kt}} =-\sigma_M^{-1}(1-\eta_{kjt})-\sigma_J^{-1}\eta_{kjt} \quad (2.9)$$

The equation (2.9) is always negative because all parameters in the right hand side vary as positive numbers. Thus, it implies that migrant wages always decrease when the new immigrants arrive.

2.4 Empirical Evidence of the Effects on Wages in Labor Importing Countries

The prime outcome from the model is that the effects tend to be ambiguous. Table 2.2 provides a summary of these studies.

Aydemir and Borjas (2006) studied the wage effects of immigration in Canada and the U.S.A. In Canada they found that a ten percent increase in immigration decreases domestic wages by about five percent. In the U.S.A. case, the impact on wages is slightly less than the Canadian experience at about 0.2 percent. Interestingly, when workers are carefully classified according to their education, as found in Borjas et al. (2010), a ten percent increase in immigration in the same education class decreases weekly domestic wages by about 5.7 percent. When the race of workers, (black and white), is taken into consideration, they found that wages for white workers decreased more than black by about 2 percent in response to an influx of immigration.

Bratsberg et al. (2014) employed the same method provided by Borjas et al. (2010), but their focus was on Nordic countries and found that a ten percent increase in immigration of workers with the same skill and education class decreases domestic wages in Nordic countries by about 27 percent. Auhukorala and Devadason (2012) estimated the wage equation at the industry-level in Malaysia by highlighting that foreign worker dependency has a small significant negative impact on real manufacturing wages. A 0.04 percent increase in the share of foreign workers in total full-time employment across industries decreases real wages by about ten percent.

However, there is considerable evidence highlighting a positive effect (Card, 2009; D'Amuri et al., 2010; Manacorda et al., 2012; Ottaviano and Peri, 2012). In explanation, there exist at least two reasons why migrant workers help labor-importing countries (Bhagwati, 1987). Firstly, foreign workers usually work in tasks that provide no future career improvement so-called "dead-end jobs", because the native workforce spurn such employment. Secondly, they work in "3-D" jobs (dirty, dangerous, and difficult). Thus, foreign workers play a role as a complementary workforce, rather than being a competing workforce. Their flow favorably pushes the functioning of the domestic labor market by deleting jams occurring in the growth process, and consequently the economy can expand.

Table 2.2

Impact of Foreign Worker on Domestic Wage

Researches	Data	Findings
Auhukorala and Devadason (2012)	Malaysia; 2000 to 2008	Negative
Aydemir and Borjas (2006)	Canada and US; 1960 to 2000	Negative
Borjas et al.(2010)	US; 1970 to 2000	Negative
Bratsberg et al. (2014)	Norway; 1993 to 2006	Negative
Card (2009)	US; 1980 to 2006	Positive
D'Amuri et al. (2010)	German; 1975 to 2001	Positive
Lathapipat (2014)	Thailand; 2007	Negative
Manacorda et al. (2012)	UK; 1970 to 2000	Positive
Ottaviano and Peri (2012)	US; 1960 to 2006	Positive
TDRI (2004)	Thailand; 1995	Negative

Source: Author's collection.

Card (2009) studied the U.S. context, specifying cross-city and time series comparisons. His key findings are that workers who have an education below high school level are perfectly substituted with high school education level employees. Secondly, high school workers have an imperfect substitutability with college workers where the elasticity of substitution varies between 1.5 and 2.5. Thirdly, he found that native workers have an imperfect relationship with foreign workers, controlling for education and skill, where the elasticity of substitution is 20. A ten percent increase in the relative supply of immigrants to native workers narrows the relative wage gap between immigrants and indigenous labor within a skill group at a rate of about 0.23 percent.

In addition, D'Amuri et al. (2010) estimated the elasticity of complementarity between workers of different experience, and between native workers and immigrants in Germany. The results all constitute imperfect substitutability at a value of 0.061, and a ten percent spike in immigration raises native wages by 3.3 percent. Moreover, Manacorda et al. (2012) studied the elasticity of complementarity between different ages, and the result was the same with a value of 0.19. He also concluded that low-educated workers suffer from the inflow of immigrants, meanwhile high-educated workers gain from such inflows.

Examining the United States, Ottaviano and Peri (2012) also found a totally positive effect of immigration on native wages in the long run because of the significant degree of imperfect substitutability between foreign and native workers. A ten percent upturn in the share of foreign workers in the totality of full-time workers within a skill group increases wages by about six percent.

In the case of Thailand, there has been many research projects estimating the effects of immigrant workers on domestic wages (TDRI 2004; and Lathapipat, 2014). The first study was conducted in 2004 by Thailand Development Research Institute (TDRI). Employing a computational general equilibrium (CGE) technique, the simulation of 700 thousand migrant workers in 1995 decreased the Thai wages of primary or lower level of education employees by about 3.5 percent. In 2014, Lathapipat (2014) used an updated Thai Labor Force Survey (2007), and found a negative effect of immigration on low-skilled native workers. However, the negative effect is much more severe in the case of existing migrant workers. Likewise, this paper

confirmed the theoretical base that the degree of substitution between migrant and native workers is more than that degree among different-experience workers.

2.5 Key Inferences

In order to estimate the impact of immigration on wage, all past studies employed wage equations using the share of immigrants as a variable of interest. Table 2.3 provides a set of dependent and explanatory variables used in those studies. Most of the literature focused on countries where information is rich because they were able to estimate the set of important variables derived from the theoretical framework. The estimations are based on the individual level with various implications.

However, there is a serious contradiction among such studies. The first group, lead by George J. Borjas, claimed the existence of a negative impact of immigration on wages corresponding to the neoclassic theory. The latter group, lead by David Card, posited a positive impact within the same issue. The answer why they arrive at different results lies in the different definitions of similarly situated workers. When wages are compared, we have to decide which wages we choose. The first group classifies the compared group quite precisely. Meanwhile, the latter group classifies the compared group quite broadly.

Overall, the key determinant of the impact sign depends on the magnitudes of elasticity of substitution in Equation 2.7. However, the total effect will be expressed in the empirical model provided in the next chapter.

Table 2.3
Summary of Reviewed Variables

	Dependent Variables	Explanatory Variables	Researches
Real wage	✓		Auhukorala and Devadason (2012)
Nomimal wage	✓		Aydemir and Borjas (2006), Borjas et al.(2010), Bratsberg et al. (2014)
Wage differnce between immigrant and native workers	✓		Card (2009), Manacorda et al. (2012), Ottaviano and Peri (2012)
Growth of wage	✓		D'Amuri et al. (2010)
Foreign worker dependency		✓	Auhukorala and Devadason (2012), Aydemir and Borjas (2006), Borjas et al.(2010), Bratsberg et al. (2014), Card (2009), D'Amuri et al. (2010), Manacorda et al. (2012), Ottaviano and Peri (2012)
Real output		✓	Auhukorala and Devadason (2012)
Capital intensity		✓	Auhukorala and Devadason (2012)
Skill intensity		✓	Auhukorala and Devadason (2012), Card (2009)
Firm size		✓	Auhukorala and Devadason (2012)
Foreign ownership		✓	Auhukorala and Devadason (2012)
Export orientation		✓	Auhukorala and Devadason (2012)
Industry concentration		✓	Auhukorala and Devadason (2012)
Education attainment		✓	Aydemir and Borjas (2006), Borjas et al.(2010), Bratsberg et al. (2014), D'Amuri et al. (2010), Manacorda et al. (2012), Ottaviano and Peri (2012)
Working experience		✓	Aydemir and Borjas (2006), Borjas et al.(2010), Bratsberg et al. (2014), D'Amuri et al. (2010), Manacorda et al. (2012), Ottaviano and Peri (2012)
Lagged Wage differnce between immigrant and native workers		✓	Card (2009)
City size		✓	Card (2009)
Manufacturing share		✓	Card (2009)
Age of worker		✓	Manacorda et al. (2012)
Time dummy		✓	Auhukorala and Devadason (2012), Aydemir and Borjas (2006), Borjas et al.(2010), Bratsberg et al. (2014), Card (2009), D'Amuri et al. (2010), Manacorda et al. (2012), Ottaviano and Peri (2012)

Source: Author's collection.

CHAPTER 3
INTERNATIONAL MIGRATION IN THAILAND

This chapter outlines the history of international migration in Thailand. Section 3.1 summarizes migration policy in Thailand. Policy development and related regulations are discussed in brief. Trends and patterns of labor migration are discussed in the following section. The last section considers international comparisons. Given the interested criteria, how does Thailand manages migrant workers?

3.1 Migration Policy in Thailand

3.1.1 Development of Migration Policy

The registration system concerning foreign workers was introduced in 1972 to manage unskilled foreign workers. Nonetheless, it was not in urgent need as there were plenty of workers in rural areas who worked within agricultural sectors. After the Thai economy entered a boom period starting in 1986, the pool of abundant labor in rural areas became smaller. The rapid expansion of export-oriented labor intensive sectors such as garments, jewelry, footwear and processed foods, caused a rapid increase in the demand for labor countrywide. This was also boosted by the boom-bust episodes in the real estate and financial sectors. Hence, Thailand experienced labor shortages in certain areas in the early 1990s. This resulted in a policy shift towards partial liberalization. For example, in 1996 the government gave permission to illegal workers to work in specific areas and industries. The specific areas were mostly confined to border provinces. The eight specific industries in which migrant workers able to seek employment were agriculture, construction, sea fishing, extended sea fishing, marine transportation, mining, manufacturing and housekeeping.

Although this policy was not successful because cost of legalization was expensive[1], the number of foreign workers began soaring. This trend was interrupted by the Asian Financial Crisis (AFC) in 1997-8 where there was a temporary policy reversal. Hiring foreign workers was not allowed. In addition, the government enhanced the law enforcement effectiveness targeting illegal migrants so that a number of foreign workers not registered were arrested and repatriated. This was expedited to preserve jobs for locals in the hope that such policy efforts would help mitigate any adverse effects of AFC on employment. It was made under the assumption that foreign and local workers are perfectly substitutable so that preventing the former opens more job opportunities for the latter. Nonetheless, such policy efforts were rather short-lived. Even during the onset of AFC, a number of firms in certain sectors experienced severe labor shortages, indicating that locals prefer certain types of jobs to others.

Between 2001 and 2006, labor shortages became severe, involving a wider range of business sectors. As a result, the government allowed local firms to hire foreign workers. Under the Thaksin Shinawatra administration (2001-2006), the cabinet lifted the restriction that migrant workers could only work in specific areas and industries. This attenuation allowed migrant workers to work in any area and industries. Moreover, migrant workers were able to change employers themselves. The main purpose of this policy was to legalize illegal workers as much as possible. This procedure was known as National Verification (NV). In the next year, however, the reserved jobs were employed again. The registered migrant workers who were Cambodian, Laotian, and Burmese were allowed to work in Thailand for only one year from then on.

In addition, the government established another channel. Thailand negotiated a Memorandum of Understanding (MOU) with Cambodia, Laos and Myanmar commencing in 2002/03. This channel focuses on unskilled migrant workers such as NVs, but migrant workers cannot change the jobs by themselves. This system provides employers a means to hire migrant workers after they fail to hire local

[1] Employers had to report their amount of workers to government, and paid 5,000 baht per one worker. Even though the government lowered the costs and expanded the working areas in 1996.

counterparts. Policymakers seem to have flexibility in managing migrant workers at first glance because they have two tools (NV and MOU channels). Thus, they can eschew one channel, and provide migrants with another channel. However, the cost of legalization when using both channels is still more expensive than exploiting illegal channels (Soyal, 2009).

3.1.1.1 Policy over the Period 2008 to 2013

However, the current policy has had many problems in practice. For example, the registration system took a prolonged time to implement, while the management system was inefficient. Hence in 2008, the new Alien Work Act was introduced with a clearer policy signal towards managing the flow of foreign workers. Under this new act, the legalization of foreign workers with an extension for temporary lodgings was implemented. The Office of Foreign Workers Administration (OFWA) classified the immigrants who have rights to work in Thailand into three sections: employees qualifying under sections 9, 12 and 13.

Within Section 9, there are four types of workers. Lifelong workers comprise the group of workers who came to Thailand in about 1972. At that time, the lifelong qualification was possible to obtain. Second, temporary workers are mostly skilled workers who come from foreign companies to work in highly skilled jobs. Third, national verification workers consist of illegal workers in the past who were managed under the NV procedures in 2001. The management system affecting this type of workers was completed in 2006. Such workers would be registered after proving their nationalities in order to obtain a work permit, the so-called “pink card”. Next, they would be required to get a temporary passport and certificate of identity, before changing their “pink card” to a “green card”. The fourth category refers to MOU workers imported from associate countries (Cambodia, Laos and Myanmar).

Section 12 includes foreign workers who come under the auspices of special laws, such as Investment Promotion, the Industrial Estate Authority of Thailand Act, etc. The majority of such workers are skilled and operate in the industrial and service sectors.

Section 13 comprises two types of workers. First, it covers foreign workers who are exiled under international laws, and wish to dwell in Thailand for a temporary period. Second, workers who cannot register under section 9. Year by year, the extension for lodging in Thailand is extended by cabinet mandate. It involves mostly unskilled workers, waiting to expedite their repatriation process.

3.1.1.2 Policy over the Period 2014 to the Present

In 2014, the National Council for Peace and Order (NCPO) introduced the Committee on Foreign Worker and Human Trafficking Policies and Management (KNR), in order to solve problems concerning migrant workers. In June 2014, they focused on solutions for human trafficking. Even through the policy was effectively set up in principle, it was delayed in practice. Hence, the NCPO introduced a One Stop Service in every province to enable migrant workers to register to obtain work permits.

Section 14 was concluded in February 2015 and includes foreign workers whose nationalities comprise countries geographically connected to Thailand who are allowed to work only in the area immediately connected to their hometown. This category allows foreign workers to enter Thailand with a border pass. They are also requested to have work permits, and are allowed to work in restricted areas only.

So far, the policy stance still involves the legalization of foreign workers with an extension for temporary lodging. The migrant workers in the NV process are allowed to work in Thailand for a maximum of six years. If they would like to return and work again, they have to register under the MOU process instead. A policy timeline of significant policy shifts is compiled in Table 3.1.

Table 3.1

Policy Timeline

Year	Policy/Regulation
1992-1998	Permission to migrant labor the right to work in a specific area and industries.
1999	Extension of the current policy; dealing with the issue of work categories open to migrants, and the creation of a quota system.
2000	Restriction that migrant workers can only do unskilled jobs.
2001	National verification (NV) procedure started for the purpose of making illegal workers become registered. Moreover, the establishment of a National Committee on Illegal Worker Administration (NCIWA).
2002	Extension of the policy of 2001 which introduced the implication that workers can change employers by themselves. Moreover, the Thai-Lao Bilateral MoU was concluded.
2003	Cabinet decision for renewal of one-year work permits. Conclusion of Thai-Cambodia and Thai-Myanmar Bilateral MoUs.
2004	NCIWA approved National Master Plan for Illegal Migrants introducing a new registration system. Migrant workers can obtain 13-digit identification cards.
2005	The government has an explicit plan for controlling the flow of migrant workers via seven strategies; (1) managing the system of immigrant outsourcing, (2) standardizing the channels through which immigrants arrive, (3) intercepting flows of illegal workers, (4) suppressing and litigating human trafficking, (5) promoting sending back immigration, (6) advertising a new system of immigrant outsourcing, and (7) monitoring and assessment.
2006	Cabinet decision extending temporary lodging for non-registered migrant workers who are waiting for the NV process, or for repatriation processes. Such migrants can work in additional one-year contracts.
2008	2008 Alien Work Act implemented, which remains valid up until now.
2009-2013	Period of legalization of migrant workers. Extension of temporary lodging available.
2014	National Council for Peace and Order (NCPO) introduced the Committee on Foreign Worker and Human Trafficking Policies and Management (KNR), in order to solve foreign workers' problems. In recent months, the One Stop Service was introduced.
2015	A period of solving problems of human trafficking. The Labor Minister presented policies to Ministry of Labor's executives on the continuation of policies on resolving IUU fishing restrictions to lift Thailand from the Tier 3 category.
2016	Continuation of legalization of migrant workers.
2017	New policy known as the *Decree on the Management of Foreign Workers Act 2017* introduced in 29 June 2017.

Sources: Office of Foreign Workers Administration, tabulated by the author.

3.2 Trends and Patterns within Labor Migration in Thailand

3.2.1 Trends and Patterns

To the year 2000 was the first time that the Office of Foreign Workers Administration reported the aggregate number of migrant workers in Thailand. Later on, migrant workers were able to be classified by key sectors in 2006. This included agriculture, manufacturing, construction and services. However, the structure of the registration system was poor because only the total amount of foreign workers was made known within each sector. The government was unable to track foreign workers because they lack of employer information. Another important shift occurred in 2009 when migrant workers switched from being classified as illegal to being legal. The official report comprised reliable data providing the number of national verification and MOU workers with classifications by key sectors.

The number of registered foreign workers increased from 101,834 (0.3% of the labor force) in 2000 to 1,476,841 (3.6% of the labor force) in 2016 (see Table 3.2). In other words, the stock of registered foreign workers increased more than 14 fold since 2000. However, this official number of foreign workers is an underestimation because it fails to include non-registered foreign workers. In 2014 the International Labor Organization reported that Thailand received more than 3.7 million foreign workers (9.8% of the labor force). Thus, more than 2.3 million foreign workers are non-registered, and the official database does not include their information. Another data source concerning foreign workers is the 2012 Labor Force Survey (LFS), but the size of foreign workers therein is also underestimated (accounting for only 0.7 million workers).

