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WPS6419

Policy Research Working Paper 6419

Title Export Liberalization, Job Creation and the Skill Premium

Evidence from the U.S.-Vietnam Bilateral Trade Agreement

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April 2013

Abstract

This paper explores how the expansion of labor-intensive manufacturing exports resulting from the United States–Vietnam Bilateral Trade Agreement in 2001 translated into wages of skilled and unskilled workers and the skill premium in Vietnam through the channel of labor demand. In order to isolate the impacts of trade shock from the effects of other market-oriented reforms, a strategy of exploiting the regional variation in difference in exposure to trade is employed. Using the data on panel individuals from the *Vietnam Household Living Standards Surveys* of 2002 and 2004, and addressing the issue of endogeneity, the results confirm the existence of a Stolper-Samuelson type effect. That is, those provinces more exposed to the increase in exports experienced relatively larger wage growth for unskilled workers and a decline of (or a smaller increase in) the relative wages of skilled and unskilled workers. During the period 2000–2004, the skill premium increased for Vietnam's economy as a whole in the sample of panel individuals. Thus, the Stolper-Samuelson type effect appears to have mitigated but did not outweigh the impacts of other factors that contributed to the rise in the skill premium.

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Produced by the Research Support Team

Export Liberalization, Job Creation and the Skill Premium: Evidence from the U.S.-Vietnam Bilateral Trade Agreement

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JEL Codes: F16, J23, J24, J31

Keywords — trade liberalization, skill premium, wage, Stolper–Samuelson theorem, Vietnam

Sector Board: Poverty Reduction and Economic Management

[1] Development Economics Research Group, World Bank. I would like to thank Wim Vijverberg for his advice and support throughout this research; Zadia Feliciano, the late Robert Lipsey and Jonathan Nelson for comments and suggestions; Chad Bown and Will Martin for guidance; and the General Statistics Office of Vietnam for providing the data. I also benefited greatly from comments by Ryan Edwards, Michael Grossman, David Jaeger, Yan Song, Thom Thurston and Merih Uctum. A shorter version of this paper has been published in *World Development* (2013a). I am grateful to the anonymous referees of *World Development* and the World Bank for their detailed and very helpful comments. Any remaining errors are mine.

1. INTRODUCTION

Since Vietnam started its transition from a centrally planned to a market oriented economy under its *doi moi* ("renovation") policy in 1986, Vietnam has been among the fastest growing economies with an average annual growth rate of 6.9 percent.[2] Vietnam's trade, measured by its sum of imports and exports, grew even faster than its Gross Domestic Product (GDP), as the share of trade relative to GDP increased from 23.2 percent in 1986 to 112.5 percent in 2000, 139.0 percent in 2004 and 169.6 percent in 2007 (WDI, the World Bank). However, Vietnam's industrial employment share initially remained unchanged at around 12 percent of total employment through the end of the 1990s (WDI), suggesting that expansion of trade does not necessarily lead to industrial job creation. In contrast, since the recent millennium, Vietnam's industrial employment share in total employment grew substantially, rising from 12.4 percent in 2000 to 17.4 percent of total employment in 2004 (WDI). The U.S.-Vietnam Bilateral Trade Agreement (BTA) of 2001, which led to a dramatic expansion of labor-intensive manufacturing exports to the U.S., appears to have contributed to the surge.

The standard Heckscher-Ohlin (H-O) theory predicts that, as developing countries are abundant in unskilled labor and scarce in skilled labor, freer trade would lead a developing country to specialize in a sector which uses its unskilled labor intensively, raising labor demand in the latter sector. Its companion theory, the Stolper-Samuelson (S-S) theorem (1941), suggests that the increase in the relative output prices of unskilled-labor-intensive goods relative to skilled-labor-intensive goods would translate into a rise in the relative wages of unskilled labor, narrowing the wage gap between skilled and unskilled workers. However, the validity of the Heckscher-Ohlin-Samuelson (H-O-S) theory has been challenged since, contrary to the prediction of the theory, many developing countries experienced an *increase* rather than a

[2] The average for the period 1986-2011 (the World Development Indicators (WDI), the World Bank).

