Chapter 5

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

Shandre M. Thangavelu
National University of Sintapore

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CHAPTER 5

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

SHANDRE M. THANGAVELU*

National University of Singapore

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

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

* Department of Economics, National University of Singapore, Email: ecssmt@nus.edu.sg

1. Introduction

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

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

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

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

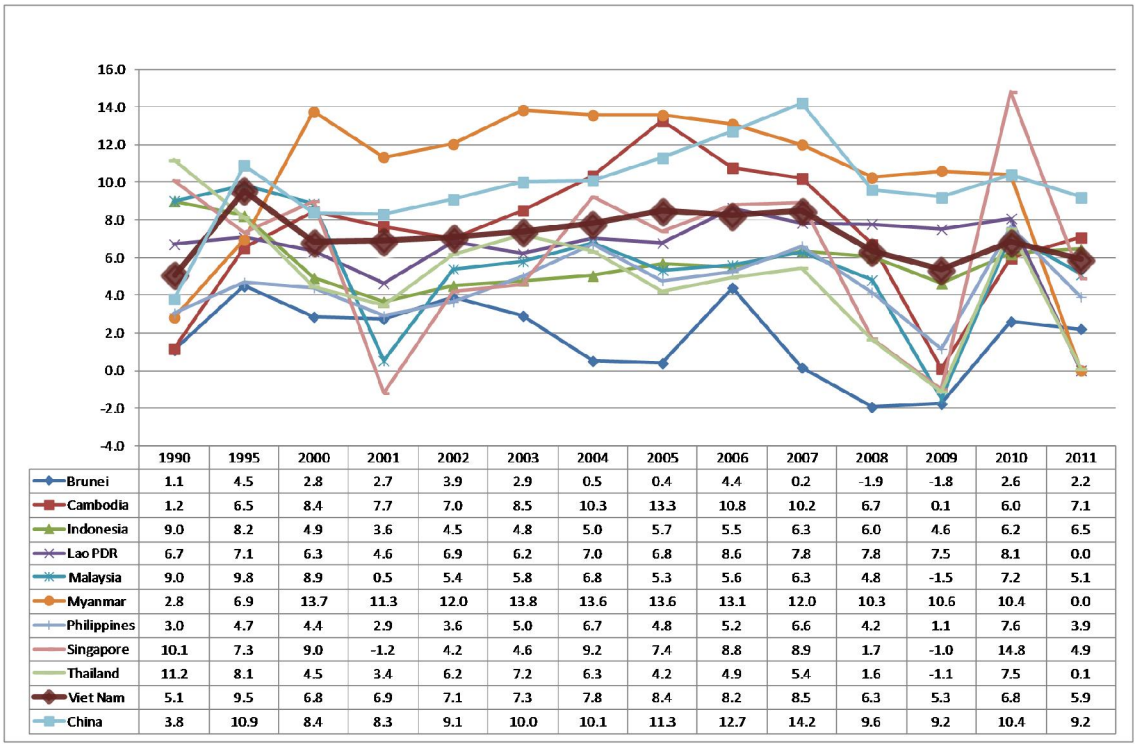
The organisation of paper is as follows. Section 2 depicts the recent trends and developments in Vietnam. Section 3 develops the empirical methodology based on the translog cost function approach. Section 4 presents and discusses the empirical results. Section 5 concludes.

2. Overview of Globalization and Vietnamese Manufacturing Industry

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

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

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



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

Source: ADB, Macroeconomic Indicators.