Section 9 covers more than 94 percent of registered foreign workers as of 2016. This share increased from 10.9 to 94.6 percent in a decade. The majority of this section is made up of the National Verification (60.8 percent) and Memorandum of Understanding (26.6 percent) groupings. The rest comprise sections 12 and 13, which accounted for only five percent of registered foreign workers.

Before 1990 registered migrant workers in Thailand mostly consisted of skilled workers from developed countries such as Japan, India, England, etc. However,

the recruitment network has shifted from receiving skilled workers to receiving unskilled workers because Thailand has achieved an increase in economic growth between 1990 and 2000. It became a magnet for migrants from neighboring countries. Those registered unskilled workers which accounted for more than 80% of total migrant workers were from Myanmar, Laos and Cambodia (see Table 3.3). They were mostly categorized as temporary, low-skilled migration; especially in 3-D jobs (dirty, dangerous, and difficult).

Up to 67 percent of the migrant workers were from Myanmar over this decade. In Figure 3.1, their number started from 575 thousand in 2006 before climbing to 940 thousand workers in 2016. Such a spike was predicated by two reasons. First, the political changes in 2008 drove Myanmar workers to Thailand because they strove to avoid political difficulties and uncertain conditions. Another reason is that there was an increase in Foreign Direct Investment (FDI) in Myanmar in 2011. This event pulled Myanmar workers from Thailand because FDI growth stimulates employment.

From about the late 1990s migrant workers in Thailand sought work as servants, classified under the services sector. Later on, the pattern shifted towards the manufacturing sector, which indicated a tightening labor market within the Thai economy (Beesey, 2004). The share of registered migrant workers in the manufacturing sector increased from about 16.8% in 2008 to 39.6% in 2016 (Table 3.4).

The manufacturing sector has become the main destination for foreign workers. It is important to note that while other non-manufacturing sectors experienced a declining relative importance, the number of foreign workers in these sectors increased. As we expected, the highest share of foreign workers was still in the manufacturing sector in 2016 (8.52 percent).

The majority of migrant workers are classified as unskilled workers[2]. From 2008 to 2016, the share of unskilled workers increased across all sectors (Table 3.5). In particular, the share in manufacturing soared from 65.1 to 94.7, and the share in services jumped from 75.3 to 95.8.

[2] Unskilled workers are workers who come to Thailand by NV, MOU and Section 13 channels.

Table 3.2

Trends Concerning Registered Foreign Workers in Thailand

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Section 9	10.9	13.7	16.0	12.2	26.7	33.4	80.3	94.6	95.5	95.1	94.6
Lifelong	1.7	2.0	2.1	0.9	1.1	0.1	0.1	0.1	0.1	0.0	0.0
Temporary	9.2	11.7	14.0	4.4	5.3	3.8	7.3	8.3	7.5	7.2	7.2
National Verification	0.0	0.0	0.0	5.0	17.1	25.9	64.7	71.6	72.5	68.5	60.8
Memorandum of Understanding	0.0	0.0	0.0	1.8	3.2	3.7	8.2	14.7	15.4	19.3	26.6
Section 12	2.8	3.4	3.9	1.5	1.7	1.3	2.6	3.0	2.8	2.8	2.9
Investment Promotion	2.8	3.4	3.9	1.5	1.7	1.3	2.6	3.0	2.8	2.8	2.9
Section 13	86.4	82.9	80.0	86.4	71.6	65.2	17.1	2.4	1.7	2.0	2.0
Minority	0.0	0.0	0.0	1.3	1.7	1.2	2.3	2.4	1.7	2.0	2.0
Cabinet Decision 3 Countries	0.0	0.0	0.0	85.1	69.8	64.0	14.8	0.0	0.0	0.0	0.0
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Total %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number (000s)	826.4	719.5	702.6	1544.9	1335.2	1950.7	1134.1	1183.8	1339.8	1443.5	1476.8

Sources: Office of Foreign Workers Administration, tabulated by the author.

Note: The data for NV and MOU are available from 2009 onwards, where missing values are reported as 0.0. Since 2012 migrant workers categorized under Cabinet Decision for three nationalities which have been legalized into the NV and MOU groups.

Table 3.3

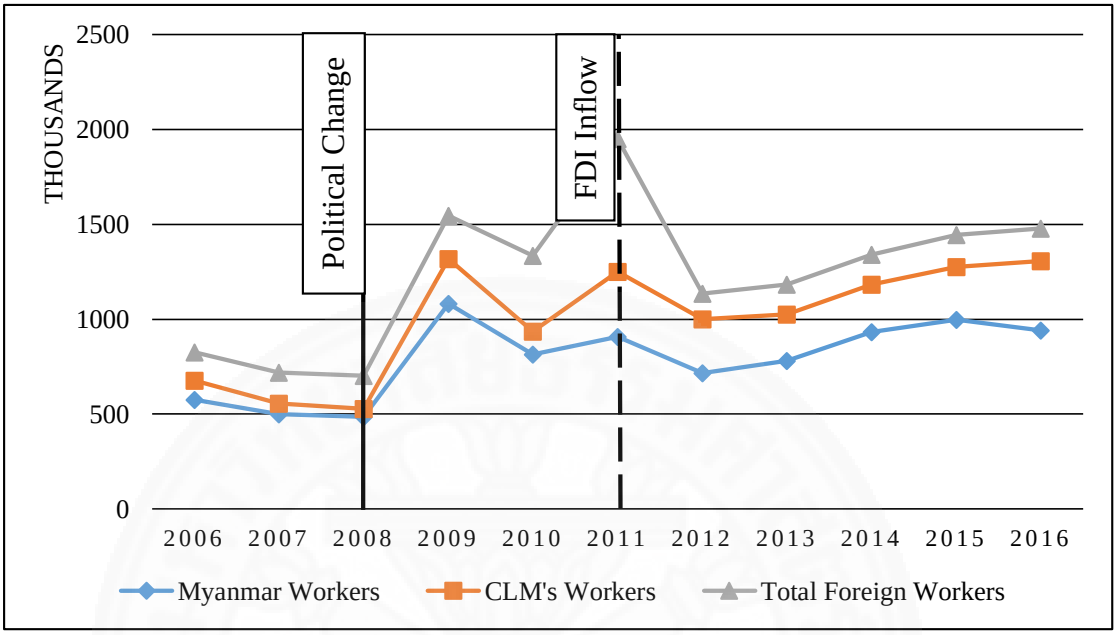
Trends Concerning Registered Foreign Workers in Thailand (Classified by Nationalities)

Nationality	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Japanese	3.03	3.77	4.69	1.50	1.80	1.33	2.62	3.00	2.65	2.54	2.47
Chinese	1.31	1.75	2.15	0.56	0.68	0.49	1.06	1.28	1.27	1.30	1.50
English	1.25	1.57	1.93	0.55	0.64	0.46	0.87	0.93	0.80	0.75	0.72
Indian	1.22	1.51	1.74	0.52	0.61	0.44	0.82	0.91	0.82	0.83	0.84
American	0.95	1.22	1.54	0.43	0.53	0.38	0.72	0.78	0.64	0.61	0.59
Burmese	75.93	77.51	78.56	69.98	61.08	46.55	63.10	65.90	69.70	69.04	63.65
Lao	6.85	5.19	4.59	7.18	4.71	5.49	7.15	5.15	4.04	4.72	7.17
Cambodian	6.38	3.54	2.21	8.08	4.23	12.07	17.82	15.67	14.55	14.57	17.54
Shan	2.66	3.44	1.96	0.70	0.88	0.63	1.18	1.21	0.78	1.01	0.87
Karen	0.41	0.50	0.62	0.05	0.11	0.09	0.20	0.22	0.19	0.21	0.21
Other	0.00	0.00	0.00	10.45	24.73	32.07	4.46	4.95	4.57	4.42	4.43
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Number (000s)	757.94	644.71	617.21	1544.90	1335.16	1950.65	1134.14	1183.84	1339.83	1443.47	1476.84

Sources: Office of Foreign Workers Administration, tabulated by the author.

Figure 3.1

Detailed Trends Concerning Registered Foreign Workers in Thailand



Sources: Office of Foreign Workers Administration.

Table 3.4

Thailand: Distribution of Registered Foreign Workers by Key Sectors (%)

Sector	2008		2010		2016	
	a	*b*	*a*	*b*	*a*	*b*
Agriculture*	17.01	0.81	19.72	1.43	15.65	1.64
Manufacturing	16.78	2.19	31.21	6.18	39.60	8.52
Construction	13.96	4.26	14.89	6.69	10.72	6.78
Services	52.25	2.40	34.18	2.30	34.03	2.79
Total %	100.00	1.86	100.00	2.78	100.00	3.57
Number (000s)	702.67	37706.30	1058.88	38037.30	1369.66	38330.40

Sources: Office of Foreign Workers Administration and the Ministry of Labor.

Note: There are another two years available (2012, 2014), but data problems are severe and create unrealistic patterns. Symbol *(a)* represents share of total migrant workers, while symbol *(b)* represents share of total employment in Thailand. * Includes forestry, fishing and mining.

Table 3.5

Thailand: Distribution of Registered Foreign Workers by Key Sectors

(% of Skilled and Unskilled Workers)

Year		Sector				
		Agriculture*	Manufacturing	Construction	Services	Total
2008	Skilled	3.2	34.9	5.0	24.7	20.0
	Unskilled	96.8	65.1	95.0	75.3	80.0
2010	Skilled	1.2	9.5	2.0	18.3	9.8
	Unskilled	98.8	90.5	98.0	81.7	90.2
2016	Skilled	0.8	5.3	0.1	4.2	3.7
	Unskilled	99.2	94.7	99.9	95.8	96.3

Source: Office of Foreign Workers Administration

Note: The skilled workers include migrant workers in Section 9 (only lifelong and temporary) and Section 12, while unskilled workers include migrant workers in Section 9 (NV and MOU) and Section 13. * Includes forestry, fishing and mining.

More than 50 percent of migrant workers are employed in the food, textiles and garment industries. The concentrations of such workers conform to the patterns of total workers within the Thai manufacturing sector (Table 3.6). Output shares in the food, electronics and electrical and transport equipment industries accounted more than 45 percent of total output share. Interestingly, one of these is foreign-worker dependent. This is different from other groups of export-orientated industries, including rubber, electronics and electrical and scientific/measuring equipment. There are two main reasons to explain this factor. First, jobs in those industries are classified as reserved for native workers. Second, the skill requirements in such industries are higher than foreign workers typically possess. Meanwhile, up to 46 percent of the share of foreign ownership has concentrated in the nuclear fuel, electronics and electrical and scientific/measuring equipment industries. Thus, there has been no correlation between foreign ownership and share of foreign workers because of unmatched skill requirements.

Table 3.6

Thai Manufacturing, Key Indicators of the Structure, Total-Worker, and Foreign-Worker Dependences (1997, 2006, and 2012)[1] (%)

ISIC	Industry	Structure				Total Workers		Foreign Workers	
		Output Share	Export Share	Export Orientation	FOS Share	Distribution by Industry		Distribution by Industry	Share in total employment
						Total	Unskilled		
151-4	Food	13.0	12.5	3.2	0.8	17.0	22.5	28.6	15.8
155	Beverages	4.2	0.8	0.8	0.3	1.8	1.2	0.6	3.0
160	Tobacco	2.3	0.1	3.1	0.9	0.5	1.0	0.0	0.0
171-3	Textiles	3.7	2.9	5.6	1.6	7.7	9.8	17.3	24.7
181-2	Garments	2.4	3.7	6.6	1.6	7.7	4.3	9.8	12.0
191	Leather	0.4	0.5	7.7	2.1	0.9	0.8	2.1	23.5
192	Footwear	0.7	0.8	7.3	2.0	1.9	1.5	4.3	21.6
201-2	Wood and wood products	1.2	1.0	5.5	0.4	2.6	2.5	1.4	5.2
210,221-3	Publishing	4.3	1.2	1.4	1.1	4.2	2.1	2.8	6.3
232	Petroleum	2.9	2.0	5.3	4.8	0.4	0.2	0.0	0.0
233	Nuclear fuel	0.0	0.0	5.0	16.5	0.0	0.0	0.0	0.0
241-3	Chemicals	5.8	3.6	9.1	5.6	4.3	3.3	1.3	2.9

Table 3.6 (Continued)

ISIC	Industry	Structure				Total Workers		Foreign Workers	
		Output Share	Export Share	Export Orientation	FOS Share	Distribution by Industry		Distribution by Industry	Share in total employment
						Total	Unskilled		
251	Rubber	4.4	10.2	15.9	6.3	3.0	4.1	2.4	7.6
252	Plastic	2.8	1.6	5.8	5.7	4.7	5.4	3.0	6.0
261	Glass	0.5	0.4	9.4	4.2	0.5	0.5	4.6	31.4
269	Nonmetallic mineral	3.6	1.3	1.7	0.6	4.8	4.3	3.1	6.1
271-3	Basic metal	3.3	2.1	5.4	4.7	2.0	1.2	1.8	8.7
281, 289	Fabricated metal	4.0	2.7	1.2	1.6	5.4	4.3	1.5	2.6
291-293	Machinery	4.3	5.5	6.9	6.7	4.4	5.4	0.8	1.8
300, 311-5, 319, 321-3	Electronics and electrical	15.3	31.3	14.5	16.1	11.9	12.6	2.0	1.6
331-3	Scientific/ Measuring Equipment	1.3	2.7	22.4	14.2	1.1	1.2	0.0	0.0

Table 3.6 (Continued)

ISIC	Industry	Structure				Total Workers		Foreign Workers	
		Output Share	Export Share	Export Orientation	FOS Share	Distribution by Industry		Distribution by Industry	Share in total employment
						Total	Unskilled		
341-3, 351-3, 359	Transport equipment	16.6	9.0	9.8	9.7	6.0	4.8	2.7	4.2
361	Furniture	1.2	0.9	3.7	0.7	3.0	3.8	6.4	20.1
369	Other	1.8	3.2	13.2	5.6	4.1	3.3	3.3	7.7
371-2	Recycling	0.0	0.0	2.8	1.6	0.1	0.1	0.0	0.0
	Total	100.0	100.0	29.6	23.1	100.0	100.0	100.0	9.4

Source: Calculated from Industrial Census and Household Socio-Economic Survey provided by the National Statistical Office, Thailand.
Abbreviation: ISIC = international standard industrial classification; FOS = Foreign Ownership.

[1] Reported values are 3-year annual average. However, export share, export orientation, and FOS share are 2-year latest annual average.

[2] Obtained from Household Socio-Economic Survey (SES) provided by the National Statistical Office (NSO). Reported values are 2-year annual averages between 2011 and 2013.

[3] Exports as a percentage of gross output.

3.3 Costs and Procedures in Hiring Unskilled Foreign Workers in Thailand

Currently, firms can hire unskilled foreign workers through three channels. They can hire existing registered foreign workers who enter Thailand with work permits, but without specific firms. They are allowed to work for any enterprises. To obtain work permits, these foreigners must complete a form, perform a medical examination and make a payment of 4,450 baht. These workers must renew their work permit every year. The cost of renewing a work permit is 1,200 baht. If these workers fulfill all requirements, they will receive a work permit (known as a green card). The second category concerns hiring workers who initially illegally entered Thailand and later registered with the government. Firms are allowed to hire these workers, but there are some procedures to follow. Such workers must be registered with a clear indication where they work and who they work for. While waiting for the nationality identification process to be completed, these workers will be issued temporary work permits, known as pink cards. They are not allowed to change jobs or employees. These workers can work continuously for four years maximum. After four years, they have to return home for at least three years before coming back.

Second, firms can express their demand for using foreign workers to the Office of Foreign Workers Administration (MOU channels) before being able to directly hire foreign workers. To complete this process, there is a four-step requirement. Firstly, employers notify their demand for using foreign workers at any Employment Office. Secondly, they submit a petition form and complete related documents. Then, recruitment companies will send a name list to employers to choose their employees. Thirdly, employers file a request instead of employees. Lastly, the work permits for foreign workers are issued and are able to be obtained when foreign workers come to Thailand. This incurs yearly costs to employers at a rate between 2,000-3,600 Baht. The whole process takes 25 days to complete. Workers cannot change jobs without the permission of employers.

Lastly, in Section 14 there is an alternative choice for hiring foreign workers in the short term. These registered workers can work continuously for one month maximum, and are still required to have work permits. To obtain work permits,

these foreigners must undertake the same process as with workers in category 1. However, the cost is cheaper at a rate of 325 Baht per three months.