decrease in skill premium after episodes of trade liberalization (Goldberg & Pavcnik, 2007; Harrison, McLaren, & McMillan, 2010). Moreover, most of the empirical research finds little evidence that trade reforms induce labor reallocation *across* sectors toward unskilled-labor-intensive sectors in developing countries (Goldberg & Pavcnik, 2007).[3] In their extensive review on the distributional consequence of globalization, Goldberg and Pavcnik (2007) view that the H-O-S theorem is generally inconsistent with the empirical evidence and conclude that the direction of research on international trade tends to be shifting from the traditional focus on countries and industries to a new focus on firms and products. However, Goldberg and Pavcnik's (2007) conclusions are mainly drawn from evidence on import liberalization, and little study has been devoted to how export liberalization resulting from policy changes by countries' trading partner(s) would affect skill premium in developing countries.

The impact of the BTA on Vietnam's labor market provides an excellent opportunity to remedy this gap in the trade liberalization and wage inequality literature. First, the BTA presents an opportunity to examine, on the export side, how a tariff cut by a country's trading partner influenced job opportunities and wages of workers with different skill levels. Second, the U.S. tariff cut on Vietnam's exports was exogenous,[4] sudden and large. Before the BTA, Vietnam's access to the U.S. market was quite limited since Vietnam faced the U.S. general tariff rate (at around 35 percent in simple average) which was much higher than the U.S. Most-Favored-Nation (MFN) tariff rate of around 4.9 percent (Fukase & Martin, 2000). Immediately after the

[3] Examining 25 liberalization episodes, Wacziarg and Wallack (2004) find no systematic evidence that increased trade openness leads to increased labor shifts. A lack of labor reallocation across sectors after trade reforms is also reported for Argentina (Galiani & Sanguinetti, 2003), for Columbia (Attanasio, Goldberg, & Pavcnik, 2004), for Mexico (Feliciano, 2001), and for India (Kijima, 2006; Topalova, 2010).

[4] The general tariff rates are for the most part the statutory rates that were applied to U.S. imports under the Tariff Act of 1930 (also known as the Smoot-Hawley Act). After the trade liberalization of the various General Agreement on Tariffs and Trade (GATT) rounds beginning in 1947, the United States has applied the MFN rate in the U.S. tariff schedule to almost all of its World Trade Organization (WTO) and non-WTO trading partners. However, the U.S. retained the general rates primarily against communist countries not participating in GATT (Fukase & Martin, 2000).

BTA came into effect on December 10, 2001, the U.S. granted MFN status to Vietnam lowering the tariff rates across the board. As a result, Vietnam's exports to the U.S., in particular, those of labor-intensive manufacturing goods, expanded dramatically. Starting from a very low level, the U.S. absorbed 38.3 percent of Vietnam's textiles exports, 56.9 percent of apparel, 16.6 percent of footwear/leather, and 26.2 percent of furniture and miscellaneous manufacturing exports by the year 2004 (the U.N. Comtrade System). Finally, unlike most of the cases in the literature, labor reallocation toward more labor-intensive manufacturing appears to have occurred in the aftermath of the BTA.

Since *doi moi*, Vietnam has undertaken a number of reforms which introduced market forces in determining wages, including labor market reforms, privatization and rationalization of state owned enterprises (SOEs) and a variety of legal, regulatory and institutional reforms (Van Arkadie & Mallon, 2003). This paper undertakes a strategy of isolating the effects of the U.S. tariff cut on wages from the impacts of the domestic reforms, following recent literature to explore regional variation in exposure to trade in analyzing consequences of trade reforms (see, for instance, Castilho, Menéndez, & Sztulman, 2011; Chiquiar, 2008; Coello, 2009; Hanson, 2005; McCaig, 2011; Topalova, 2010; and Wei & Wu, 2001). A contribution of this paper is to model explicitly the change in labor demand induced by exports as a mechanism through which exports would influence wages. I construct an Export Index at the province level, taking account of Vietnam's provincial industrial composition and its export- and labor-intensities. In order to overcome potential endogeneity, the U.S. tariff cut measure inspired by Topalova (2010) is used as an instrument. Then, using the panel individuals from the *Vietnam Household Living Standards Surveys* (VHLSS) who were interviewed both in 2002 and 2004, I evaluate how the

provincial variation in exposure to trade would have influenced the wage levels of skilled and unskilled workers and the skill premium in Vietnam.