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

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

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

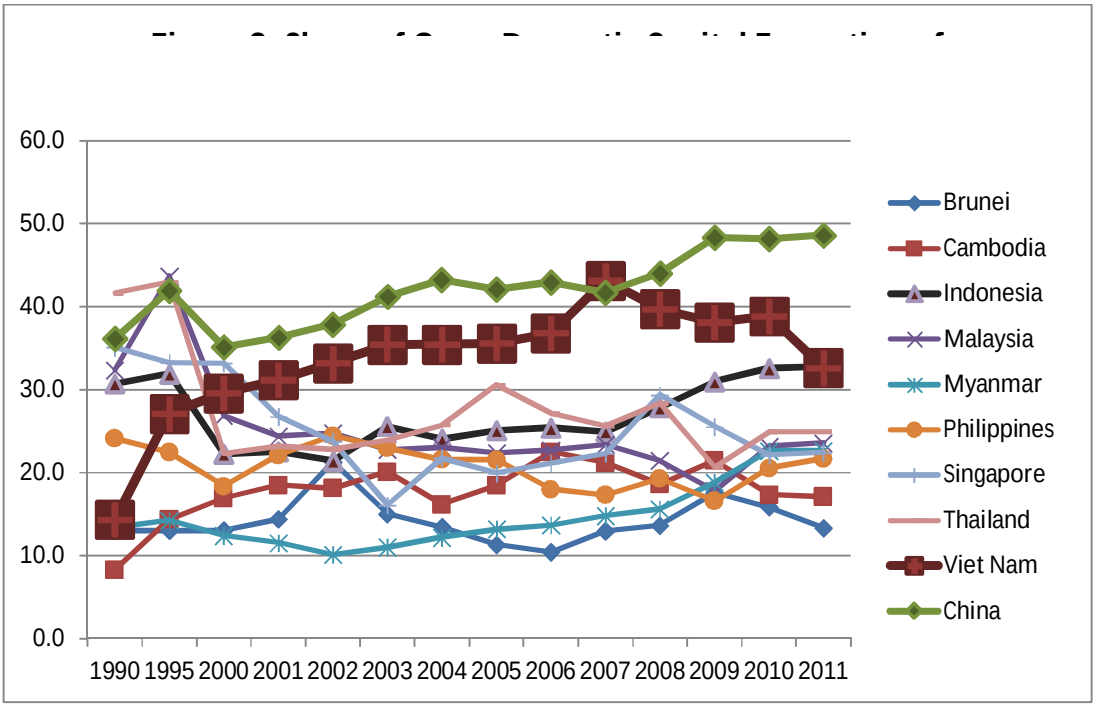
manufacturing with concurrent declining share of the agricultural sector. The share of manufacturing to GDP ratio rising from 22% in 1990 to over 40% in 2011, and concurrently, we observed the agricultural sector declining to 22 percent in 2011 from over 39 percent in 1990. In contrast, the share of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

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

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

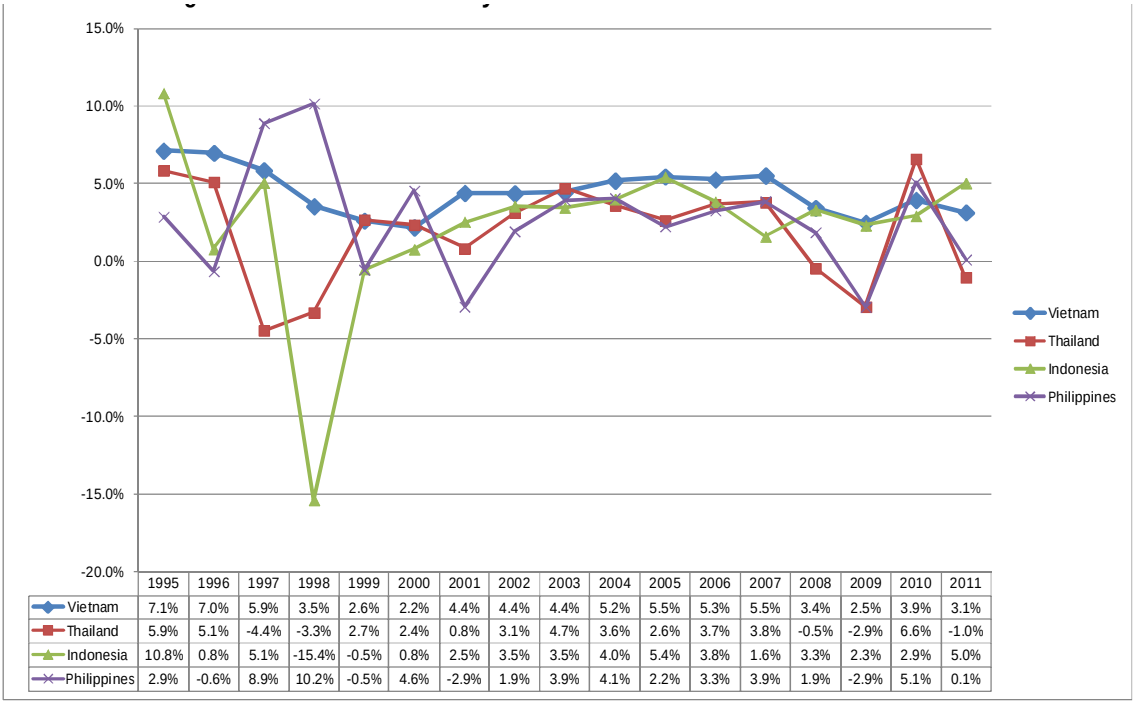
Source: ADB.