3.4 Implications from Remittance Flows

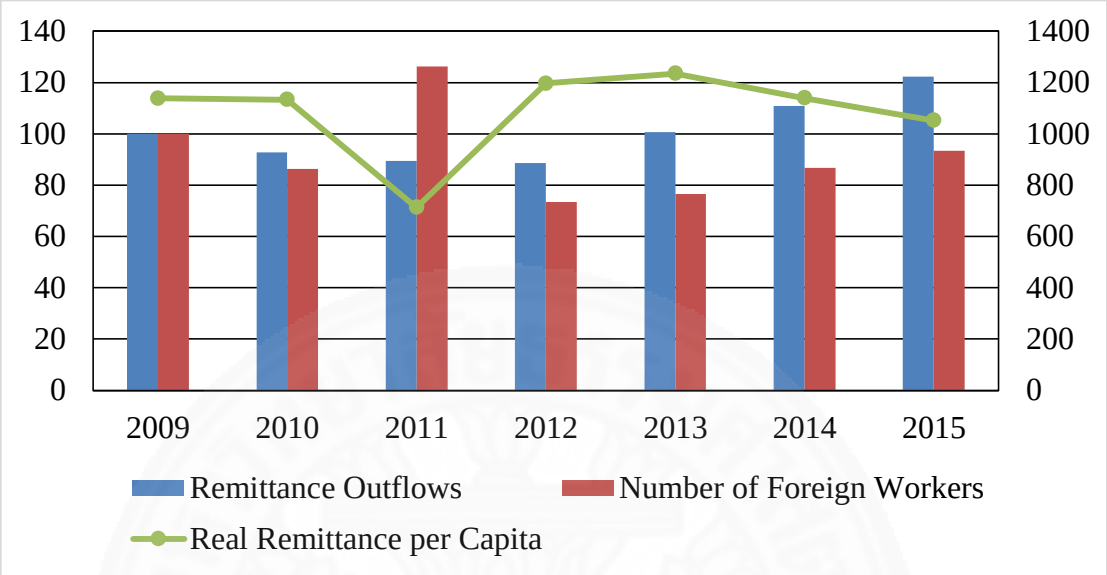
As the number of foreign workers increased, an upward trend in remittances was observed. Remittance outflows from Thailand increased from 13.49 million USD in 1975 to 3,992.37 million USD in 2015. In 2015 most was sent to Myanmar ($1,848 million), China ($840 million) and Japan ($352 million).

One feature of this outflow is that it can indicate cross-border smuggling in Thailand by analyzing the accordance between remittance outflows and the number of foreign workers (see left side of Figure 3.2). The total amount of remittances and number of foreign workers are normalized to indexes for which the reference year is 2009. We observe that in 2012 the number of foreign workers dramatically dropped, but the amount of remittance outflows still increased overtime. One elaboration is that the total number of foreign workers increased, but they do not register in the formal system.

Interestingly, the yearly real remittance per worker varies between $1,000 and $1,200 except 2011 (see right side of Figure 3.2). In other words, foreign workers still remit their money in the same amount regardless to the increasing number of foreign workers in Thailand. This reflects the fact that wage paid to foreign workers is not depressed because this workers is in need.

Figure 3.2

Remittance Outflows and Number of Foreign Workers in Thailand



Sources: World Development Indicators, World Bank and OFWA.

3.5 International Comparison

From the international perspective, Thailand was the largest labor importer in terms of absolute number of migrant workers (3.8 million), and was second in terms of migrant share to total employment after Malaysia (see Table 3.7). Most of migrant workers came from CLM countries, which is different from the case with Malaysia (second largest labor-importing country). Most migrant workers in Malaysia were from China, Indonesia and India. Such different origins imply that Thailand would still receive workers from CLM countries because they are not competing with each other.

Comparisons with aging economies is presently in focus because Thailand is projected to become an aging economy in the near future. The large labor importers in this group are Singapore, which experiences a more than 37.41 percent rate of migrant share to total employment and the United States of America which has a rate of more than 33.48 percent. The implication is that Thailand might find it necessary to employ more migrant workers when it eventually becomes recognized as an aging economy.

Table 3.7

International Migrant Workers (Classified by Interested Countries)

	Total employment*	Employed migrant workers*	Share of migrants to total employment (%)
Developing East Asia	*292200*	*6395*	*2.19*
Thailand	38016	3722	9.79
Cambodia	8060	49	0.61
Myanmar	21873	119	0.55
Lao PDR	2606	14	0.52
Indonesia	114819	66	0.06
Malaysia	14068	2127	15.12
Mongolia	1270	17	1.36
Philippines	38651	213	0.55
Vietnam	52838	68	0.13
Aging Economy	*979298*	*51771*	*5.29*
Singapore	3624	1356	37.41
Japan	65302	2437	3.73
China	770000	978	0.13
US	140372	47000	33.48

Source: International Labor Organization database, 2014.

Note (1) ∗ represents the number in thousand units.

(2) The migrant workers in Thailand included both registered and non-registered labor.

CHAPTER 4
EMPIRICAL ANALYSIS

This chapter begins with a discussion of the research methodology employed in this thesis. (Section 4. 1). Generally, there are two approaches, one concerns the simulation experimental analysis derived from the theoretical model of labor demand and the other econometric analysis where all policy-relevant variables are captured in an eclectic fashion. There are both pros and cons inherent in each, so that combining the two approaches is used in a complementary manner to constitute a robustness check. Data sources and variable construction are discussed in Section 4.2.

4.1 The Empirical Model

As mentioned above, there are two approaches used in the literature to estimate the effects of foreign workers on domestic wages. The first approach involves the simulation experiments. The core model is based on the theoretical model wherein firms maximize their profits where heterogeneous labor is allowed. The key parameters and elasticity of substitution across worker groups used in the simulation are estimated coefficients from wage equations where relative wages, the dependent variable, is a function of worker characteristics such as education, work experience and nationality. This approach is employed in many key studies in labor economics (Aydemir and Borjas, 2006; Card, 2009; Borjas et al., 2010; D'Amuri et al., 2010; Manacorda et al., 2012; Ottaviano and Peri, 2012; Bratsberg et al., 2014), when long-period panel data sets regarding employment are available (See Table 2.2 in Chapter 2).

The main advantage of this approach is that the constructed model is fully informed by theories related to workers' decisions. In particular, demand for labor is derived from firms' profit maximization where labor is categorized according to nationality, education and work experience. Hence, the estimated coefficient captures the effect of these factors on wages. The main shortcoming is that amassing such data is demanding. In particular, we need to have yearly individual data on wages, education, experiences and nationalities. Hence, data availability becomes a necessary

condition in obtaining reliable outcomes. In addition, the availability of long-period data panel data is also crucial. This is done to obtain the reliable estimates of substitution elasticity among worker groups. Such data sets are not always available in many countries, including Thailand.

To the best of our knowledge so far, there have been two Thai studies which adopted this approach, one of which was Lathapipat (2014), which used a labor force survey from 2007 (data for 2006). This data set is cross-sectional as sample identification in each year is not systematically collected and revealed. This could be problematic as the well-known shortcoming of such cross-sectional data sets is the relationships revealed are assumed to be at a steady-state equilibrium. This assumption could be restrictive in reality especially, when labor markets in developing countries are concerned. In fact, the decision of a firm to hire a worker could be influenced by existing market imperfections and/or constraints, such as location, financial considerations, information imperfection and selecting siblings over and above the standard determinants (e.g. wage, experience, education and nationality).

Alternatively, an econometric analysis is undertaken to obtain estimated wage equations where explanatory variables are nested in an eclectic manner. So far this method has been systematically employed in the recent study by Athukorala and Devadason (2012).[1] The main advantage of this approach is that it requires much less information than the previous methodology. Any possible market imperfections and constraints, as well as other policy-relevant variables (e.g. export-orientation, presence of foreign firms, producer concentration), can be explicitly examined. This is highly relevant in the context of developing countries where many constraints are binding due to the presence of cumbersome regulation. The main shortcoming is that the model is not fully derived from the standard economic theory (e.g. optimization). Hence, both two approaches are employed in this thesis with appropriate comparisons.

[1] There was a Thai study by Kulkolkarn and Potipiti (2007). However, the analysis was subject to severe regression problem because they omitted the roles of experience, time, and capital variables. As we can see from the regression results, they are inconsistent subject to their alternative estimations.

4.1.1 The Simulation-based Model

As mentioned above, the only data available to perform correct simulation experiments is cross-sectional. Following Lathapipat (2014), province is used as a proxy of time dimension to overcome problems caused by absence of panel data. Hence, in the following discussion, t and p, denote time and provinces respectively, and are used in an interchangeable manner.

To obtain elasticity measures of all of the substitution parameters used in the simulation, we begin with wage difference equation between migrants (M) and natives (N) with a given education background (k), skill intensity (b), and work experience (j) in province (p). This comprises a focus on the effect of nationality on wages which is a function of differences in productivity $\left(\theta_{Mkj} / \theta_{Nkj}\right)$ and the relative importance of migrants to native workers $\left(M_{kjp} / N_{kjp}\right)$ (See Equation 4.1). The former is measured by an unobservable fixed-effect. The elasticity of substitution between locals and foreign workers is measured by the estimated coefficient corresponding to $\left(M_{kjp} / N_{kjp}\right)$. In particular, a one per cent increase in migrants (M) narrows down wage differences by $(1/\sigma_M)$ per cent, all other things being equal.

$$\ln\left(\frac{w_{Mbkjp}}{w_{Nbkjp}}\right) = \ln\left(\frac{\theta_{Mkj}}{\theta_{Nkj}}\right) - \frac{1}{\sigma_M}\ln\left(\frac{M_{kjp}}{N_{kjp}}\right) \tag{4.1}$$

Where (w_{Mbkjp} / w_{Nbkjp}) represents the wage difference between migrants and native workers at given b, k, j, and p. $(\theta_{Mkj} / \theta_{Nkj})$ represents migrant-native productivity differences at a given k and j. Subscript b, k, j, and p indicate skill intensity (low, and high), education level (primary, secondary, vocational, and college), work experience and province, respectively.

The productivity difference in Equation 4.1 is obtained by replacing by education by experience fixed effects (I_{kj}) as in Equation 4.2. Thus, Equation 4.1 can be estimated by the following equation:

$$\ln\left(\frac{w_{Mbkjp}}{w_{Nbkjp}}\right) = I_{kj} - \frac{1}{\sigma_M}\ln\left(\frac{M_{kjp}}{N_{kjp}}\right) + u_{bkjp} \tag{4.2}$$

Where (I_{kj}) reflect 16 education by experience fixed effects and (u_{bkjp}) is a specific error term of nationality.

Next, we focus on the effect of experience on wages. Note that migrants and native workers are combined as a single category of worker at given levels of k, j, and t (L_{kjt}) with elasticity of substitution between them at $(1/\sigma_J)$. This is the aggregation of Equation A.7 and A.8 in Appendix A which implies the relationship between average wages paid to this single category of worker $(\overline{w}_{bkjt})$ and its supply (L_{kjt}). Hence, the observations in this stage involve workers with different education background, experience, and skill intensity. At this stage, the composite of labor supply (L_{kjt}) allows us to perform a panel estimation onwards, where province dimension (p) is switched into time dimension (t).

To capture the effect of experience on wages in practice, in Equation 4.3, the marginal pricing conditions for each education level and experience category, are estimated. In Equation 4.3, there are three unobservable fixed effects, which are yearly fixed effects (I_t), year by education fixed effects (I_{kt}), and education by experience fixed effects (I_{kj}). The roles of these three controlling variables are derived according to profit maximization procedure. In particular, a one per cent increase in combined labor supply (L_{kjt}) narrows down the average wages paid by $(1/\sigma_J)$ per cent, all other things being equal. Thus, we can obtain the following equation:

$$\ln\left(\overline{w}_{bkjt}\right) = \ln\left(\alpha A_t k_t^{1-\alpha}\right) + \frac{1}{\sigma_{HL}}\ln(\mathrm{L}_t) + \ln(\theta_{bt}) - \left(\frac{1}{\sigma_{HL}} - \frac{1}{\sigma_{bb}}\right)\ln(\mathrm{L}_{bt}) + \ln(\theta_{kt})$$
$$-\left(\frac{1}{\sigma_{bb}} - \frac{1}{\sigma_J}\right)\ln(\mathrm{L}_{kt}) + \ln(\theta_{kt}) - \frac{1}{\sigma_J}\ln\left(L_{kjt}\right) \tag{4.3}$$

Where (k_t) is the capital-labor ratio and $(\bar{w}_{bkjt})$ is the weighted average wage between foreign and native workers in a combined labor supply. After we control for the effect of unobservable fixed effects, Equation 4.3 is estimated as follow:

$$\ln\left(\bar{w}_{bkjt}\right) = I_t + I_{kt} + I_{kj} - \frac{1}{\sigma_J}\ln\left(L_{kjt}\right) + u_{kjt} \tag{4.4}$$

Where (I_t) are 28 time fixed effects (1986-2013), (I_{kt}) are 112 education by time fixed effects, and (I_{kj}) are the same fixed effects used in Equation 4.2. (u_{bkjp}) is an education and experience specific error term.

Next, we focus on the effect of education background on wages. Note that migrants and native workers are combined as a single category of worker at given levels of k, and t (L_{kt}) with elasticity of substitution between them at $(1/\sigma_{bb})$. This is a one level further aggregation of Equation A.7 and A.8 in Appendix A which implies a relationship between average wages paid to that single category of worker $(\bar{w}_{bkt})$ and its supply (L_{kt}). Hence, the observations in this stage concern workers with different skill intensity, and education background.

To capture the effect of education background on wages in practice, Equation 4.6 is estimated. The combined labor supply measure (L_{kt}) is constructed using Equation A.4. In that equation, it is a function of experience-education specific relative efficiency (θ_{kj}), elasticity of substitution between workers with different experience levels (σ_j), and a single category of worker at given levels of k, j, and t (L_{kjt}). The former is estimated by following Ottaviano and Peri (2012), while the rest are obtained from Equation 4.4. The estimations of $\left(\hat{\theta}_{kj}\right)$ are calculated from the education by experience fixed effects using the following normalized formula:

$$\hat{\theta}_{kj} = \frac{\exp(\hat{I}_{kj})}{\sum_{j=1}^{4}\exp(\hat{I}_{kj})} \tag{4.5}$$

$$\ln\left(\bar{w}_{bkt}\right) = \ln\left(\alpha A_t k_t^{1-\alpha}\right) + \frac{1}{\sigma_{HL}}\ln(\mathrm{L}_t) + \ln(\theta_{bt}) - \left(\frac{1}{\sigma_{HL}} - \frac{1}{\sigma_{bb}}\right)\ln(\mathrm{L}_{bt})$$

$$+ \ln(\theta_{kt}) - \frac{1}{\sigma_{bb}}\ln(\mathrm{L}_{kt}) \qquad (4.6)$$

Where $(\bar{w}_{bkt})$ is the weighted average wage in the same skill intensity group b and specific education group k at time t. Note that Equation 4.6, represents an abbreviated equation of two hidden equations where the subscript $\mathrm{b} \in \{\mathrm{L},\mathrm{H}\}$. In order to estimate the effect of education background (k) within the same skill intensity group (b), we employ the method proposed by Katz and Murphy (1992). Thus, we can take a different expression (4.6) for any pair of schooling groups within the same skill intensity to obtain Equation 4.7 and 4.8.

$$\ln\left(\frac{\bar{w}_{HSt}}{\bar{w}_{PRt}}\right) = \ln\left(\frac{\theta_{HSt}}{\theta_{PRt}}\right) - \frac{1}{\sigma_{LL}}\ln\left(\frac{L_{HSt}}{L_{PRt}}\right) \qquad (4.7)$$

$$\ln\left(\frac{\bar{w}_{COt}}{\bar{w}_{TVETt}}\right) = \ln\left(\frac{\theta_{COt}}{\theta_{TVETt}}\right) - \frac{1}{\sigma_{HH}}\ln\left(\frac{L_{COt}}{L_{TVETt}}\right) \qquad (4.8)$$

Equation 4.7 expresses the effect of education background on wages in a low skill intensity group (primary and high school), while Equation 4.8 expresses the case of high skill intensity (vocational and college). In both equations, the productivity differences are replaced by time fixed effects in the same manner. Thus, the empirical transformations of those two equations are the following:

$$\ln\left(\frac{\bar{w}_{HSt}}{\bar{w}_{PRt}}\right) = I_{Lt} - \frac{1}{\sigma_{LL}}\ln\left(\frac{\hat{L}_{HSt}}{\hat{L}_{PRt}}\right) + u_{Lt} \qquad (4.9)$$

$$\ln\left(\frac{\bar{w}_{COt}}{\bar{w}_{TVETt}}\right) = I_{Ht} - \frac{1}{\sigma_{HH}}\ln\left(\frac{\hat{L}_{COt}}{\hat{L}_{TVETt}}\right) + u_{Ht} \qquad (4.10)$$

Where $(\bar{w}_{HSt} / \bar{w}_{PRt})$ represents the wage differences between high school and primary workers, while $(\bar{w}_{HSt} / \bar{w}_{PRt})$ represents the wage differences between college and vocational workers. Note that the time fixed effects (I_{Lt}) and (I_{Ht}) control the variations in productivity differences in low skill and high skill groups, respectively.

Finally, we focus on the effect of skill intensity on wages. Note that migrants and native workers are combined again as a single category of worker at given levels of b, and t (L_{bt}) with the elasticity of substitution between them at $(1/\sigma_{HL})$. This is a top level aggregation of Equation A.7 and A.8 in Appendix A which implies a relationship between average wages paid to the single category of worker $(\bar{w}_{bt})$ and its supply (L_{bt}). Hence, the observations in this stage concern workers with different skill intensity.