Section 2 demonstrates the trends of trade and industrial employment in Vietnam. Section 3 specifies and implements a series of regression models which relate changes in the Export Index to changes in wages of skilled and unskilled workers and in the skill premium. Section 4 concludes.

2. BACKGROUND

(a) Trends of Vietnam's trade and the U.S.-Vietnam Bilateral Trade Agreement

The coming into effect of the U.S.-Vietnam BTA in December 2001 and Vietnam's accession to the WTO in January 2007 contributed significantly to the expansion of Vietnam's trade. Figure 1 plots the evolution of Vietnam's exports to the United States. After the United States lifted its embargo in 1994, Vietnam's exports to the United States grew steadily. Prior to the BTA, Vietnam's exports to the U.S. were mainly concentrated in primary products such as coffee, shrimp and petroleum whose general tariff rates are zero or close to zero (Fukase and Martin, 2000). However, Vietnam faced almost prohibitive general tariff rates for many manufactured goods.[5] Immediately after the BTA came into force in December 2001, the United States extended normal trade relations and MFN status to Vietnam. As a result, the United States emerged as Vietnam's top export destination in 2002, with Vietnam's exports to the United States more than doubling from $1,066 million in 2001 to $2,453 million in 2002. They have continued to increase, reaching $11,903 million in 2008.

During the same period, Vietnam's exports to destinations other than the U.S. also grew rapidly with Vietnam's total exports to the world rising from $14,483 million in 2000 to $62,685

[5] See Fukase and Martin (2000, Table 2) for the differences between general and MFN tariff rates by commodity. For instance, the general tariff rates for apparel were as high as 68.9 percent compared to 13.4 percent for MFN rates.

million in 2008. Figure 2 plots the share of the United States in Vietnam's total exports. Vietnam's exports to the U.S., which accounted for 7.1 percent of Vietnam's exports in 2001, jumped to 14.7 percent in 2002, and further increased to 19.6 percent in 2003; since then, the ratio has remained relatively steady at around 19 percent. Thus, it would be reasonable to assume that most of the immediate impacts of the U.S. tariff reduction took effect between 2001 and 2004.

(b) Composition of trade

Figures 3.1 through 3.3 show the composition of Vietnam's "industrial" exports to the world (Figure 3.1), to the U.S. (Figure 3.2) and to the rest of the world (Figure 3.3) for the period 2000-2007.[6] This paper focuses on the "industrial" sector which in turn is defined as mining (Categories 10-14 in the Vietnam Standard Industrial Classification (VSIC) which in turn is based on the International Standard Industrial Classification (ISIC)), and manufacturing (VSIC 15-41).[7]

Figure 3.1 demonstrates the importance of export-oriented, labor-intensive[8] manufacturing, such as apparel/textiles, furniture, and footwear/leather, in Vietnam's export values and growth. Figure 3.2 demonstrates that Vietnam's exports to the United States are predominantly concentrated in labor-intensive sectors. For instance, starting from a negligible level, the U.S. absorbed 38.3 percent of Vietnam's textiles exports (VSIC 17), 56.9 percent of apparel (VSIC 18),[9] 16.6 percent of footwear/leather, and 26.2 percent of furniture and miscellaneous

[6] See Appendix Table A.1 and A.2 for the values of exports to the world and to the U.S. respectively.

[7] In my paper, I excluded the (unprocessed) agriculture/forestry/aquaculture sectors (VSIC 1-5) due to the difficulty in estimating the comparable impacts of exports on labor. For the impact of agricultural trade liberalization by Vietnam's trading partners on cash crop production, see Coello (2009).

[8] In this paper, manufacturing goods with relatively high "employment coefficients", i.e., the number of workers required to produce one billion dong worth of output, are referred to "labor-intensive" goods. See Appendix Table A.4 for the employment coefficients at the VSIC two-digit level.