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



Source: ADB.

Figure 3: Labour Productivity of Vietnam and Selected Asian Countries



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

Source: Statistics from ADB.

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

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

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

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

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

Source: ADB.

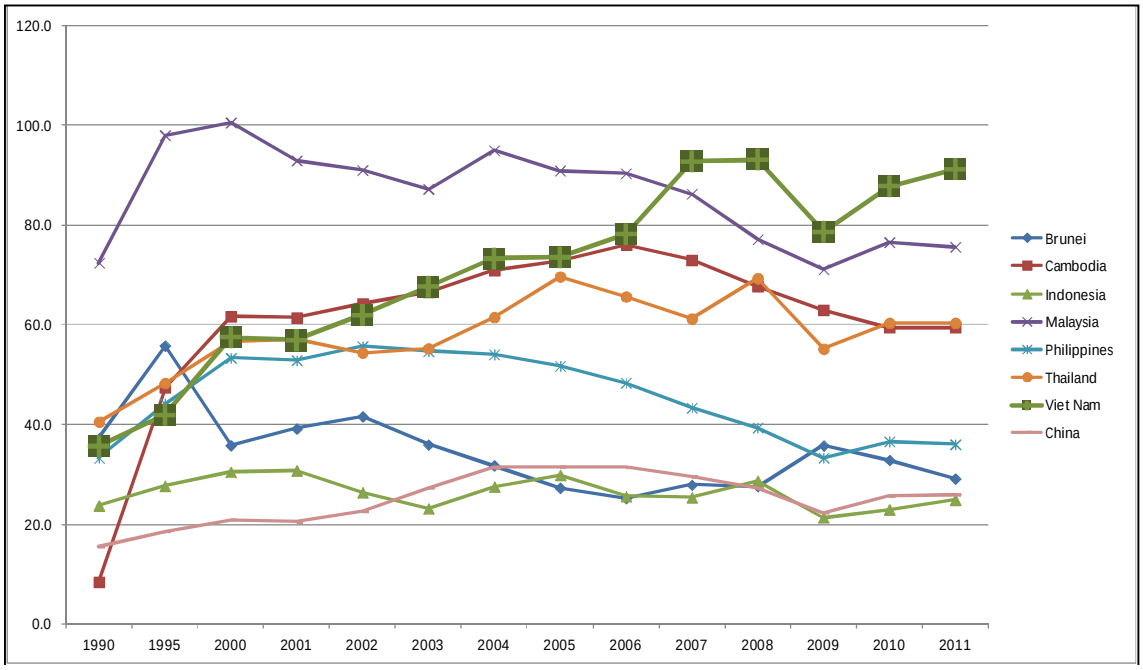
It is important to highlight that the economic liberalization of Vietnam is mainly driven by the growth in global trade. The share of export to GDP increased to 87 percent in 2011 from 26 percent in 1990. The impact of openness is also observed with the rising share of imports to GDP, whereby it increased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

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

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

Source: ADB.

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



Source: ADB.