To capture the effect of skill intensity on wages in practice, Equation 4.13 is estimated. The combined labor supply (L_{bt}) is constructed using Equation A.3. In that equation, it is a function of the education specific relative productivities (θ_{kt}), elasticity of substitution between workers with different education levels (σ_{bb}), and a single category of worker at given levels of k, and t (L_{kt}). The former is estimated as before, while the rest are obtained from Equations 4.9 and 4.10. The estimations of $(\hat{\theta}_{kt})$ are calculated from the education fixed effect using the following normalized formula:

$$\hat{\theta}_{lt} = \frac{\exp(\hat{I}_{bt})}{1+\exp(\hat{I}_{bt})} \tag{4.11}$$

$$\hat{\theta}_{mt} = \frac{1}{1+\exp(\hat{I}_{bt})} \tag{4.12}$$

$$\ln\left(\bar{w}_{bt}\right) = \ln\left(\alpha A_t k_t^{1-\alpha}\right) + \frac{1}{\sigma_{HL}}\ln(\mathrm{L}_t) + \ln(\theta_{bt}) - \frac{1}{\sigma_{HL}}\ln(\mathrm{L}_{bt}) \tag{4.13}$$

The standardized relative productivity terms $(\hat{\theta}_{lt})$ and $(\hat{\theta}_{mt})$ stand for the relevant (l,m) -pair of education groups within the same broad education b , where $(\bar{w}_{bt})$ is the weighted average wage in the same broad education group b at time t. Employing the method proposed by Katz and Murphy (1992) again, we can take a different expression (4.13) between pairs of broad education groups to obtain:

$$\ln\left(\frac{\bar{w}_{Ht}}{\bar{w}_{Lt}}\right) = \ln\left(\frac{\theta_{Ht}}{\theta_{Lt}}\right) - \frac{1}{\sigma_{HL}}\ln\left(\frac{L_{Ht}}{L_{Lt}}\right) \tag{4.14}$$

Equation 4.14 represents the effect of differences in skill intensity on wages. An empirical estimation of the above equation is as follows:

$$\ln\left(\frac{\bar{w}_{Ht}}{\bar{w}_{Lt}}\right) = I_{HLt} - \frac{1}{\sigma_{HL}}\ln\left(\frac{\hat{L}_{Ht}}{\hat{L}_{Lt}}\right) + u_{HLt} \tag{4.15}$$

Where the time fixed effect (I_{HLt}) controls the variations in productivity differences between high and low skill intensity. (u_{HLt}) is a skill specific error term.

All of the estimated parameters, comprising (σ_M) , (σ_J) , (σ_{LL}) , (σ_{HH}) , and (σ_{HL}) , represent filled in demand for worker equations (Equation A.7 and A.8) to capture the total effect on wages of the presence of foreign workers. Where the effect on wages among foreign workers is concerned, it is measured by:

$$\frac{\Delta w_{Mbkjt}}{w_{Mbkjt}} = \frac{\Delta w_{Nbkjt}}{w_{Nbkjt}} - \frac{1}{\sigma_M}\frac{\Delta M_{bkjt}}{M_{bkjt}} \tag{4.16}$$

To evaluate the effect on wages paid to the natives in Thailand, we undertake a partial derivation of Equation A.7, i.e. an increase of foreign workers in all subgroups of labor, as expressed in Equation 4.17. This is under the assumption that capital-labor ratios remain unchanged as a result of any increase in foreign workers.

$$\frac{\Delta w_{Nbkjt}}{w_{Nbkjt}} = \frac{1}{\hat{\sigma}_{HL}} \sum_{c\in B}\sum_{q\in E}\sum_{i=1}^{4} \frac{w_{Mcqit}}{\bar{w}_t} \frac{M_{cqit}}{L_t} \frac{\Delta M_{cqit}}{M_{cqit}} \tag{4.17}$$

$$-\left(\frac{1}{\hat{\sigma}_{HL}} - \frac{1}{\hat{\sigma}_{bb}}\right) \sum_{q\in b}\sum_{i=1}^{4} \frac{w_{Mbqit}}{\bar{w}_{bt}} \frac{M_{bqit}}{L_{bt}} \frac{\Delta M_{bqit}}{M_{bqit}}$$

$$-\left(\frac{1}{\hat{\sigma}_{bb}} - \frac{1}{\hat{\sigma}_{J}}\right) \sum_{i=1}^{4} \frac{w_{Mbkit}}{\bar{w}_{kt}} \frac{M_{bkit}}{L_{kt}} \frac{\Delta M_{bkit}}{M_{bkit}}$$

$$-\left(\frac{1}{\hat{\sigma}_{J}} - \frac{1}{\hat{\sigma}_{M}}\right) \frac{w_{Mbkjt}}{\bar{w}_{kjt}} \frac{M_{bkjt}}{L_{kjt}} \frac{\Delta M_{bkjt}}{M_{bkjt}}$$

Where $B = \{L, H\}, \mathrm{E} = \{\mathrm{PR}, \mathrm{HS}, \mathrm{TVET}, \mathrm{CO}\}$, and the rest of the parameters are the same as in the previous declaration.

4.1.2 The Econometric-based Model

The empirical model used in this section is based on a wage determinant equation where wages are the dependent variable. A set of explanatory variables are nested in an eclectic fashion based on the relevant theories concerning labor markets in the context of developing countries. Given the thesis's core hypothesis, the extent to which firms rely on foreign workers is the first explanatory variable in our empirical model. The corresponding coefficient would indicate the effect of foreign workers on wages. Its expected sign, nonetheless, can be either positive, or negative, depending on whether foreign workers are substitutes or complementary to the native workforce. Under a 3-D job hypothesis, foreign workers take jobs shunned by native workers so that they complement each other. Hence, the coefficient is expected to be positive. Conversely, a negative coefficient is expected when foreign workers compete with native workers for a given job.

In addition, there are six explanatory variables used as controlling variables in our analysis. They can be grouped into two main categories, firm- and industry-specific explanatory variables.

4.1.2.1 Firm-specific Factors

Market orientation (MKT) is the first firm-specific variable. It is introduced according to the core postulation of the firm heterogeneity literature (Helpman, 2006: Bernard et al, 2011; Meltiz and Reeding, 2015) within which exporting firms exhibit higher productivity than domestic-oriented as higher productivity is needed for firms to compensate for any fixed costs incurred by exporting activities. However, it is possible that the exporting firms operate under higher demand pressure compared to non-exporting firms because they can exploit the benefits from policy-induced and natural protection. Hence, all other things being equal, exporting firms tend to pay higher wages so that the corresponding coefficient is expected to be either positive or negative.

The second variable concerns ownership (FOS). As echoed in the literature on foreign direct investment as well as that of firm heterogeneity (e.g Lipsey, 2002; Melitz and Reeding, 2015), multinational enterprises (MNEs) usually exhibit higher productivity to compensate for any disadvantages that they might have in operating aboard so that they pay their workers higher wages. Hence, foreign firms tend to pay higher wage as opposed to their local counterparts.

Capital intensity (KI) is another firm-specific factor introduced in the empirical model to capture the extent to which fixed costs are important for an industry (Brown and Medoff, 1989; Murphy and Topel, 1990). The higher the fixed costs, the higher the wages firms in the industry tend to offer workers. Firms with a higher level of capital intensity, size or both, tend to offer higher wages to ensure that they can obtain workers at the level wherein they can exploit their capital investment efficiently. In other words, the opportunity cost of labor shortages tends to be higher for firms with higher fixed costs. In addition, wage expenses is rather a small proportion of overall production costs in the capital-intensive firm. Hence, we expect the estimated coefficient to be positive.

The role of skill intensity (SI) used as an explanatory variable is to a certain extent similar to that of capital intensity (Harrigan and Reshef, 2015). Firms with a higher share of skilled workers in the total workforce offer higher wages as the marginal product of hired workers would be higher at a given level of total workers. This is due

to the fact that these skilled workers potentially lift up the firms' overall productivity. Hence, a positive sign is expected.

4.1.2.2 Industry-specific Factors

The first industry-specific explanatory variable is (real) output growth (RO). Its rationale is based on the fact that when an industry is expanding, firms must offer higher wage to entice workers from elsewhere to change jobs (Hammerhesh, 1993). Therefore, we expect the sign of the corresponding coefficient to be positive.

The other industry-specific factor concerns producer concentration (CR). It is introduced to capture the effect of market power on wages. Nonetheless, the effect could be either positive or negative. On the one hand, firms operating together with fewer competitors (a highly concentrated industry) could avoid market pressure and experience excess profits. All other things being equal, they can offer higher wage rates compared to others in competitive markets. On the other hand, when firms gain market power because of existing within a highly concentrated industry, they could abuse their market power by freezing wages paid to employees. As a result, the expected sign of this coefficient can be positive, or negative.

4.2 Data Sources

In this thesis, we employ three main sources of data - Labor Force Survey (LFS), Industrial Census (IC) and Household Socio-Economic Survey (SES). They are all provided by the National Statistical Office (NSO) with different inherent features. In general, there are LFSs available in Thailand. LFS contain rich information on workers in Thailand, such as wages earned, education, experience, working hours, all of which are required in the simulation experiment. LFS from 1986-2013 are used in the experiment.

However, LFS provide rather limited data on firm and industry-specific characteristics because the questionnaires are based on samples of individuals within the labor supply. Thus, it is too broad to examine the effect of relevant industry characteristics. Hence, when econometric analysis is concerned, IC is the main data

source. So far there are three ICs available in Thailand, 1997, 2007 and 2012. Year expressed here represents when that data was released, but the information in the IC was actually measured in a year earlier. For example the 1997 IC represents activities in 1996. IC provides data on the characteristics of firms in a given industry classified according to 4-digit ISIC. They include age, market orientation, ownership, capital and workers. Interestingly, workers are further disaggregated into operational and non-operational staff.

In theory, to assess the effect of foreign workers on wages, information about foreign workers hired by a given firm is needed. However, IC datasets do not contain such information. Hence, we need to find a proxy. To do so, SES is used in this study. A broad measure of the presence of foreign workers at the sectorial level is constructed. One might argue that LFS began reporting information about foreign workers. To the best of our knowledge so far, the found information is in 2012 which does not match with the IC dataset. Note that in SES there is no data on worker nationality. Hence, we use a proxy, language spoken in the family, to identify foreign workers.

4.2.1 Data Cleaning and Variable Construction

4.2.1.1 Simulation Experiments

We follow the practice used in Lathapipat (2014). Respondents covered in LFS whose age is under 16 or over 65 are dropped. Those are not legally classified as part of the labor force. Workers who reported positive working hours and zero wages, as well as unpaid family workers, are excluded. The hourly wage rate paid per worker represents total monthly wage earnings per total working hours (TOTAL_HR). Note that total earnings include monthly wage earnings (APPROX), “BONUS” per month and average overtime payments received per month, “OT”. All are adjusted to hourly wages.

Foreign workers are identified when respondents are registered as a foreigner. Otherwise, they are treated as native workers. Primary and secondary schooling comprise respondents having been in school for less than or equal to six years

and between seven and 12 years, respectively. Workers with vocational education and training refers to respondents attending school for more than 13 years without a bachelor degree, whereas the rest is composed of those with a college graduate background. To capture work experience, we assume that workers with less than a high school education entered the labor force at the age of 15, and those with a high school education entered at the age of 17 and the experience is calculated by deducing from the current age with that when entering the labor force and years in school. Worker experience is discretionarily categorized into four ranges, i.e. 0-10 years, 11-20 years, 21-30 years, and more than 30 years.

The resulting sample contains 50,648 individuals, of which the supply of foreign workers accounted for 4.29 percent of the total weekly hour supply in our sample. In addition, the total weekly wage bill of foreign workers accounted for 2.71 percent of the total weekly wage bill in our sample. Note that the LFS sampling weights are used in the calculations of all average and aggregate statistics and variables throughout this study.

In the dynamic level from 1986-2013, the variables again are constructed into 28 year-4 schooling-4 experience groups. Note that the four detailed schooling groups and four experience groups are classified employing the same criteria as defined earlier. After we obtained the proportions of foreign workers in each single category, we use these proportions to classify the proportions of foreign workers in other years in the simulation experiment (see more in Appendix B).

4.2.1.2 Econometric Analysis

To construct export orientation, and output growth, we make use of the gross output series from NESDB. They are reported at the 4 Digit- International Standard of Industrial Classification (ISIC) Rev. 3. Note that gross output is reported in constant and current values so that we can calculate price indices at 4 digits ISIC. They are used to convert three censuses into real terms. Export data is from the UNComtrade database.

Ideally, detailed information on how many foreign workers are employed by a given firm is needed to measure the extent to which foreign workers are employed.

Such data does not exist in Thailand and is not available in these three censuses. Hence, we opt to use information from the official report of foreign workers in the manufacturing sector by the Office of Foreign Workers Administration (OFWA), Ministry of Labor and Social Welfare. In practice, the data from OFWA and LFS is not compatible with IC. Finally, we employ data from SES using language spoken in the family as a proxy for nationality (see more in Appendix C). The measurement of variables is presented in Table 4.1.

Our processed IC data has to be cleaned because the raw data incurs many problems that do not reflect reality, i.e. duplications, non-sense values from some variables and missing variables of interest. Thus, we create the following criteria in order to eliminate these problems. Table 4.2 provides the eliminated numbers in detail.

First, there exist the duplications in our dataset. For example, a firm has many factories, and respondents answer the questionnaire twice or more. In such cases, we mark the pair of observations as duplications when they have equal values with respect to the following data: (1) registered capital, (2) male employees, (3) female employees, (4) total employees, (5) sales of good produced, (6) fixed assets at January, (7) fixed assets at December, and (8) costs of purchasing materials and components. Second, non-sense values are eliminated following these criteria: (1) the yearly output is less than 10,000 THB, (2) the total workers is zero, (3) the yearly nominal value added is less than 10,000 THB, (4) the yearly nominal total wage bill is less than 5,000 THB, (5) the yearly nominal operational wage bill is less than 5,000 THB, and (6) the fixed assets both in the beginning and at the end of year are zero. Ultimately, the missing variables of interest are eliminated from our dataset.

As the core dataset comprises industrial censuses collected at the plant level, there are two choices in performing econometric analysis, i.e. plant and industry levels. Each has advantages and disadvantages.

Arguably, when workers can move freely within a given industry, wages across firms/plants would not be different. Any arbitrary wages could be eliminated by worker movement. It is less likely to observe arbitrary wages across firms within a given industry in circumstances where the labor market is tightening, such as we currently observe in Thailand. Hence, this would justify the analysis at the industry level.

When the analysis is undertaken at the industry level, the main advantage is that we can perform panel econometric analysis. This is due to the fact that even though there are three censuses, plant identification across censuses is not systematically collected. Hence, it is unlikely to panelize plant level data of these three censuses. However, when plant level is aggregated to the industry-level, panelizing is possible in spite of certain shortcomings. This would allow us to understand the dynamics of wage determinants over the considered periods. This is especially true in the context of wage determinants where certain time differences are needed.

The clear disadvantage of analysis at the industry level is certain theoretically sound firm-specific variables are unable to be fully captured. As echoed in the firm heterogeneity literature, operations tend to exhibit different productivity across firms. Hence, firm-specific characteristics, e.g. non-exporting vs. exporting, foreign vs. domestic firms) matter in wage determinant analysis. This could result in wage differences across firms even though they are in the same industry. While these characteristics can be captured by the average figure at the industry level, it would be far better to examine them at the plant level. Given this line of argument, we are in favor of plant level analysis. As mentioned earlier, plant data in the censuses cannot be panelized so that the analysis at the plant level is pooled cross-sectional. Hence, this is the main trade-off.

To overcome this data shortcoming, we will perform both plant and industry level analysis instead of choosing one over the other. Both results are used to promote robust checking within our analysis. Some firm-specific variables will be proxied by the industry average in the industry-level analysis.

Table 4.1
Measurement of Variables

Abbreviation	Variable	Measurement
lORW	Log operational real wage	Annual operational earning to total worker, deflated by consumer price index
lTRW	Log total real wage	Annual total earning per total worker, deflated by consumer price index
IMD_N2	Actual immigrant dependency	Share of foreign workers in total employment
IMD_dum	Dummy of immigrant dependency	Dummy of industry that employed high proportion of foreign workers to total workers. 0 if the proportion is low, and 1 if the proportion is high
lRO	Log real output (value added)	Nominal value added deflated by producer price index
lLP	Log labor productivity	Labor productivity is calculated from real output divided by total workers
lKI	Log capital intensity	A ratio of nominal fixed assets deflated by gross fixed capital formation in total employees
SI	Skill intensity	Share of non-operational workers to total workers
CR	Concentration ratio	Share of four largest firms in total gross output in a given industry
FOS	Dummy of foreign ownership	Dummy of industry that has foreign shareholding. 0 if share is zero, and 1 if another
FOS_1	Actual percentage of foreign ownership	Share of foreign shareholding, in percentage
MKT	Dummy of market orientation	Dummy of industry that export product. 0 if export is zero, and 1 if another
MKT_1	Actual percentage of market orientation	Export share in gross output, in percentage
Time_2006	Time dummy for year 2006	Dummy of time fixed effect. 1 if year is 2006, and 0 if another
Time_2011	Time dummy for year 2011	Dummy of time fixed effect. 1 if year is 2011, and 0 if another

Source: Author's tabulation.

Table 4.2

Data Cleaning Process in IC

	1997	2007	2012
Raw Data	11113	66203	98482
Duplications	12	4058	19478
Non-realistic Values	612	30241	39365
Missing Values	428	1960	1406
Remaining Observations	10061	29944	38233

Source: Author's calculation from the IC.

In the plant level analysis, wages is the dependent variable, measured by the ratio of total wage compensation to total workers. As foreign workers in our focus are unskilled, using overall wages might be misleading to a certain extent. Hence, wages paid for operational (blue collar) workers is used as alternative dependent variable.