[9] Vietnam's exports to the United States of apparel and textiles expanded more than twenty-fold from $48 million in 2001 to $1,040 million in 2002, and then nearly doubled again to $2,020 million in 2003. However, the surge in

manufacturing (VSIC 36) exports by the year 2004. Figure 3.1 also reveals that the electronics, machinery and transport equipment sector has been one of the Vietnam's fastest growing export sectors, perhaps stimulated by the process of Vietnam's WTO accession. Figure 3.2 suggests that Vietnam's expansion of this sector's exports to the U.S. was relatively modest immediately after the BTA, but appears to be emerging at a later time, perhaps signaling Vietnam's changing comparative advantage.[10]

Figure 3.1 shows that food products have been an important class of Vietnamese export commodities throughout the period, reflecting Vietnam's rich agricultural resources (Athukorala, 2009). However, the export growth of food products to the U.S. was inhibited in 2003 and 2004 by the U.S.'s imposition of antidumping duties against Vietnam's frozen fillets and shrimp (Brambilla, Porto, & Tarozzi, 2009). Overall, mining (of which crude petroleum is Vietnam's main export commodity)[11] remains one of Vietnam's leading export sectors and its export values increased substantially starting in the mid-2000s, mainly due to an increase in world oil prices.

Figures 4.1 through 4.3 demonstrate my estimates of the number of Vietnam's workers engaged in producing exports to the world (Figure 4.1), to the U.S. (Figure 4.2) and to the rest of the world (Figure 4.3). The labor contained in exports is calculated using a similar methodology to the standard factor content analysis which in turn was used to estimate the employment effects of trade in Vietnam (see, for instance, Belser, 2000; Jenkins, 2004; Kien & Heo, 2009). The

these categories of exports came to a halt in mid-2003 as the U.S. applied quantitative restrictions against them. Subsequent to Vietnam's accession to the WTO in 2007, Vietnamese quotas were eliminated as the Agreement on Textiles and Clothing under the provisions of the Uruguay Round Agreement expired in 2005, abolishing the quotas against WTO-member exporters (Dimaranan, Duc, & Martin, 2005). Using an applied general equilibrium model, Dimaranan *et al.* (2005) show that the welfare gains to Vietnam coming from the abolition of the export quotas on textile and clothing would be substantial.

[10] The U.S. emerged as Vietnam's second largest export destination for electronics, machinery and transport equipment goods (after Japan) in 2006. This may reflect the start of operation of new Foreign Direct Investment (FDI) enterprises such as Inter Corporation and Taiwanese electronics contract manufacturers (e.g., Hon Hai Precision Industry Co., Foxconn) (Athukorala, 2009).

[11] At the VSIC two-digit level, crude petroleum (VSIC 11) has been Vietnam's largest single export commodity throughout the period. For instance, it accounted for about 92 percent of Vietnam's mining exports and 21 percent of Vietnam's total exports in 2004.

employment coefficients, i.e., the number of workers needed to produce one billion dong worth of goods,[12] were calculated using the employment and production data from the annual *Enterprise Survey* data and exports data from the UN Comtrade System at the two-digit VSIC level for the period 2000-2007. As the *Enterprise Survey* data do not include household enterprises, Vietnam's goods are assumed to be exported through formal enterprises.[13]

The visual comparison between Figures 3.1-3.3 and Figures 4.1-4.3 reveals that the employment effect of exports is disproportionately larger for labor-intensive industries due to the relatively larger employment creation per dollar of goods exported in such industries. In contrast, the employment effect of increases in the value of mining sector exports is relatively modest due to that sector's low labor-intensity despite the importance of the mining sector in Vietnam's exports in value terms. Since Vietnam's exports to the U.S. consist mainly of labor-intensive goods, if exports are evaluated in terms of their labor content, the share of the U.S. in Vietnam's "industrial" exports for the year 2004 rises to about 28 percent. Specifically for the period 2001-2004, exports to the U.S. accounted for about 35 percent and 70 percent of *changes* in Vietnam's total industrial exports in terms of export values and labor content respectively. In the empirical section, I will use these large changes to identify the impact of exports on wages.