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

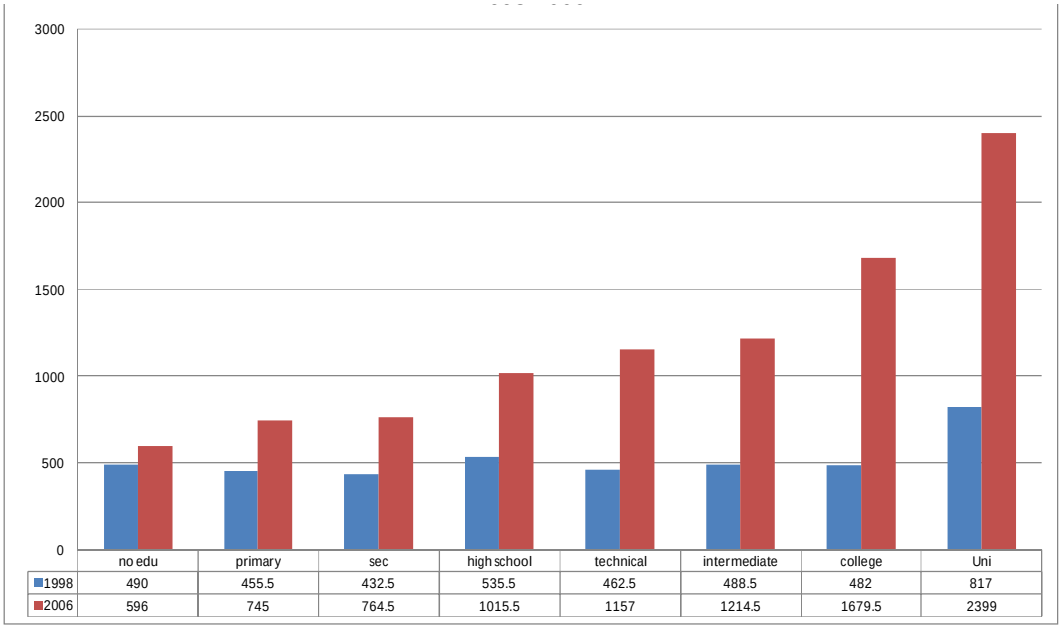
to GDP, where domestic firms are likely to outsource some of their key services and other activities to the global production value-chain. The rising share of imports and hence outsourcing is given at Figure 2, where the share of imports increased from 36 percent in 1990 to nearly 91 percent in 2011.

2.1. Impact of Trade on Wage Gap

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

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

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



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

Source: Nguyen Thi Lan Huong (2008).