As mentioned earlier, firm-specific information on how much a given firm hires foreign workers as a percentage of its total workforce is available only for 2011 onwards. Hence, a dummy is needed. In this thesis, we use two alternative industry-level proxies. The first is the ratio of foreign workers used to total employment in a given industry. The reported figure of foreign workers from SES will be used together with total employment at the industry level to measure this ratio (see Figure 4.1). While this seems to be a proper measure of how important foreign workers are in a given industry, the employment data of the manufacturing sector in Thailand is rather poor in quality and not up-to-date. The only one year that can be estimated in this alternative is 2012 IC. This could make the proposed ratio problematic. As an alternative measure, the binary zero-one dummy is proposed. In industries, which heavily rely on foreign workers, the dummy variable is equal to one and zero otherwise. This could be a decent proxy due to the fact that foreign workers in Thailand are highly concentrated in certain industries, such as processed foods, garments, footwear. Hence, in such industries the dummy variable is set to one. Both are used as a robustness check on the sensitivity of the estimates on choices of proxies.

The firm's market orientation is measured by the binary zero-one dummy variable where one indicates export and 0 otherwise. In theory, an actual export-output ratio is superior to the dummy, but it is not available in the 1996 census. To guard against any possible bias as a consequence of using the dummy, alternative regression analysis using the actual export-output ratio is performed in the sub-samples including only two censuses (2007 and 2012). A similar problem is found with the foreign ownership variable. Hence, the binary zero-one dummy variable is used. The dummy variable is equal to one when the firm in consideration has non-zero foreign ownership and zero otherwise.

Capital intensity is measured by the capital–labor ratio of the plant. Capital is measured by the initial period fixed asset value. The skill intensity reflects the ratio of skill operation to total operational workers. Three censuses are converted using the deflator at the 4-digit ISIC available in the NESDB gross output data series.

(Real) gross output (value added) is the difference between a firm's total output and total input, then we transform it into labor productivity (*LP*) by dividing it with the firm's total workers. Producer concentration is from Kohpaiboon and Ramsetter (2008). It is available at the 4-digit ISIC.

When analysis is undertaken at the industry level, we modify the firm-specific variables as follows. The market orientation is measured by the ratio of exports to gross output at the 4-digit ISIC. While export data is classified in Harmonized System (HS), the standard concordance is used to convert it into ISIC. The ownership variable is measured by the output share of foreign firms in a given industry. The capital and skill intensity variables comprise the weighted average of all plants available in the censuses, using the number of workers and operational workers as the weight, respectively.

All in all, the descriptive statistics of these constructed variables are tabulated in Table 4.3 with the wage equation in the empirical model to examine the impact of immigration on wage responses as follow:

$$RW_{it} = \beta_0 + \beta_1 IMD_{it} + \beta_2 LP_{it} + \beta_3 KI_{it} + \beta_4 SI_{it} + \beta_5 FOS_{it} + \beta_6 MKT_{it} + \beta_7 CR_{it} + \mu \quad (4.18)$$

Where $i = 1, 2, ..., n$ is the plant/industry unit, and $t = 1, 2, ..., T$ is the yearly time unit.

RW = (real) wages measured by two alternatives;
- (1) Log (real) wage of all workers (*lTRW*)
- (2) Log (real) wage of operational workers (*lORW*)

IMD (+/-) = immigrant share
- (1) Binary dummy in the case of plant level (*IMD_dum*)
- (2) Share of foreign workers to total full-time employment in the case of plant level in 2012 (*IMD_N2*)

LP (+) = (real) labor productivity,
- (1) plant unit in case of plant level
- (2) weighted average of all plants in the given industry in case of industry level

KI (+) = capital-labor ratio in a given plant
- (1) plant unit in case of plant level
- (2) weighted average of all plants in the given industry in case of industry level

SI (+) = ratio of skill operation to total operational workers in in a given plant
- (1) plant unit in case of plant level
- (2) weighted average of all plants in the given industry in case of industry level

FOS (+) = foreign ownership
- (1) Binary dummy in the case of plant level (*FOS*)
- (2) Output share of foreign firm in a given industry in the case of the industry level (*FOS_1*)

MKT (+/-) = market orientation
- (1) Binary dummy in the case of plant level (*MKT*)

(2) Actual export-output ratio in the case of the industry level (*MKT_1*)

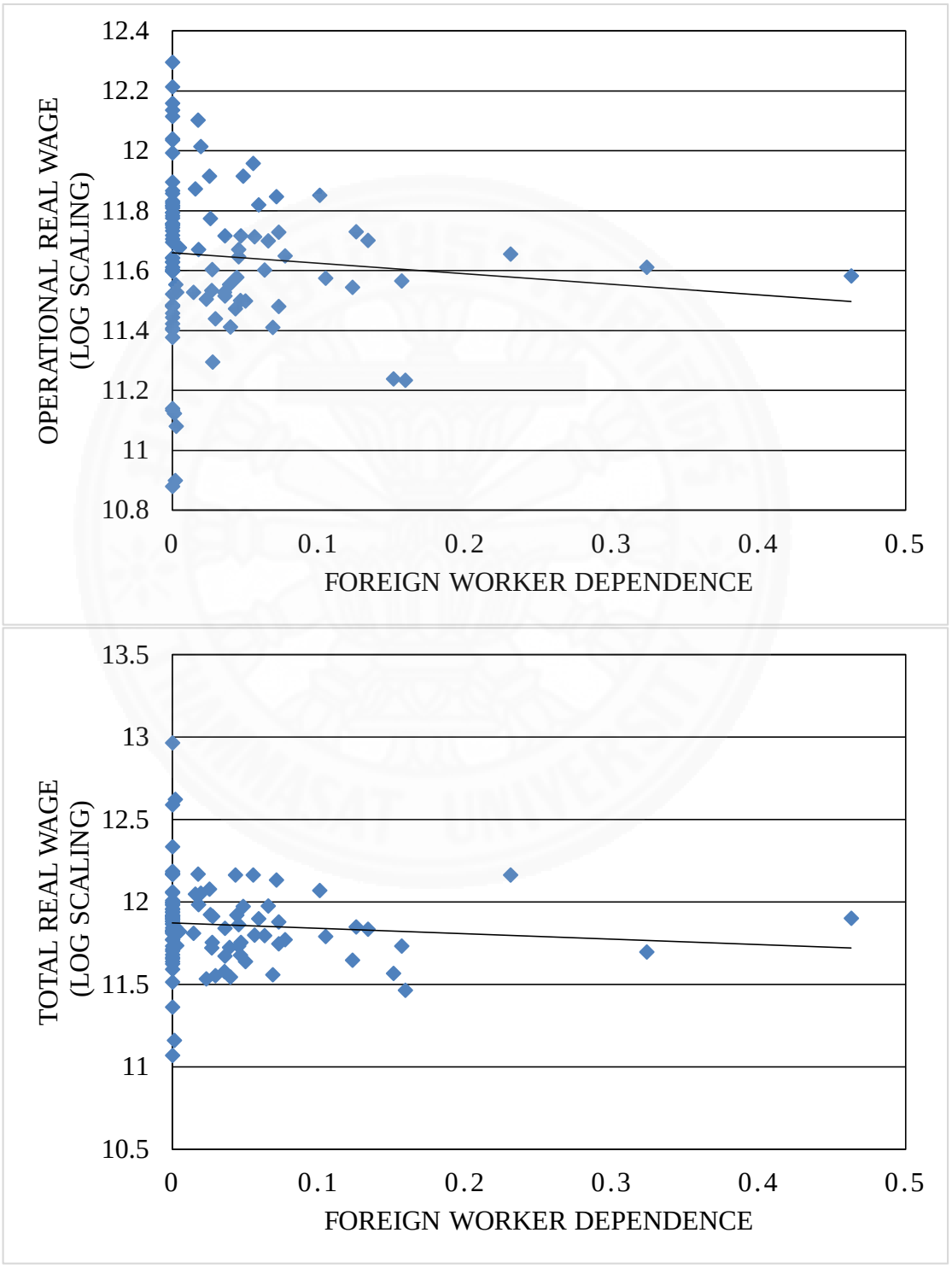
CR (+/-) = producer concentration

(1) Share of four largest plants in total gross output in a given industry

Figure 4.1

Share of Foreign Workers in Total Employment (%)

and Related Wages in ISIC Four-Digit Industries



Source: Author's scatter with linear trend from SES and 2012 IC database.

Table 4.3

Descriptive Statistics of Constructed Variables.

	1997				2007				2012			
	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max
lORW	11.01	0.77	5.27	14.71	10.76	0.78	5.24	13.88	10.74	0.88	5.38	12.93
lTRW	11.31	0.80	5.27	14.84	10.92	0.86	5.24	13.90	10.81	0.92	5.38	13.14
IMD_N2	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	0.06	0.08	0.00	0.46
lRO	15.91	1.81	8.68	23.73	14.62	2.34	8.56	24.79	14.23	2.38	9.13	25.05
lKI	12.71	1.44	4.18	21.75	10.59	2.81	6.79	20.83	12.82	1.90	2.53	20.12
SI	0.15	0.15	0.00	0.96	0.22	0.16	0.00	0.99	0.04	0.11	0.00	0.98
CR	0.44	0.22	0.15	1.00	0.34	0.18	0.10	1.00	0.36	0.19	0.09	1.00
FOS_1	*n/a*	*n/a*	*n/a*	*n/a*	0.01	0.09	0.00	1.00	0.02	0.12	0.00	1.00
MKT_1	*n/a*	*n/a*	*n/a*	*n/a*	0.02	0.12	0.00	1.00	0.04	0.16	0.00	1.00

Sources: Author’s tabulation from IC and SES databases.

Note: The total observations are 10,061, 29,944, and 38,233 for year 1997, 2007, and 2012 respectively.

4.3 Econometric Procedures

Where plant-level analysis is concerned, standard pooled-cross sectional analysis i.e. OLS estimation, is performed. The estimations can be separated into two groups. First, we estimate the three-year IC using a dummy variable to measure foreign worker dependence. Second, we estimate 2012 IC using share of foreign workers instead of a dummy.

Nonetheless, the problem of heterogeneity exists in all our estimates because the nature of our employed data is cross-sectional. The variances of each observation are indeed different. Thus, all of our results in Chapter 5 are reported with adjustments for this problem.

Moreover, the empirical model might experience endogeneity problems because foreign worker dependency in the wage equation is potentially endogenous with wage variables for several reasons. First, the higher wages for both immigrants and native workers attract workers to work in effected firms. Second, the government usually considers the labor market conditions (including wage trends) faced by individual industries in managing foreign worker inflows.

Given these concerns, an instrumental variable estimation method is employed to examine any possible bias from the endogeneity problem. The instrument used reflects lagged foreign worker dependency. The rationale behind this instrumental variable choice is that inflows of migration in the past actually affect the current-year. The tenacity of migration is indeed a common feature in the migratory process; past migration leads to future migration through network effects (Hanson, 2010). Moreover, past migration could influence present wages through firms' wage prospects less than current migration.

However, most of our estimations employ dummy variables in order to capture immigrant dependency. Thus, the lag term of this variable does not exist in practice. The solution here is that we get back to the policy changes in Section 3.1.1, and observe that there have been five periods of huge change in immigrant flow according to the literature. Then, we determine the overlapping periods of IC data which are 1996, 2006, and 2011. As the result, all of IC the data does not overlap with

those periods of change. Hence, we assume there is no difference between current dummies and previous ones.

In case of actual immigrant dependency, the instrumental variable (IV) estimation could be employed in order to address the possible endogeneity problem.

In the industry-level analysis, the estimation techniques are generalized least square (GLS), fixed effect (FE), and random effect (RE). Again, this estimation employs dummy variables in order to capture immigrant dependency. Thus, there is no change in this lag term, as was the scenario with our plant-level analysis.

CHAPTER 5
FINDINGS

This chapter exhibits the findings in this thesis. Section 5.1 presents the results from the simulation-based model. The results are classified into two cases. First, we focus on all sector samples in order to capture the total effect of foreign workers on Thai wages. Second, we direct our focus onto the manufacturing sector. Section 5.2 presents the results from the econometric-based model.

5.1 Results from Simulation-based Models

The purpose of the first section of this chapter is to estimate the elasticity of substitution parameters. Table 5.1 shows all the interested parameters. In the first two columns (1), two elasticities of substitution between immigrants and native workers (σ_M) are reported. The left comprises results from all sectors estimated, while the right includes results from the manufacturing sector. Note that the estimated elasticities are 53.64 in absolute terms and statistically insignificant and 14.71 in absolute term and statistically significant respectively. This suggests that these two types of workers are substitutable, interestingly the degree is higher in case of all sectors. This seems to be in line with the 3D job hypothesis that migrant workers are imported to work in jobs shunned by locals in the manufacturing sector.

In the latter two columns (2), the elasticities of substitution between labor with different levels of experience groups (σ_J) are 6.43 in case of all sectors and 8.03 in the case of manufacturing. Both parameters are different from zero at the one per cent level. In addition, these two are higher than the elasticities of substitution according to education groups, regardless of skill intensity.

Another found pattern is that the absolute value of elasticity of substitution across low educational background respondents (σ_{LL}) is higher than with those of a high educational background (σ_{HH}). However, the pattern reverses in the case of manufacturing. The former values are both different from zero at 10 per cent, while

the latter values are different from zero at one per cent only with the group of low educational background. Finally, we found the lowest values of elasticity of substitution between low skill and high skill intensity groupings (σ_{HL}) in both cases.

All estimated elasticities in Table 5.1 are used in the simulation exercises to assess the effects of foreign workers. The simulation results are presented in Table 5.2 and 5.3. Table 5.2 represents the simulation results from all sectors. Meanwhile, Table 5.3 represents the case of the manufacturing sector. The total foreign and Thai wage bills are reported in columns (1) and (2), respectively. While the corresponding total foreign and Thai working hour supplies are reported in columns (3) and (4), respectively.

From the last two columns in Table 5.2, the effects of increases in foreign workers on foreign and Thai wages are exhibited. Its negative effect on foreign wages is in line with the theoretical framework. We find negative impacts in all skill groups. The percentage changes vary between -2.38 and -1.81. Note that the highest negative impact is found on foreign workers whose education is primary and experience duration is less than 11 years, while the most modest impact is found on foreign workers whose education is collegiate and experience more than 30 years. However, the effects tend to be ambiguous in the case of Thai wages. We find negative impacts for Thai workers whose education is primary and high school, while the effects turn to be positive when education is vocational and collegiate. The highest negative impact is found with the similar skill groups as in the case of foreign wages, and the highest positive impact is found in the same manner.

Table 5.3 reports the results with the focus on the manufacturing sector. We still find all negative impacts in case of foreign wages, highlighting that the effects are more severe in every skill group compared to the case of all sectors. The pattern of those impacts is not different from the former case. That is, the highest negative impact is found on foreign workers whose education is primary and experience less than 11 years, while the most modest impact is found on foreign workers whose education is collegiate and experience more than 30 years. However, the effects tend to be lighter in the case of Thai wages. We find negative impacts for Thai workers whose education is only primary, while the effects turn to be positive when education is high school, vocational and collegiate. The highest negative impact is found with similar skill

groups as in the case of foreign wages, and the highest positive impact is found in the same manner. Interestingly, the weighted average of Thai wage changes in all groups turns out to be positive (0.04 per cent) in the case of the manufacturing sector.

The results of Tables 5.2 and 5.3 show that foreign workers have a higher negative effect on the wages of existing foreign workers than the wages of native workers because of their imperfect substitutability in production. Interestingly, the results indicate that inflows of foreign workers increase the productivity of high-skilled native workers with vocational and collegiate education. Furthermore, the positive impact has extended to native workers with high school education in the case of the manufacturing sector. Thus, this validates the "3-D" jobs hypothesis in the Thai manufacturing sector.

Table 5.1
Regression Estimates of the Elasticity of Substitution Parameters

	σ_M (1)		σ_J (2)		σ_{LL} (3)		σ_{HH} (4)		σ_{HL} (5)	
	Total	MFT	Total	MFT	Total	MFT	Total	MFT	Total	MFT
Inverse Elasticity	-0.02	-0.068***	-0.16***	-0.125***	-0.19*	-0.267***	-0.25*	-0.088	-0.50***	-0.364***
Estimate	(0.03)	(0.022)	(0.021)	(0.029)	(0.1)	(0.0067)	(0.146)	(0.2694)	(0.016)	(0.0196)
p-value	0.47	0.00	0.00	0.00	0.07	0.03	0.1	0.74	0.00	0.00
Elasticity of Substitution	53.64	14.71	6.43	8.03	5.24	3.74	4	11.33	2.01	2.75
Fixed Effects:										
Education x Experience	Yes	Yes	Yes	Yes	No	No	No	No	No	No
Education x Year	No	No	Yes	Yes	No	No	No	No	No	No
Year	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	615	268	448	448	28	28	28	28	28	28
R-Squared	0.11	0.15	0.99	0.95	0.96	0.29	0.56	0.07	0.99	0.98

Source: Author's estimate from LFS database.

Note: Robust standard errors in parentheses. MFT stands for manufacturing and *** $p < 0.01$, ** $p < 0.05$,* $p < 0.1$.