Appendix Table A.3 reports the evolution of Vietnam's imports by the VSIC sub-categories for the period 2000-2008. Vietnam's imports rose from $15,637 million in 2000 to $31,969 million in 2004, and, after Vietnam's accession to the WTO in January 2007, increased at an accelerated pace to $80,714 million in 2008. Since United States goods enjoyed MFN tariff status in

[12] The implicit assumption of this exercise is that export products are typical of their industries. However, Figures 4.1-4.3 may be understating the labor content of exports if the exports were relatively more labor-intensive than other non-exported products within the same industries. On the other hand, the figures may be overestimating the labor content of exports as exporting firms tend to be more productive and thus use less labor to produce a given value of output than non-exporters.

[13] Some household enterprises sold directly to the international market. Out of 4,326 households who reported non-farm household activities in the VHLSS 2004, 50 households (about 1.2 percent) responded affirmatively to the question asking whether they "have sold goods/services on international market".

Vietnam before the BTA, the share of the U.S. in Vietnam's imports has remained relatively unchanged before and after the BTA at around 2.5 percent.[14] The composition of Vietnam's imports is characterized by a high proportion of three VSIC sub-categories, namely, "basic manufacturing", "chemical, rubber, and plastic products", and "electronics, machinery, and transport equipment" which accounted for more than three quarters of Vietnam's imports in 2004. If the latter products are capital and skilled-labor intensive, Vietnam's trade pattern is consistent with the prediction of the H-O model.

(c) Evolution of Vietnam's industrial employment

Vietnam's "formal"[15] industrial employment recorded in the *Enterprise Survey* data (General Statistics Office (GSO)) grew substantially from 1.8 million workers in 2000 to 3.2 million in 2004 and further increased to 4.1 million in 2007. Figure 5 and Appendix Table A.5 show the actual number of workers employed by industrial enterprises for the period 2000-2007. It appears that employment growth is highly influenced by the expansion and the factor intensity of exports. The number of workers employed by export-oriented labor-intensive manufacturing, and in particular, those in the sectors whose exports to the U.S. expanded (namely apparel/textiles, footwear/leather and furniture and miscellaneous manufacturing) increased substantially. Employment growth in the electronics, machinery and transport equipment sector was also strong, perhaps helped by the rise in exports (e.g., of electronics goods). However, despite the high value of Vietnam's crude oil exports, enterprise employment generation has been slowest in the mining sector due to the low labor intensity of crude oil production. At the two-digit VSIC

[14] The rise of the U.S. share in Vietnam's total imports to 4.5 percent in 2003 is attributable to Vietnam's purchase of U.S. aircraft (Boeing 777s) (Parker, Riedel, & Quang, 2007).

[15] Throughout the paper, jobs in "enterprises" as well as those in government are referred to as "formal" employment. The term "enterprise" is defined as "an economic unit that independently keeps business account and acquires its own legal status" under the relevant laws (GSO). "Informal" employment is defined to include wage workers who work in a variety of informal wage sectors as well as those who are self-employed.

level, no industry reveals a systematic employment decline during the same period. These patterns of employment are consistent with Kien and Heo's (2009) study which investigates formally the impacts of trade liberalization on employment in Vietnam using a system generalized method of moments (GMM) model.[16]

Figure 6 and Appendix Table A.6 show how Vietnam's industrial employment spread across Vietnam's two big cities and eight regions. Of these regions, Ho Chi Minh City (HCMC), the Southeast region (excluding HCMC), and the Red River Delta region (excluding Hanoi) are host to a majority of Vietnam's industrial employment, accounting for about 62 percent of total industrial employment in 2004. Growth in industrial employment has been faster in the rest of the Southeast region than in HCMC and in the rest of the Red River Delta than in Hanoi, showing that industrial development has spread beyond Vietnam's two big cities. In contrast, the North Central Coast, the Central Highlands, and the Northwest regions are clearly lagging behind in terms of industrial development.