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

Figure 6: Share of Unskilled Compensation to Fixed Capital

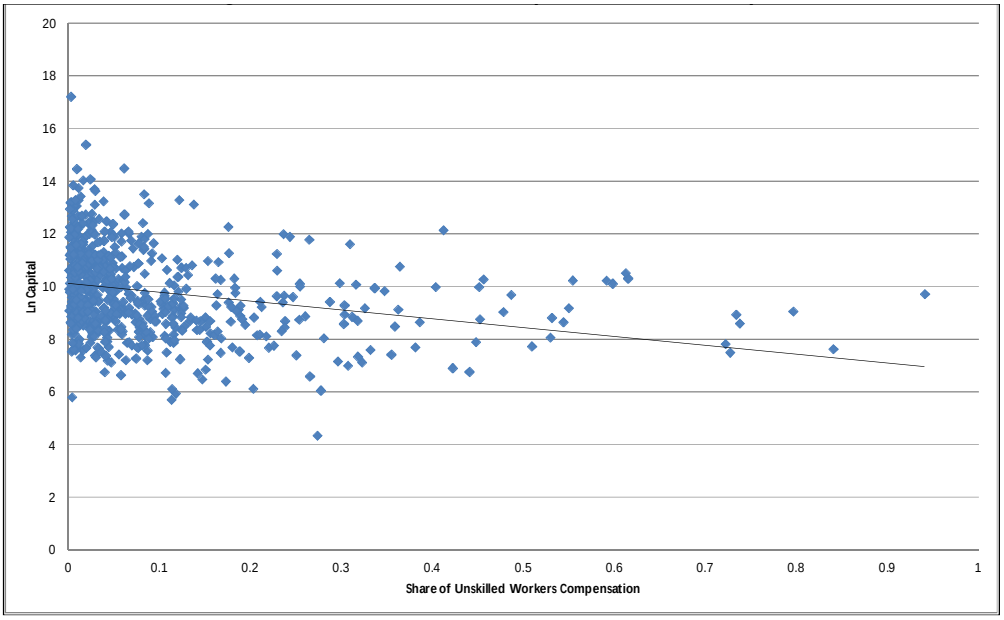
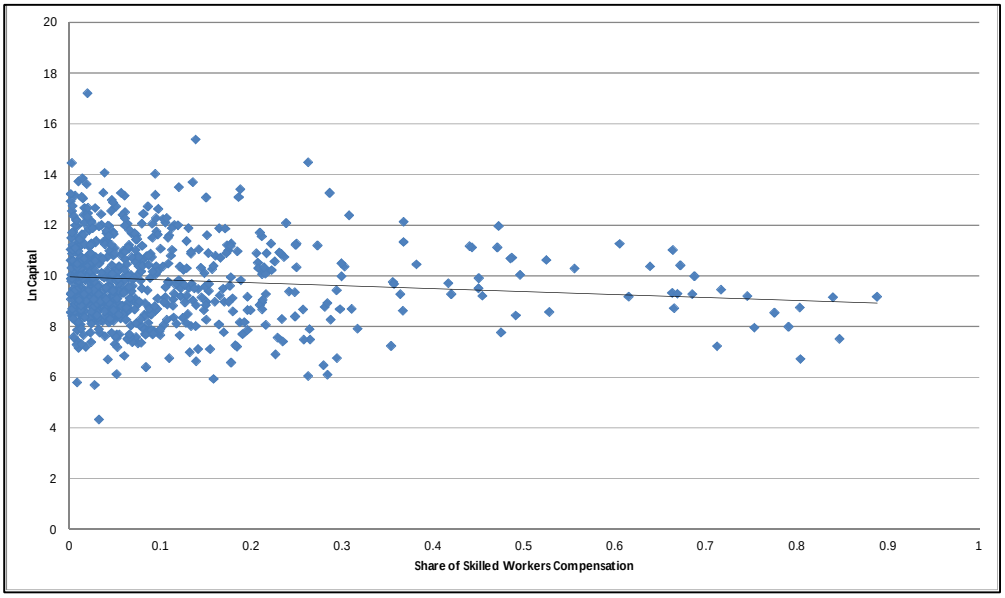