Table 5.2

Simulated Long Run Effects of Foreign Workers on Domestic Wages, All Sectors

Education	Experience	Foreign Wage Bill (Baht) (1)	Thai Wage Bill (Baht) (2)	Foreign Hours Supply (3)	Thai Hours Supply (4)	Foreign Wage Change % (5)	Thai Wage Change % (6)
Primary	0-10	273.75	1129.75	11.04	56.62	-2.38%	-0.52%
	11-20	185.23	1930.11	10.14	72.80	-2.09%	-0.23%
	21-30	111.04	1948.56	3.90	70.55	-1.99%	-0.12%
	31 plus	40.14	1851.11	1.15	63.04	-1.95%	-0.09%
High School	0-10	54.06	2255.04	2.61	75.89	-1.89%	-0.02%
	11-20	49.94	2125.02	2.34	50.29	-1.89%	-0.03%
	21-30	13.51	1433.17	0.57	23.80	-1.88%	-0.02%
	31 plus	0.12	10.83	5.83	10.27	-1.88%	-0.01%
Technical and Vocational Education and Training	0-10	21.09	835.34	0.76	17.16	-1.82%	0.04%
	11-20	14.16	819.63	0.36	10.90	-1.82%	0.05%
	21-30	7.27	512.55	0.08	4.50	-1.81%	0.05%
	31 plus	1.36	237.76	0.01	1.41	-1.81%	0.05%
College	0-10	114.66	2354.87	1.04	31.85	-1.83%	0.04%
	11-20	68.07	3168.98	0.50	27.17	-1.81%	0.05%
	21-30	7.96	2769.83	0.07	16.28	-1.81%	0.06%
	31 plus	1.10	1383.59	0.01	6.13	-1.81%	0.06%

Source: Author's estimate from LFS database, 1986-2013.

Note: The units reported in column (1) and (2) are million Baht, and those reported in column (3) and (4) are million hours. The last two column are percentage changes of foreign and Thai wages when we simulate positive shock (doubling of foreign workforce).

Table 5.3

Simulated Long Run Effects of Foreign Workers on Domestic Wages, Manufacturing Sector

Education	Experience	Foreign Wage Bill (Baht) (1)	Thai Wage Bill (Baht) (2)	Foreign Hours Supply (3)	Thai Hours Supply (4)	Foreign Wage Change % (5)	Thai Wage Change % (6)
Primary	0-10	185.773	342.727	7.131	7.320	-8.13%	-1.33%
	11-20	150.639	585.432	5.307	14.146	-7.46%	-0.66%
	21-30	25.057	554.085	1.502	14.976	-7.17%	-0.37%
	31 plus	20.566	337.970	0.295	10.125	-7.16%	-0.36%
High School	0-10	23.052	970.127	1.130	29.425	-6.78%	0.02%
	11-20	26.565	790.006	1.218	16.767	-6.79%	0.01%
	21-30	6.211	356.321	0.251	5.583	-6.78%	0.02%
	31 plus	2.870	134.234	0.044	1.395	-6.78%	0.02%
Technical and Vocational Education and Training	0-10	5.801	263.827	0.338	4.881	-6.68%	0.11%
	11-20	2.384	216.596	0.043	2.848	-6.68%	0.12%
	21-30	5.925	77.109	0.041	0.667	-6.70%	0.10%
	31 plus	0.100	31.996	0.004	0.169	-6.68%	0.12%
College	0-10	3.192	433.158	0.142	4.863	-6.68%	0.12%
	11-20	3.374	456.683	0.074	3.211	-6.68%	0.12%
	21-30	1.163	245.929	0.009	1.144	-6.68%	0.12%
	31 plus	0.000	86.942	0.000	0.263	-6.68%	0.12%

Source: Author's estimate from LFS database, 1986-2013.

Note: All reported details are similar to Table 5.2.

5.2 Results from Econometric-based Models

Table 5.4 presents the results of the plant-level econometric analysis. This is based on an Ordinary Least Square (OLS) estimation. In the table, the corresponding robust standard error is used to mitigate any possible heteroscedasticity problem. Correlation coefficient matrix as well as variance inflation factor (VIF) analysis suggest that any possible multi-collinearity problem is not severe in our estimation results. In particular, correlation coefficients among variables are rather low (less than 0.4) and the variance inflation factor (VIF) value is small (Table 5.5). Cook's Distance is used to indicate possible outliers. We found that there are 3,524 samples identified as outliers by Cook's distance criteria[1]. 4-digit ISIC dummies are introduced in the regression to capture any industry-specific fixed effects that might be present.

In Table 5.4, Columns 1.1 and 1.2 represent the results with and without outlier samples where operational wage compensation is the dependent variable. The results are resilient to each other, suggesting outliers identified by Cook's Distance do not have any severe effect on our estimation. Nonetheless, the following analysis is based on the sample where outliers are excluded. Column 1.3 is a re-run of Colum 1.2, but the dependent variable is total wage compensation. Results in Columns 1.2 and 1.3 are remarkably similar, except for the coefficient corresponding to SI. Since the main interest in our thesis is on the effects of foreign workers on operational workers' wage compensation, the following discussion is based on Column 1.2. Findings found in Column 1.3 will be integrated when they are relevant.

In general, two time fixed effect dummies (2006 and 2011) are statistically significant and negative. Together with the positive and significant intercept, the found negative and statistical significant estimates of these two time dummies indicate a slowdown in the growth rate of domestic wages. As presented in Figure 1.2, domestic wages rapidly increased up to the pre-Asian financial crisis and then slightly dipped despite positive growth.

[1] The standard practice is samples are identified as outliers when the Cook's distance statistic is greater than 4/n, where n is the number of observations.

The other controlling variables reach theoretical expected signs at the conventional statistical level, i.e. five per cent, or better. The coefficient corresponding to *lLP* turns out to be positive and statistically significant at the one per cent level of statistical significance, indicating firms exhibiting higher productivity pay higher wages, all other things being equal. This is even true when considering the fact of the increasing labor tightening in the market experienced within Thailand.

Similar to other previous studies, capital and labor in Thai manufacturing are used in a complementary manner so that firms with higher capital-labor ratios tend to have higher productivity- so that they pay higher wages. Nonetheless, the complementary effect is rather small at around 0.03.

When skill intensity is concerned, a non-linear relationship is found. The corresponding coefficient of *SI* is negative, but its interaction term with *SIZE* is positive, both of which are statistically significant at the one per cent level of significance. Our interpretation is that hiring white collar workers for firms with small sizes (*lSIZE* values of less than five or firms employing less than 150 total workers), might generate pressure on operational workers wages. When the amount surpasses certain levels, hiring white-collar workers could enhance the overall productivity of firms and then raise wages paid to all employees, including operational workers. Interestingly, when the dependent variable is total wage compensation, the coefficient associated with SI turns out to be positive and statistically significant (Column 1.3). This indicates that in general non-operational workers receive higher wages. Firms hiring more non-operational workers tend to have higher average wage compensation.

Table 5.4
Explanations of Inter-Plant Wage Differences: Pooled OLS Estimates

Regressors	(1.1)	(1.2)	(1.3)
Foreign Worker Dependence	-0.0938***	-0.1670***	-0.1684***
(IMD_dum)	(0.0294)	(0.0261)	(0.0259)
Labor Productivity	0.2547***	0.2576***	0.2576***
(lLP)	(0.0021)	(0.0019)	(0.0019)
Capital Intensity	0.039***	0.0345***	0.0342***
(lKI)	(0.0015)	(0.0015)	(0.0014)
Skill Intensity	-1.016***	-1.312***	0.2435***
(SI)	(0.0533)	(0.0489)	(0.0485)
Skill Intensity x Firm Size	0.1452***	0.2574***	0.2411***
(SI_SIZE)	(0.0130)	(0.0122)	(0.0121)
Industry Concentration	0.1221***	0.0140	0.0161
(CR)	(0.0289)	(0.0268)	(0.0266)
Foreign ownership	0.0813***	0.0493***	0.0802***
(FOS)	(0.0111)	(0.0101)	(0.0100)
Market orientation	0.2151***	0.1698***	0.1953***
(MKT)	(0.0085)	(0.0076)	(0.0075)
Time_2006	-0.0414***	-0.0414***	-0.0409***
	(0.0094)	(0.0094)	(0.0094)
Time_2011	-0.1259***	-0.1259***	-0.1747***
	(0.0084)	(0.0084)	(0.0084)
IMD_dum x Time_2006	0.1881***	0.2082***	0.2205***
	(0.0307)	(0.0283)	(0.0281)
IMD_dum x Time_2011	-0.2004***	-0.0267	-0.0247
	(0.0272)	(0.0253)	(0.0251)
Constant	7.165***	7.338***	6.910***
	(0.0366)	(0.0334)	(0.0334)
Observations	57,313	53,789	53,789
R-squared	0.442	0.483	0.581

Source: Author's estimate from IC and SES databases, 1997-2012.

Note: Dependent variables are logged real wages, *lORW* reported in column (1) and (2), while *lTRW* reported in column (3). Robust standard errors adjustment in parentheses, with *** p<0.01, ** p<0.05, * p<0.1.

Table 5.5

Correlation Matrix, Plant Level

	lTRW	*lORW*	*IMD_dum*	*lRO*	*lKI*	*SI*	*CR*	*FOS*	*MKT*	*VIF*
lORW	1.00									
lTRW	0.94	1.00								
IMD_dum	-0.21	-0.25	1.00							5.69
lLP	0.58	0.62	-0.16	1.00						1.57
lKI	0.33	0.30	-0.17	0.41	1.00					1.48
SI	0.14	0.41	-0.21	0.27	0.01	1.00				8.77
CR	0.02	0.03	-0.18	0.04	0.07	0.04	1.00			5.45
FOS	0.20	0.25	-0.12	0.16	0.09	0.18	0.05	1.00		1.34
MKT	0.25	0.31	-0.12	0.19	0.05	0.20	0.02	0.44	1.00	1.51

Source: Author's tabulation from IC and SES database.

We found that both export-oriented and foreign-owned firms paid higher wages to their operational workers as opposed to domestic-oriented and indigenous operations, all other things being equal. This is especially true for market orientation. The finding is consistent with the major finding in the firm heterogeneity literature wherein exporting firms tend to post higher productivity in order to cover the fixed costs incurred by them as well as to be able to survive in the more intense competition extant in the world market. Hence, wages paid to operational workers are higher than those paid by domestic-oriented firms. In addition, firms in Thai manufacturing are undergoing consolidation processes, as documented in Kohpaiboon (2016) whereby exporting firms are expanding in size, whereas domestic-oriented become smaller, many of which are facing exiting the market. Such consolidation works on top of the tightening labor market. Kohpaiboon and Sri-udomkajorn (2017), drawing from Thai garment firms, also found that the latter is severely struggling to maintain both native and foreign workers in their employment. All in all, survival export-oriented firms pay higher wages to maintain their operations. One (e.g. Auhukorala and Devadason, 2012) might argue that exporting companies might be facing tougher competition and this might put pressure on wages paid to operational workers. However, our findings suggest that such a negative effect is overshadowed by countermanding positive effects, as previously discussed.

A rather similar argument is applicable for foreign-owned firms. Hence, the coefficient corresponding to *FOS* is positive and significant. Nonetheless, the magnitude of estimated coefficients is much smaller than that of *MKT* . This finding is not counter-intuitive when we consider the fact that Thailand has always welcomed foreign direct investors since the 1960s. The need for these direct investors to post higher productivity to compensate any disadvantage they might face compared to indigenous operations becomes less and less. Hence, the wage gap between these two types of firms was not expected to be huge by the mid-1990s onward. There is no statistical support for the possible effect of producer concentration on wages in Thai manufacturing. In particular, the coefficient turns out to be statistically insignificant.

With respect to the effect of foreign workers on operational wage, the main interest in this thesis, the figure is found to be negative and statistically significant at the one per cent level of significance. Interestingly, coefficients of interaction terms with the 2006 time dummy turn out to be positive and different from zero statistically significance at the conventional level. The coefficient with the 2011 time dummy is not different from zero, significantly. Our interpretation is that while in theory the presence of foreign workers could have a negative effect on domestic wages and operational workers' wage compensation in particular, this was true in 1996 when a number of unskilled foreign workers from neighboring countries began entering Thailand. As the labor market in Thailand becomes more and more constricted and the need for foreign workers soar to fill in jobs shunned by the native workers, the negative effect tends to lessen. The effect on wages turned out to be positive in 2006 as the coefficient associated with the interaction term was larger than that associated with the foreign worker dummy. The net positive effect is not found in 2011. Such a finding is a bit surprising. This might be due to the flooding and its effect on data collection.

This is similar to the key finding in empirical studies such as Kohpaiboon et al. (2012), Kohpaiboon and Jongwanich (2016), and Kohpaiboon and Sri-udomkajorn (2017) based on firm survey analysis. In an example in the context of the garment industry, firm owners agreed to the fact that they had to hire foreign workers instead of Thai workers because this kind of work was not popular among Thai workers compared to other alternatives, and the problem of labor shortage was not as a consequence of wage differences. From the interview, they confirmed that they could

pay workers slightly more than market rate (excluding overtime payments), but they were still unable to attract Thai workers.

There are two reasons supporting that the negative impact of foreign workers on wage is limited. First, the market for foreign workers in Thailand right now is very competitive. The movement of foreign workers among firms is determined by the difference among overtime payment rates. Second, firms hiring foreign workers are still improving their process upgrading, and maintaining their productivity levels.

Two robustness checks are performed in this study. First, as the variable related to the presence of foreign workers is the main interest in this thesis, an alternative measure is used. As information about foreign workers in a given industry is available in SES 2011, hence, the actual ratio of foreign workers (IMD_N2) employed to total workers in a given industry is used and applied to IC 2012. The result is reported in Table 5.6. Interestingly, we found a positive effect of foreign workers on operational wages and this was statistically significant at the one per cent benchmark (Column 2.1). Note that the endogeneity problem is accounted for here using the lag term of the actual ratio of foreign workers (IMD_N2l) as an instrumental variable (Column 2.2). The positive effect is sharpened when we correct the endogeneity bias. Besides, the rest of the controlling variables are not different from each other. Column 2.3 and 2.4 represent the effect of foreign workers on total wages in the same manner. We found that the positive effect is echoed in the case of total wages.

Second, we re-run Equation 4.18 using panel data at the industry level. That is, plant-level data for a given year are added to the industry level. All variables in each year (i.e. 1996, 2006 and 2011) are converted into real terms and then panelized. The results are reported in Table 5.7. Note that the main difference in the model between plant- and industry-level analyses is the interaction term between skill intensity and plant size. The interaction term in the plant-level analysis is introduced to capture the role of plant size, conditioning the effect of skill intensity on wages. As an industry-level analysis is the average figure of plant-level data, such an interaction term becomes irrelevant. Hence, it is dropped from the industry-level analysis.

Columns 3.1 and 3.6 in Table 5.7 report the estimation results where dependent variables are operational and total wage rates, respectively. There are three estimation methods used in this industry-level analysis. First, the Generalized Least

Squared (GLS) estimates are reported in Columns 3.1 and 3.3. Second, the Fixed Effect (FE) estimates are presented in Columns 3.2 and 3.4. Third, the Random Effect (RE) estimates are given in Columns 3.3 and 3.6. In addition, Table 5.8 reports the replication of Table 5.7, but the results are not subject to time trends and interaction terms.

Generally, the key finding is consistent with the plant-level data analysis. All key variables such as labor productivity, capital intensity, skill intensity and concentration reach similar signs as in the plant-level except for differences in the level of statistical significance. The coefficient corresponding to *IMD_dum* turns out to be negative, but smaller than that associated with the interaction term between *IMD_dum* and *Time_*2006. Nonetheless, both coefficients are not statistically different from each other at the five per cent level[2]. Similarly, the coefficient associated with *Time_*2011, despite being smaller in magnitude (0.223), is not different from that of *IMD_dum* significantly[3]. All in all, this indicates the limited effect of foreign workers on domestic wages.

The negative coefficient corresponding to *MKT* seems to be in contradiction with results found in the plant-level analysis. In fact it is not. Such a negative coefficient must be interpreted with care. As echoed in the firm heterogeneity literature, the more the industry is integrated into the global economy, the larger the difference in firm productivity is observed. Hence, wage compensation paid by exporting firms tends to be larger than non-exporting operations, reflected in the results from the plant-level analysis. When an industry-level analysis is concerned, the wages

[2] The Chi-square statistic under the hypothesis (Null Hypothesis is the coefficient associated with 2006 year interaction equals to that with *IMD_dum*; the alternative hypothesis is otherwise) is 0.09 and 0.03 for total and operation wage cases, respectively.

[3] The Chi-square statistic under the hypothesis (Null Hypothesis is the coefficient associated with 2011 year interaction equals to that with *IMD_dum*; the alternative hypothesis is otherwise) is 0.13 and 0.25, for total and operation wage cases, respectively.

paid between both groups of firms within a given industry must be averaged, using the number of plants as a weight. The larger value of *MKT* implies there are more firms exporting and the pressure to widen wage differences between these two groups is greater. Therefore, in an industry with higher *MKT*, the observed weighted average of wages tends to be lower, as opposed to that with lower *MKT* (see more elaboration in Appendix D).

Table 5.6

Explanations of Inter-Plant Wage Differences: OLS and 2SLS Estimates

Regressors	(2.1)	(2.2)	(2.3)	(2.4)
Foreign Worker Dependence	0.208***	1.690***	0.221***	1.793***
(IMD_N2)	(0.0574)	(0.466)	(0.0567)	(0.461)
Labor Productivity	0.266***	0.262***	0.265***	0.261***
(lLP)	(0.00263)	(0.00285)	(0.00258)	(0.00280)
Capital Intensity	0.0569***	0.0594***	0.0569***	0.0595***
(lKI)	(0.00220)	(0.00234)	(0.00216)	(0.00230)
Skill Intensity	-0.397***	-0.391***	1.267***	1.274***
(SI)	(0.0396)	(0.0395)	(0.0314)	(0.0315)
Skill Intensity x Firm Size	0.000274	0.000258	0.000313*	0.000295*
(SI_SIZE)	(0.000195)	(0.000183)	(0.000186)	(0.000173)
Industry Concentration	0.0410*	0.0368*	0.0386*	0.0342*
(CR)	(0.0210)	(0.0209)	(0.0207)	(0.0206)
Foreign Ownership	0.0559***	0.0579***	0.0772***	0.0793***
(FOS)	(0.0171)	(0.0174)	(0.0166)	(0.0168)
Market Orientation	0.310***	0.313***	0.317***	0.320***
(MKT)	(0.0120)	(0.0121)	(0.0116)	(0.0116)
Constant	6.671***	6.640***	6.678***	6.645***
	(0.0330)	(0.0360)	(0.0328)	(0.0357)
Observations	36,483	36,483	36,483	36,483
R-squared	0.479	0.468	0.538	0.528

Source: Author's estimate from 2012 IC and SES databases.