Vietnam's establishment of normal trade relations with the United States appears to have induced a shift of its labor toward sectors that use the abundant factor more intensively. Using the *Enterprise Survey* data, Figure 7.1 shows the proportion of workers employed by "labor-intensive" industries in total industrial employment.[17] The ratio rose from 50.7 percent in 2001 to 53.6 percent in 2003 and then remained relatively unchanged, suggesting that Vietnam's labor

[16] Estimating a labor demand equation derived from the Cobb-Douglas production function for the period 1999-2004, Kien and Heo (2009) find that, holding the output level constant, the rising export intensity (measured by export-output ratio) in an industry increased Vietnam's derived labor demand. This implies that an increase in exports may create more job opportunities per unit of output because export-oriented goods are labor-intensive in Vietnam. In terms of imports, whereas intensified import penetration would likely have destroyed some jobs, it may also have stimulated labor demand positively when domestic production depends on the importation of raw materials and capital goods or imported inputs are assembled in Vietnam for exports (e.g., in the electronics industry). The coefficients of import penetration (measured by import-output ratio) in Kien and Heo's regressions turn out to be positive but statistically insignificant suggesting that the increase in imports did not necessarily negatively impact Vietnam's employment level.

[17] By the "labor-intensive industries", I refer the industries whose employment coefficients in 2004 are above median, which is 6.5 persons per billion dong of output.

appears to have shifted toward more labor-intensive industries in the aftermath of the BTA. Alternatively, Figure 7.2 demonstrates the change in the proportion of *unskilled*-labor-intensive industries in total industrial enterprise employment during the same period.[18] Figure 7.2 reveals a similar pattern, a shift of labor toward unskilled-labor-intensive industries paralleling the shift toward labor-intensive industries shown in Figure 7.1. However, this parallelism is expected since in Vietnam, labor-intensive industries are generally unskilled-labor-intensive industries.

During the same period, "formal" industrial employment as a whole expanded substantially. Thus, besides labor reallocation within the industrial sector (if it occurred), there appear to have been two additional sources of labor supply for the expansion of labor-intensive manufacturing. First, the increase in industrial employment may reflect a shift of labor from agriculture to industry. While industrial employment grew rapidly in the recent years, agricultural employment declined from 65.3 percent in 2000 to 57.9 percent in 2004 (WDI). It is likely that this move was partly induced by trade openness (Dodzin & Vamvakidis, 2004; Fu & Balasubramanyam, 2005).[19] Second, the expansion of formal enterprise employment is likely to reflect a move of labor from the "informal" to the "formal" sector. The implementation of the Enterprise Law (2000) was a major step toward reducing numerous barriers to private business and has greatly encouraged the establishment of new enterprises (Ramstetter & Ngoc, 2007). It is also likely that this trend was partly accelerated through trade, as the largest expansion of industrial enterprise

[18] Unfortunately, the *Enterprise Survey* data 2000-2007 do not break down different types of workers either in terms of education or occupation. However, the *Industrial Survey* (GSO, 2000) breaks down employees of 17 provinces into production workers, technicians and administrative workers for the year 1998. The "unskilled-labor intensive industries" here refer to the industries whose proportion of production workers in total labor force is above median (85.7 percent) in 1998.

[19] Applying the Smith-Myint model of "vent for surplus" to China, Fu and Balasubramanyam (2005) find that the expansion of exports from labor-intensive manufacturing has accelerated the transfer of surplus labor from the agricultural to the export sector. Using a panel of 92 developing countries in the period 1960-2000, Dodzin and Vamvakidis (2004) find that an increase in openness to trade leads to an increase in the industrial value added share of production at the expense of the agricultural share suggesting that trade leads developing countries to industrialization.

employment occurred in export-oriented sectors.[20] As labor reallocation appears to occur across broad economic sectors, analyses which focus only on the formal industrial sector seem to be incomplete in capturing the whole impact of trade shock. The VHLSS 2002 and 2004 data used for analyzing wage movements in this study have an advantage relative to firm-level data as they allow the researcher to extend the analysis to all of Vietnam's economic sectors.

3. THE IMPACTS OF THE BTA ON WAGES AND THE SKILL PREMIUM

(a) Estimation strategy

This section investigates empirically how the exogenous trade shock resulting from the BTA translated into changes in wages for skilled and unskilled workers. Whereas this paper is inspired by the basic insights from the H-O-S model, its analysis does not follow the strict version of the H-O-S theory. Instead, I relax some of its assumptions so that the conceptual framework is consistent with Vietnam's "real world" data and my empirical design. First, whereas the Stolper-Samuelson theorem links changes in relative output prices to changes in relative wages, it is difficult to model this linkage directly since price data are not readily available. Thus, I take an indirect approach assuming that the impacts of changes in product prices induced by trade are "revealed" in changes in labor demand.