Figure 7: Share of Skilled Workers Compensation to Fixed Capital



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

Figure 8: Share of Skilled Workers Compensation to Export

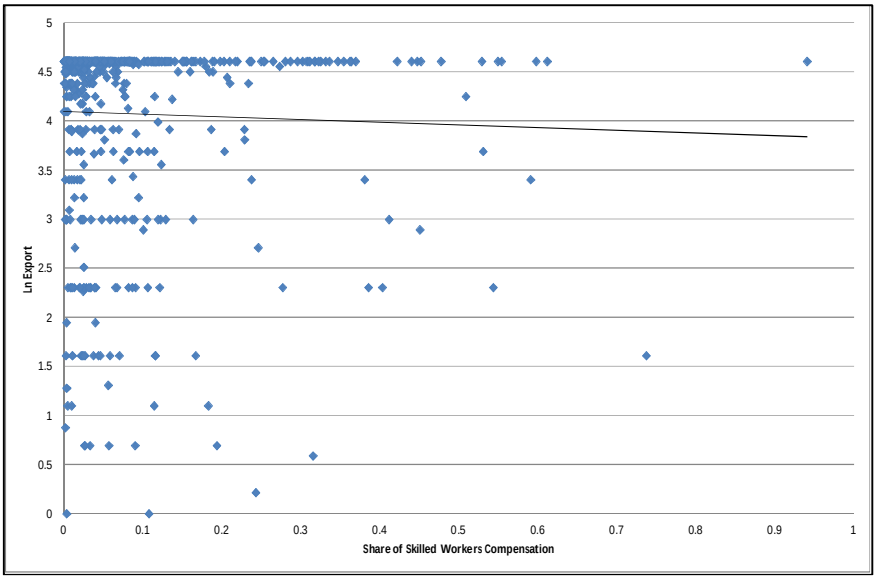
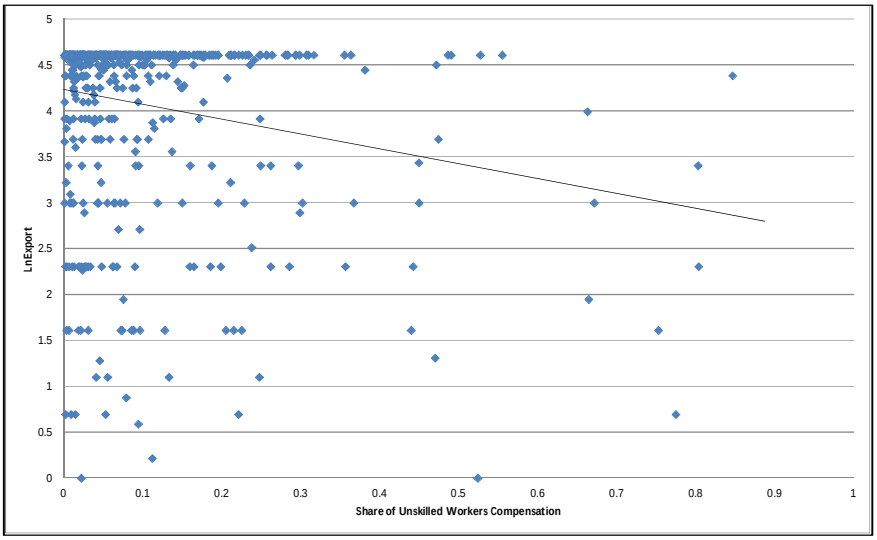


Figure 9: Shared of Unskilled Workers Compensation to Export



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

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

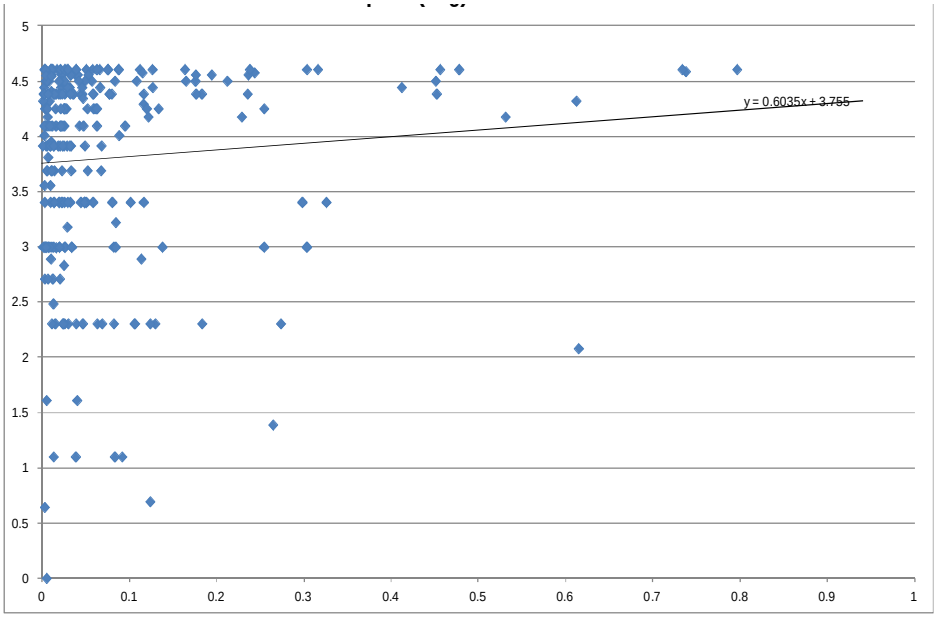
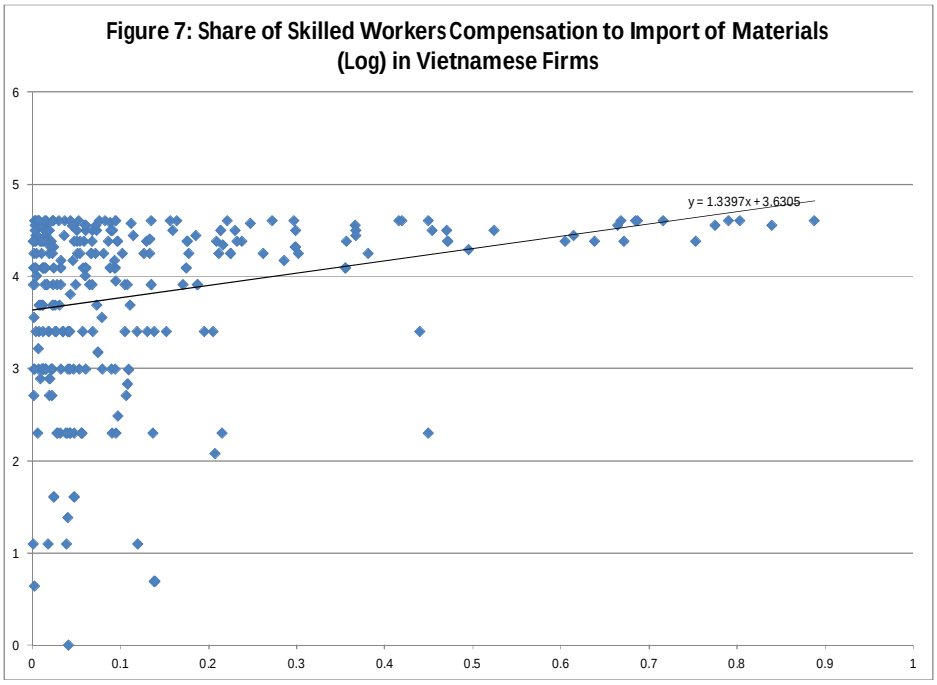