Note: *lORW* is reported in column (2.1)-(2.2), while *lTRW* is reported in column (2.3)-(2.4). First, columns (2.1) and (2.3) represent the actual foreign worker dependency IMD_N2. Second, columns (2.2) and (2.4) represent the lagged foreign worker dependency IMD_N2_{t-1} in instrumental variable estimations.

Table 5.7

Explanations of Inter-Industry Wage Differences: Panel Estimates

	Operational Wages			Total Wages		
Regressors	GLS (3.1)	FE (3.2)	RE (3.3)	GLS (3.4)	FE (3.5)	RE (3.6)
Foreign Worker Dependence	-0.269***	-0.362***	-0.270***	-0.178***	-0.309***	-0.185***
(IMD_dum)	(0.0207)	(0.103)	(0.0355)	(0.0360)	(0.0997)	(0.0383)
Labor Productivity	0.0886***	0.0825**	0.0870***	0.0569***	0.0555	0.0750***
(lLP)	(0.0112)	(0.0378)	(0.0210)	(0.0116)	(0.0369)	(0.0208)
Capital Intensity	0.0224**	0.0645**	0.0372**	0.0263**	0.0577*	0.0363**
(lKI)	(0.0114)	(0.0319)	(0.0184)	(0.0107)	(0.0304)	(0.0182)
Skill Intensity	-0.408***	-0.469*	-0.301	1.773***	1.651***	1.686***
(SI)	(0.131)	(0.270)	(0.195)	(0.137)	(0.356)	(0.171)
Industry Concentration	0.0758**	0.0964	0.103	0.174***	0.188	0.136**
(CR)	(0.0362)	(0.175)	(0.0687)	(0.0293)	(0.160)	(0.0648)
Foreign Ownership	0.00861***	0.00607**	0.00775***	0.00705***	0.00595**	0.00673***
(FOS)	(0.000719)	(0.00271)	(0.00145)	(0.000649)	(0.00267)	(0.00121)
Market Orientation	-0.00462***	-0.00485***	-0.00343***	-0.00286***	-0.00375**	-0.0026***
(MKT)	(0.000509)	(0.00161)	(0.00121)	(0.000487)	(0.00146)	(0.000946)
Time_2006	0.00164	-0.00248	0.00807	-0.0803***	-0.0803	-0.0851**
	(0.0233)	(0.0654)	(0.0430)	(0.0220)	(0.0584)	(0.0397)
Time_2011	0.0662**	-0.0254	0.0666	0.0937***	0.0208	0.0510
	(0.0285)	(0.0832)	(0.0533)	(0.0247)	(0.0727)	(0.0483)

Table 5.7 (Continued)

	Operational Wages			Total Wages		
Regressors	GLS (3.1)	FE (3.2)	RE (3.3)	GLS (3.4)	FE (3.5)	RE (3.6)
IMD_dum x Time_2006	0.118***	0.139	0.158*	0.281***	0.277***	0.293***
	(0.0295)	(0.0978)	(0.0836)	(0.0511)	(0.0589)	(0.0592)
IMD_dum x Time_2011	0.0537*	0.147*	0.0708	0.223***	0.267***	0.228***
	(0.0299)	(0.0792)	(0.0578)	(0.0452)	(0.0688)	(0.0502)
Constant	10.12***	9.683***	9.876***	10.37***	10.01***	10.03***
	(0.149)	(0.477)	(0.226)	(0.152)	(0.474)	(0.238)
R-squared	-	0.232	0.328	-	0.257	0.438
Observations	316	316	316	316	316	316
Number of Industries	112	112	112	112	112	112

Source: Author's estimate from IC and SES databases, 1997-2012.

Note: Dependent variables are logged real wages, *lORW* is reported in column (3.1)-(3.3), while *lTRW* is reported in column (3.4)-(3.6).

Robust standard error adjustment is in parentheses, with *** p<0.01, ** p<0.05, * p<0.1.

Table 5.8

Explanations of Inter-Industry Wage Differences: Panel Estimates without Time Trends and Interaction Terms

	Operational Wages			Total Wages		
Regressors	GLS (4.1)	FE (4.2)	RE (4.3)	GLS (4.4)	FE (4.5)	RE (4.6)
Foreign Worker Dependence	-0.121***	-0.172**	-0.0884**	-0.0527**	-0.0573	-0.0283
(IMD_dum)	(0.0228)	(0.0708)	(0.0365)	(0.0248)	(0.0825)	(0.0425)
Labor Productivity	0.0926***	0.0792***	0.0920***	0.0540***	0.0342	0.0625***
(lLP)	(0.00945)	(0.0264)	(0.0179)	(0.0119)	(0.0290)	(0.0187)
Capital Intensity	0.0304***	0.0573**	0.0445***	0.0682***	0.0895***	0.0646***
(lKI)	(0.0100)	(0.0225)	(0.0154)	(0.00986)	(0.0218)	(0.0169)
Skill Intensity	-0.608***	-0.411	-0.461***	1.375***	1.328***	1.390***
(SI)	(0.0992)	(0.261)	(0.165)	(0.126)	(0.291)	(0.153)
Industry Concentration	0.0499	0.0980	0.0929	0.186***	0.272**	0.160**
(CR)	(0.0388)	(0.137)	(0.0656)	(0.0280)	(0.127)	(0.0634)
Foreign Ownership	0.00842***	0.00609**	0.00743***	0.00572***	0.00631**	0.00638***
(FOS)	(0.000804)	(0.00255)	(0.00142)	(0.000853)	(0.00263)	(0.00122)
Market Orientation	-0.00505***	-0.00471***	-0.00390***	-0.00273***	-0.00395**	-0.00269***
(MKT)	(0.000554)	(0.00140)	(0.00109)	(0.000614)	(0.00153)	(0.000910)
Constant	10.04***	9.804***	9.778***	9.902***	9.828***	9.822***
	(0.135)	(0.379)	(0.220)	(0.141)	(0.387)	(0.226)
R-squared	-	0.228	0.214	-	0.228	0.211
Observations	299	299	299	296	296	296
Number of Industries	112	112	112	111	111	111

Source: Author's estimate from IC and SES databases, 1997-2012.

CHAPTER 6
CONCLUSIONS AND POLICY IMPLICATIONS

This chapter wraps up the thesis. Section 6. 1 presents the concluding remarks. While, Section 6.2 introduces the policy implications drawn from our findings and contributions. Finally, we outline the limitations of our estimated results in the last section.

6.1 Concluding Remarks

While the number of foreign and unskilled workers from this country's neighbors has continued to grow over the past decade, importing such workers remains controversial at the policymaking level with fears concerning possible adverse effects. One such prospective adverse effect lies in the perceived retarding effect on productivity and, subsequently, the pressure on wages paid to local workers. While policies governing these workers were changed towards managing them in order to serve domestic needs, a new policy known as the Decree on the Management of Foreign Workers Act 2017 was introduced in 29 June 2017 with hefty fines which could cause policy uncertainty. The lofty fees imposed on firms hiring illegal workers might signal a policy reversal. All in all, the effects of foreign workers remain controversial and at the center of policy circles in Thailand.

Against this backdrop, the current thesis undertakes a systematic analysis of their effect on Thai manufacturing wages. The effect on wages occupies the thesis focus simply because it represents the main economic consequence as well as being measurable. The other possible effects, such as sanitary, pandemic, social problems, and so on are on a par in importance, but measuring such effects is very difficult and cannot be performed given the time and resources available to conduct the research enabling this thesis. In Chapter 2, the analytical framework is laid down to gain a better understanding of the motivation behind hiring foreign workers and unskilled labor in particular. Hiring foreign workers is also discussed in the context of the country's structural adjustment options in this chapter. The analysis in the thesis begins with an

analysis of policy stances towards foreign workers, as well as the trends and patterns in connection with foreign workers (Chapter 3) As the issue is controversial, various quantitative methods are used to mitigate any bias emerging from choices of methodology. Two approaches, simulation experiment and econometric analysis, are employed in a complementary manner. The former classification of empirical equation is widely supported by conventional theory concerning the demand for workers from firms. Annual labor force surveys (LFS) from 1983 to 2013 are used. The latter classification concerns econometric analysis estimating (equilibrium) wage equations in which explanatory variables are nested in an eclectic fashion and policy-relevant variables, such as the relative importance of foreign workers, are included. The three available industrial censuses, i.e. 1997, 2007, and 2012 are all utilized.

As revealed in Chapter 3, policy measures governing flows of unskilled foreign workers have been directed into managing them to serve domestic needs since the new millennium. The recent change and imposition of hefty fees found in June 2017 might be a signal of a policy reversal. From the beginning of the new millennium, Thai manufacturing has gained in relative importance as a destination of foreign worker inflows, dominated by unskilled labor from CLM countries. They are concentrated in labor-intensive industries, such as food, textiles and garment industries, reflecting the hypothesis of 3D jobs found in Thailand's labor market. In particular, foreign workers are imported to fill jobs shunned by locals. Hence, the effect on wages of these workers is limited. This is supported by our quantitative analysis in Chapter 4. The simulation experiment suggests that the entry of foreign workers causes depressing pressure on wages only affecting low-skilled Thai workers. Interestingly, the effect turns out to be positive in respect to other types of workers and higher-skilled labor in particular. This finding is consistent with Lathapipat (2014). In our econometric analysis, we find the significant negative impact of foreign worker dependency on real manufacturing wages, both in total and operational remuneration. However, the negative impacts have decreased overtime. Until 2011, we found the positive impact of foreign workers on both total and operational wages.

6.2 Policy Implications

1. The complementary relationship revealed between foreign and local workers is in a favor of facilitating foreign workers, instead of restricting/preventing their employment. In particular, these workers are employed in labor-intensive industries where associated jobs are shunned by locals. While this seems in line with overall policy changes since the new millennium, the recent changes are worrisome. When importing foreign workers is the result of a mutual benefit accrued between firms in labor-importing countries and workers in exporting countries, hefty fees could do more harm than good. They could in turn encourage such foreign workers to seek illegal employment resulting in various undesirable social consequences, including corruption and human rights violations. This also causes uncertainty that could jeopardize the overall investment climate unnecessarily.

2. A complementary policy to managing the flows of foreign workers is to facilitate local workers at the lowest end of education background levels to rise to higher levels. Facilitating these workers could improve their chance of gaining higher education, as well as lowering the cost of secondary and educational opportunities.

3. Another key policy implication is in favor of the global integration of firms. This is supported by the finding that the higher wages are paid by exporting and/or raw-materials-importing firms. The higher wages reflect the higher productivity levels in these firms. Thus, to mitigate any adverse effect of hiring foreign workers, policy measures encouraging firms to become globally integrated are recommended, including further trade liberalization, improving cumbersome customs procedures, as well as improving exporting-related activities.

6.3 Limitations of the Study

The main shortcoming of this thesis lies in the data availability issue. In particular, data concerning how firms hire foreign workers does not exist for many years, although the number of foreign workers grew at a remarkable rate. In this thesis, a proxy of actual data is utilized so that the found estimation outcome could represent a best approximation. This points to the room for improvement for future projects.

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APPENDICES

APPENDIX A
MODIFIED THEORETICAL FRAMEWORK

Consider a Cobb-Douglas aggregate production function with constant returns to scale technology:

$$Y_t = A_t L_t^{\alpha} K_t^{1-\alpha} \tag{A.1}$$

Where Y_t is aggregate output, A_t is total factor productivity (TFP), K_t is capital, L_t is the Constant Elasticity of Substitution (CES) aggregate of different types of labor in year t, and α is the income share of labor. The labor aggregate L_t is defined as:

$$L_t = \left[\theta_{Lt} L_{Lt}^{\frac{\sigma_{HL}-1}{\sigma_{HL}}} + \theta_{Ht} L_{Ht}^{\frac{\sigma_{HL}-1}{\sigma_{HL}}} \right]^{\frac{\sigma_{HL}}{\sigma_{HL}-1}} \tag{A.2}$$

Where L_{Lt} and L_{Ht} are aggregate measures of labor with low (L) and high (H) education level observed in time t, respectively. The θ's used throughout are relative productivity levels specific to the particular skill groups - indexed by subscripts - within the same CES nest. The parameter σ_{HL} is the elasticity of substitution between the two broad schooling groups. These two groups, low (L) and high (H), are in turn CES aggregates of detailed schooling groups of primary (PR), high school (HS), technical and vocational education and training ($TVET$), and college (CO) labor as follows:

$$L_{Lt} = \left[\theta_{PRt} L_{PRt}^{\frac{\sigma_{LL}-1}{\sigma_{LL}}} + \theta_{HSt} L_{HSt}^{\frac{\sigma_{LL}-1}{\sigma_{LL}}} \right]^{\frac{\sigma_{LL}}{\sigma_{LL}-1}} \tag{A.3}$$

$$L_{Ht} = \left[\theta_{TVETt} L_{TVETt}^{\frac{\sigma_{HH}-1}{\sigma_{HH}}} + \theta_{COt} L_{COt}^{\frac{\sigma_{HH}-1}{\sigma_{HH}}} \right]^{\frac{\sigma_{HH}}{\sigma_{HH}-1}}$$

Where the parameters σ_{bb} 's are the elasticity of substitution parameters between education subgroups within a broad schooling group b, where $b \in \{L, H\}$

A detailed education group $k \in \{\text{PR}, \text{HS}, \text{TVET}, \text{CO}\}$ further nests labor groups with different experience levels. In the spirit of Card and Lemieux (2001), this specification allows us to explore the possibility that similarly educated workers in different experience groups are imperfect substitutes in production. Specifically:

$$L_{kt} = \left[\sum_{j=1}^{4} \theta_{kj} L_{kjt}^{\frac{\sigma_J - 1}{\sigma_J}} \right]^{\frac{\sigma_J}{\sigma_J - 1}} \tag{A.4}$$

Where σ_J is the elasticity of substitution between workers with different experience levels within the same detailed education subgroup, and the subscript j indexes the experience group. In this thesis, we separate workers into four experience levels. That is, workers with 0-10 years, 11-20 years, 21-30 years and 31 or more years of experience are allocated to groups $j = 1, 2, 3$ and 4 respectively. Note that we assume that the experience-education specific relative efficiency parameters, θ_{kj} 's, are constant across time.

Finally, the L_{kjt} 's are CES aggregates of supplies of native (N_{kjt}) and migrant (M_{kjt}) workers within the same k, j, education-experience cell at time t :

$$L_{kjt} = \left[\theta_{Nkj} N_{kjt}^{\frac{\sigma_M - 1}{\sigma_M}} + \theta_{Mkj} M_{kjt}^{\frac{\sigma_M - 1}{\sigma_M}} \right]^{\frac{\sigma_M}{\sigma_M - 1}} \tag{A.5}$$

Where σ_M is the elasticity of substitution between native and immigrant workers.

In a competitive market, profit maximization must hold the first-order condition that the price of inputs in real terms equals its marginal product. The case for native workers is shown below:

$$w_{Nbkjt} = \alpha A_t \kappa_t^{1-\alpha} \left(\frac{\partial L_t}{\partial L_{bt}}\right)\left(\frac{\partial L_{bt}}{\partial L_{kt}}\right)\left(\frac{\partial L_{kt}}{\partial L_{kjt}}\right)\left(\frac{\partial L_{kjt}}{\partial N_{kjt}}\right) \tag{A.6}$$

Where (κ) is capital-labor ratio. Then, take the logarithm and rearrange to obtain:

$$\ln(w_{Nbkjt}) = \ln(\alpha A_t \kappa_t^{1-\alpha}) + \frac{1}{\sigma_{HL}}\ln(\mathrm{L}_t) + \ln(\theta_{bt}) - \left(\frac{1}{\sigma_{HL}} - \frac{1}{\sigma_{bb}}\right)\ln(L_{bt}) \tag{A.7}$$

$$+ \ln(\theta_{kt}) - \left(\frac{1}{\sigma_{bb}} - \frac{1}{\sigma_J}\right)\ln(L_{kt}) + \ln(\theta_{kj}) - \left(\frac{1}{\sigma_J} - \frac{1}{\sigma_M}\right)\ln(L_{kjt})$$

$$+ \ln(\theta_{Nkj}) - \left(\frac{1}{\sigma_M}\right)\ln(\mathrm{N}_{kjt})$$

The case for immigrants is derived in the same manner:

$$\ln(w_{Mbkjt}) = \ln(\alpha A_t \kappa_t^{1-\alpha}) + \frac{1}{\sigma_{HL}}\ln(\mathrm{L}_t) + \ln(\theta_{bt}) - \left(\frac{1}{\sigma_{HL}} - \frac{1}{\sigma_{bb}}\right)\ln(L_{bt}) \tag{A.8}$$

$$+ \ln(\theta_{kt}) - \left(\frac{1}{\sigma_{bb}} - \frac{1}{\sigma_J}\right)\ln(L_{kt}) + \ln(\theta_{kj}) - \left(\frac{1}{\sigma_J} - \frac{1}{\sigma_M}\right)\ln(L_{kjt})$$

$$+ \ln(\theta_{Mkj}) - \left(\frac{1}{\sigma_M}\right)\ln(\mathrm{M}_{kjt})$$

APPENDIX B
SUMMARY STATISTICS AND DATA CONSTRUCTED TO SEPARATE THE PROPORTION OF FOREIGN WORKERS IN LABOR FORCE SURVEYS

The summary statistics of 2012 data are shown in Table B1, while the structure of whole data is shown in Table B2 and B3. In this case, the total labor supply of Thai men is slightly higher than Thai women, while foreign men are mostly equal to foreign women. Regarding labor supply, high school workers, both in terms of Thai and foreign workers, are groups with the highest working hours. Note that the coverage of this data is 2012 because it is the only year that we were able to classify foreign workers.