Figure 11: Share of Skilled Workers Compensation to Import of Materials (Log) in Vietnamese Firms



3. Empirical Model

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

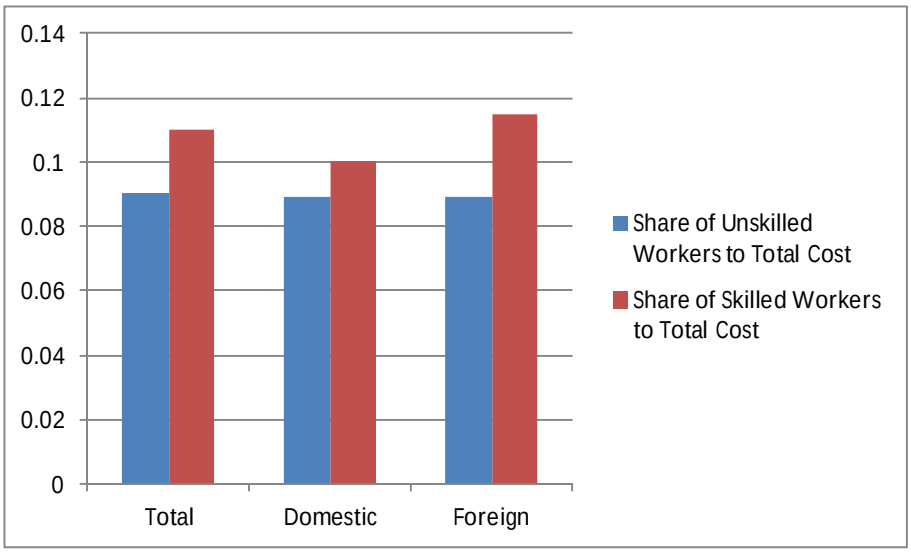
In the above analysis we have three variable inputs: skilled, unskilled and material inputs. For the adding-up condition to hold, the summation of shares of the factor inputs should add to unity. To account for the adding-up condition, we dropped the share of material inputs and estimated only the labour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

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

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

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

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



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

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

4. Empirical Results

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

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

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

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

Source: Authors' compilation.

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

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

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

Source: Authors' compilation.

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

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

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

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

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

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

5. Policy Conclusion

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

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

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

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

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

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

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

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

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

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

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