Table B1

2012 Summary Statistics

	Observations	Mean	Standard Deviation
Average weekly hours -Thai men	25974	46.01	11.09
Average weekly hours -Thai women	22532	44.82	10.7
Average weekly hours -Thai employed workers			
Primary	16876	46.42	11.95
High School	15762	47.76	10.88
Technical and vocational education and training	4077	45.41	10.09
College	11791	41.01	8.09
Average weekly hours -Foreign men	1163	49.36	10.44
Average weekly hours -Foreign women	979	48.76	10.22
Average weekly hours -Foreign employed workers			
Primary	1436	48.98	11.16
High School	444	50.13	8.5
Technical and vocational education and training	103	49.66	8.46
College	159	46.69	7.75

Source: Quarter 3 2012 LFS.

Table B2

Total Summary Statistics

	Observations	Mean	Standard Deviation
Average weekly hours -Total men	1381758	43.47	21.21
Average weekly hours -Total women	1591467	35.37	25.03
Average weekly hours -Total employed workers			
Primary			
-experience 0 to 10 years	189169	43.5	23.13
-experience 11 to 20 years	334150	44.66	21.9
-experience 21 to 30 years	458856	45.42	21.01
-experience more than 30 years	706681	39.92	23.5
High School			
-experience 0 to 10 years	385520	24.14	26.5
-experience 11 to 20 years	200705	44.16	21.04
-experience 21 to 30 years	134714	44.42	20.76
-experience more than 30 years	84289	38.71	23.47
Technical / vocational education and training			
-experience 0 to 10 years	68832	29.54	24.76
-experience 11 to 20 years	42185	43.9	18.11
-experience 21 to 30 years	22282	43.11	18.3
-experience more than 30 years	8997	34.64	21.82
College			
-experience 0 to 10 years	134989	27.95	23.68
-experience 11 to 20 years	96303	41.05	15.41
-experience 21 to 30 years	70025	39.28	14
-experience more than 30 years	35528	30.76	19.61

Source: 1986-2013 LFS.

Table B3

Distribution of Actual Weekly Hours Supplied

	Percent
Primary	50.38%
-experience 0 to 10 years	11.77%
-experience 11 to 20 years	14.45%
-experience 21 to 30 years	12.95%
-experience more than 30 years	11.21%
High School	29.01%
-experience 0 to 10 years	13.70%
-experience 11 to 20 years	9.15%
-experience 21 to 30 years	4.25%
-experience more than 30 years	1.91%
Technical and vocational education and training	6.13%
-experience 0 to 10 years	3.13%
-experience 11 to 20 years	1.96%
-experience 21 to 30 years	0.80%
-experience more than 30 years	0.25%
College	14.48%
-experience 0 to 10 years	5.74%
-experience 11 to 20 years	4.83%
-experience 21 to 30 years	2.85%
-experience more than 30 years	1.07%
Total	100.00%

Source: 1986-2013 LFS.

As mentioned at the end of Section 4.2.1.1, LFS does not provide data on foreign workers for every year, the available data was collected in the third quarter of 2012. However, our employed model requires the labor supplies of foreign workers and their wages in each k, j education-experience cell at time t. What we have available is only the data for 2012. Thus, we have to use this data as a proxy of every year in this analysis.

At first, the proportions between foreign and Thai workers in each k, j education-experience cell at time t are calculated from their labor supplies and their wages (see Table B4). Then, we aggregate this proportions by averaging into the above

nested cell, the workers in each k education at time t. We repeat this process again in each b broad education at time t. Finally, we achieve the first nested cell containing workers at time t.

After we obtained all the required proportions, we apply them to every yearly LFS. Note that the lowest nested cell in every year is the workers in each k, j education-experience cell, except for 2012.

Table B4

Proportions of Labor Supplies and Wages between Foreign and Thai Workers

Education	Experience	Labor Supplies		Wages	
		Thai	Foreign	Thai	Foreign
Primary	0-10	0.84	0.16	0.80	0.20
	11-20	0.88	0.12	0.91	0.09
	21-30	0.95	0.05	0.95	0.05
	31 plus	0.98	0.02	0.98	0.02
High School	0-10	0.97	0.03	0.98	0.02
	11-20	0.96	0.04	0.98	0.02
	21-30	0.98	0.02	0.99	0.01
	31 plus	0.99	0.01	0.99	0.01
Vocation	0-10	0.96	0.04	0.98	0.02
	11-20	0.97	0.03	0.98	0.02
	21-30	0.98	0.02	0.99	0.01
	31 plus	0.99	0.01	0.99	0.01
College	0-10	0.97	0.03	0.95	0.05
	11-20	0.98	0.02	0.98	0.02
	21-30	1.00	0.00	1.00	0.00
	31 plus	1.00	0.00	1.00	0.00

Source: Author's tabulation from LFS Q3 2012.

APPENDIX C
DATA CONSTRUCTED TO GENERATE FOREIGN WORKER DEPENDENCY IN ECONOMETRIC-BASED MODEL

So far, we have faced a severe problem concerning data scarcity. The data we lack in order to perform the analysis in Section 4.1.2 reflects foreign worker dependency in each plant/industry in 1996, 2006, and 2011. The 2011 SES data is employed to fill this gap.

The 2011 SES data basically does not provide the nationality of each worker, but we can use languages spoken in their families as a proxy of their nationalities. The languages that we use to specify foreign workers are Mon/Burmese and Cambodian/Souy. One advantage from using this SES data is that the total weighted number of foreign workers equals the total number from OFWA (about 1.6 million workers). Next, we aggregate the workers by industries using ISIC at the 4-digit level. This means that we eliminate all workers who are not working in the manufacturing sector. Again, the total weighted number of workers in the manufacturing sector equals the total number from IC (about 270 thousand workers). Up to this point, it possible to merge two datasets together (IC and SES) in order to obtain a foreign worker dependency variable. This *IMD_N2* is calculated from the number of foreign workers in a given industry divided by the total number of workers in that industry.

However, there is a problem from this merging process. The main issue when merging two data sources between IC and SES by 4-digit ISIC is that there exist some non-matching industries. There are two possible reasons for this phenomenon: (1) the SES data does not cover foreign workers in those absent industries, and (2) there are no foreign workers in those industries.

To overcome the first possibility, we find the average values of this variable using ISIC at the three digit level, and use them to fill in for the absent data. For the next possibility, we review the reserved jobs in detail, and set the variable to be zero when those jobs are reserved only for Thai workers. The industries at the four digit level that match with reserved jobs are 1551-52, 1600, 2023, 2211-12, 2222, 2230,

2320, 2413, 2423-24, 2429, 2812-13, 2911-15, 2921-27, 2929-30, 3130, 3140, 3150, 3210, 3220, 3230, 3311-12, 3320, 3691-92, and 3710 (see Table 4.5 for descriptive statistics concerning this variable).

From the above construction, it is just available as an actual foreign worker dependency variable in 2011. Thus, we have to construct dummy variables *IMD_dum*, in order to deal with the other years of IC. For the base case of this dummy, it is calculated using actual number *IMD_N2*. The dummy value is one when the actual number of *IMD_N2* is greater than its mean. Step back to 2006, we modified the dummy in 2011 given the condition that *IMD_N2* is greater than the summation of its mean and its one standard deviation, and two standard deviations for 1996. Table C1 provides the dummy values from 110 industries in 1996, 2006, and 2011.

Table C1

Summary of Foreign Worker Dependency Dummy Variables

ISIC at 4-digit level & Details		Dummies of foreign worker dependency		
		2011	2006	1997
1511	Production of meat and meat products	0	0	0
1512	Processing and preserving of fish and fish Products	1	1	0
1513	Processing of fruit and vegetables	1	1	0
1514	Manufacture of vegetable and animal oils and fats	1	1	0
1520	Manufacture of dairy products	0	0	0
1531	Manufacture of grain mill products	1	0	0
1532	Manufacture of starches and starch products	1	0	0
1533	Manufacture of prepared animal feeds	0	0	0
1541	Manufacture of bakery products	0	0	0
1542	Manufacture of sugar	1	0	0
1543	Manufacture of cocoa, chocolate and sugar confectionery	1	0	0
1544	Manufacture of macaroni, noodles, couscous and similar farinaceous products	0	0	0
1549	Manufacture of other food products n.e.c.	1	0	0

Table C1 (Continued)

1551	Distilling, rectifying and blending of spirits; ethyl alcohol production from fermented materials	0	0	0
1552	Manufacture of wines	0	0	0
1553	Manufacture of malt liquors and malt	0	0	0
1554	Manufacture of soft drinks; bottling of mineral waters	0	0	0
1600	Manufacture of tobacco products	0	0	0
1711	Preparation and spinning of textile fibres; weaving of textiles	1	1	1
1712	Finishing of textiles	1	1	1
1721	Manufacture of made-up textile articles, except apparel	1	1	1
1722	Manufacture of carpets and rugs	0	0	0
1723	Manufacture of cordage, rope, twine and netting	1	1	1
1729	Manufacture of other textiles n.e.c.	1	1	1
1730	Manufacture of knitted and crocheted fabrics and articles	0	0	0
1911	Tanning and dressing of leather	0	0	0
1912	Manufacture of luggage, handbags and the like, saddlery and harness	0	0	0
1920	Manufacture of footwear	0	0	0
2010	Sawmilling and planing of wood	0	0	0
2021	Manufacture of veneer sheets; manufacture of plywood, laminboard, particle board and other	0	0	0
2022	Manufacture of builders' carpentry and joinery	0	0	0
2023	Manufacture of wooden containers	0	0	0
2029	Manufacture of other products of wood; manufacture of articles of cork, straw and	0	0	0
2101	Manufacture of pulp, paper and paperboard	0	0	0
2102	Manufacture of corrugated paper and paperboard and of containers of paper and paperboard	0	0	0
2109	Manufacture of other articles of paper and paperboard	1	0	0
2211	Publishing of books, brochures, musical books and other publications	0	0	0

Table C1 (Continued)

2212	Publishing of newspapers, journals and periodicals	0	0	0
2221	Printing	0	0	0
2222	Service activities related to printing	0	0	0
2230	Reproduction of recorded media	0	0	0
2320	Manufacture of refined petroleum products	0	0	0
2411	Manufacture of basic chemicals, except fertilizers nitrogen compounds	0	0	0
2412	Manufacture of fertilizers and nitrogen compounds	0	0	0
2413	Manufacture of plastics in primary forms and of nitrogen compounds synthetic rubber	0	0	0
2422	Manufacture of paints, varnishes and similar coatings, printing ink and mastics	0	0	0
2423	Manufacture of pharmaceuticals, medicinal chemicals and botanical products	0	0	0
2424	Manufacture of soap and detergents, cleaning and polishing preparations,	0	0	0
2429	Manufacture of other chemical products n.e.c.	0	0	0
2511	Manufacture of rubber tires and tubes; retreading and rebuilding of rubber tires	0	0	0
2519	Manufacture of other rubber products	0	0	0
2520	Manufacture of plastic products	0	0	0
2610	Manufacture of glass and glass products	1	0	0
2691	Manufacture of non-structural non-refractory ceramic ware	0	0	0
2693	Manufacture of structural non-refractory clay products	0	0	0
2694	Manufacture of cement, lime and plaster	0	0	0
2695	Manufacture of articles of concrete, cement and plaster	0	0	0
2696	Cutting, shaping and finishing of stone	0	0	0
2699	Manufacture of other non-metallic mineral products n.e.c.	0	0	0
2710	Manufacture of basic iron and steel	0	0	0
2720	Manufacture of basic precious and non-ferrous metals	0	0	0
2811	Manufacture of structural metal products	0	0	0

Table C1 (Continued)

2812	Manufacture of tanks, reservoirs and containers of metal	0	0	0
2813	Manufacture of steam generators, except central heating hot water boilers	0	0	0
2892	Treatment and coating of metals; general mechanical engineering	0	0	0
2893	Manufacture of cutlery, hand tools and general hardware	0	0	0
2899	Manufacture of other fabricated metal products n.e.c.	0	0	0
2911	Manufacture of engines and turbines, except aircraft,	0	0	0
2912	Manufacture of pumps, compressors, taps and valves	0	0	0
2913	Manufacture of bearings, gears, gearing and driving elements	0	0	0
2914	Manufacture of ovens, furnaces and furnace burners	0	0	0
2915	Manufacture of lifting and handling equipment	0	0	0
2919	Manufacture of other general purpose machinery	0	0	0
2921	Manufacture of agricultural and forestry machinery	0	0	0
2922	Manufacture of machine-tools	0	0	0
2923	Manufacture of machinery for metallurgy	0	0	0
2924	Manufacture of machinery for mining, quarrying and construction	0	0	0
2925	Manufacture of machinery for food, beverage and tobacco processing	0	0	0
2926	Manufacture of machinery for textile, apparel and leather production	0	0	0
2927	Manufacture of weapons and ammunition	0	0	0
2929	Manufacture of other special purpose machinery	0	0	0
2930	Manufacture of domestic appliances n.e.c.	0	0	0
3000	Manufacture of office, accounting and computing machinery	0	0	0
3110	Manufacture of electric motors, generators and transformers	0	0	0
3130	Manufacture of insulated wire and cable	0	0	0
3140	Manufacture of accumulators, primary cells and primary batteries	0	0	0

Table C1 (Continued)

3150	Manufacture of electric lamps	0	0	0
3190	Manufacture of other electrical equipment n.e.c.	0	0	0
3210	Manufacture of electronic valves and tubes and other electronic components	0	0	0
3220	Manufacture of television and radio transmitters and apparatus for line telephony	0	0	0
3230	Manufacture of television and radio receivers and associated consumer goods	0	0	0
3311	Manufacture of medical and surgical equipment and or orthopedic appliances	0	0	0
3312	Manufacture of instruments and appliances for measuring, checking, testing, navigating and	0	0	0
3320	Manufacture of optical instruments and photographic equipment	0	0	0
3330	Manufacture of watches and clocks	0	0	0
3410	Manufacture of motor vehicles	0	0	0
3420	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers	0	0	0
3430	Manufacture of parts and accessories for motor vehicles and their engines	0	0	0
3511	Building and repairing of ships	0	0	0
3530	Manufacture of aircraft and spacecraft	0	0	0
3591	Manufacture of motorcycles	0	0	0
3610	Manufacture of furniture	1	0	0
3691	Manufacture of jewelry and related articles	0	0	0
3692	Manufacture of musical instruments	0	0	0
3693	Manufacture of sports goods	0	0	0
3694	Manufacture of games and toys	0	0	0
3699	Other manufacturing n.e.c.	0	0	0
3710	Recycling of metal waste and scrap	0	0	0
3720	Recycling of non-metal waste and scrap	0	0	0
Total positive dummies		17	9	5

Source: Author’s calculation.

APPENDIX D
ELABORATION ON THE MARKET ORIENTATION VARIABLE

According to the inconsistent sign of the market orientation variable between plant and industry levels, it is indeed consistent if we interpret such findings with care. Let an average weighted wage in a given industry be a function of wages paid to exporting and non-exporting firms weighted by the total number of firms in that industry:

$$\overline{W} = \alpha W_1 + (1-\alpha) W_2 \tag{D.1}$$

$\overline{W}$ = Weighted wage paid
W_2 = Wage paid by non-exporting firms
W_1 = Wage paid by exporting firms
α = Share of exporting firms

As echoed in the firm heterogeneity literature, the more the industry is integrated into the global economy, the larger the difference in firm productivity. Hence, wage compensation paid by exporting firms tends to be a function of wages paid by non-exporting firms with premiums, taking the formula as in Equation D.2:

$$W_1 = \left(1+\varepsilon(\alpha)\right) W_2 \tag{D.2}$$

$\varepsilon(\alpha)$ = Wage premiums in exporting firms

The assumptions here are that $\varepsilon > 0$ and $\partial\varepsilon/\partial\alpha > 0$, then we replace Equation D.2 in Equation D.1 above:

$$\begin{aligned} \overline{W} &= \alpha\left(1+\varepsilon(\alpha)\right) W_2 + (1-\alpha) W_2 \\ &= W_2 - \alpha\varepsilon(\alpha) W_2 \end{aligned} \tag{D.3}$$

Next, we take a partial derivation with respect to the share of exporting firms (α) to get the condition that explains the possibility of the negative sign:

$$\frac{\partial \overline{W}}{\partial \alpha} = -\left[\varepsilon(\alpha) + \alpha \, \partial \varepsilon / \partial \alpha \right] \tag{D.4}$$

The RHS of Equation D.4 is always negative, and this is consistent with our results.

BIOGRAPHY

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