Second, this paper extends the idea of the H-O-S theory to Vietnam's provinces; i.e., it is assumed that Vietnam's provinces have different specialization patterns given heterogeneity in endowments and difference in initial industrial development, and that the impacts of trade shocks translate differently at the province level. The model is designed to capture general equilibrium impacts of the trade shock within a province: it is assumed that labor is mobile across sectors and that factor prices tend to be equalized within province. In regard to labor mobility across

[20] Discussing a similar situation, Anderson and Dimon (1999) report evidence that export oriented production in *maquiladoras* (across-border export processing plants) created formal sector job opportunities for single women in Mexico.

provinces, it is assumed that Vietnam's workers are "sufficiently immobile" (Hanson, 2005, p.4) across provinces as province-specific labor demand shocks influence the wages of workers living in that province.[21] Overall, the empirical framework is similar to the model employed by Chiquiar (2008) who finds responses of the "Stolper-Samuelson type" effect following the North American Free Trade Area (NAFTA), by exploiting the regional variations in exposure to international markets.[22]

Third, the S-S results may become less pronounced if the supply of unskilled labor is elastic. Winters (2002) presents a useful way of thinking about the impacts of trade on wages for unskilled workers by considering two polar forms of labor markets in developing countries. The first is that assumed by traditional trade theory in which factor supplies are exogenously fixed and wages are perfectly flexible (Winters, 2002, p.1348-1350). In this case, the Stolper-Samuelson Theorem, under particular conditions, generates the powerful result that an increase in the price of the unskilled labor-intensive good in production will increase the unskilled real wage and decrease that of skilled workers. The polar opposite view of labor markets for unskilled workers is one suggested in development theory that considers factor supplies to be infinitely elastic (Lewis, 1954; Winters, 2002, p.1350-1352). In the latter case, the formal sector can draw infinite amounts of labor from the informal sector or subsistence agriculture at a subsistence wage, such that the wage for unskilled workers is unaffected by the trade shock.

[21] It appears that Vietnam's labor is neither "perfectly" mobile nor "perfectly" immobile. The 1999 and 2009 census indicates that interprovincial migration accelerated in the past decade as the number of people aged five and older who had migrated across provinces within the census period increased from 2.0 million individuals (or 2.9 percent of population) in the 1999 census to 3.4 million (4.3 percent) in the 2009 census (GSO, p.21, 2011). The rest either moved intra provincially or stayed in the same location. The rise in interprovincial migration is not inconsistent with the theory since a large majority of people do not migrate and it appears to be precisely the disparity in earnings opportunities which would induce some individuals to migrate (Fukase, 2013b).

[22] Chiquiar (2008) used one percent samples of male individuals taken from Mexico's 1990 and 2000 population censuses and complemented them with site-specific data for globalization-related variables. Specifically, "globalization" is measured in Chiquiar's study by the shares of state employment in agriculture and industry, the distance from the U.S., the share of FDI in the state GDP, the shares of *maquiladora* employment and imports, and migration rates. Controlling for personal characteristics in his cross section data, Chiquiar (2008) finds that Mexican states more exposed to globalization experienced a decrease in the skill premium relative to the other states.

Winters posits that neither of the polar extremes is likely to be precisely true and suggests the importance of determining the elasticity of labor supply in evaluating the supply response of unskilled workers. Thus, theoretical predictions with regard to the effects of trade on wages of unskilled workers are ambiguous, and the existence of S-S effects becomes an empirical question.

(b) Data

(i) The *Vietnam Household Living Standards Surveys*

The VHLSS 2002 and 2004 were conducted by the GSO of Vietnam with the technical support of the World Bank and are generally recognized to be of high quality and are representative of all of Vietnam. The VHLSS 2002 and 2004 consist of 30,000 households and 9,188 households respectively, and about half of the households interviewed for the VHLSS 2004 came from the sample of the VHLSS 2002. The timeframe of the VHLSS 2002 and 2004, which reflect information for the years 2001/2002 and 2003/2004 respectively, overlaps reasonably with the period when Vietnam's exports to the U.S. expanded in the aftermath of the BTA (see Figure 2). During the same period, protection appears to have been still in place for import-competing production.[23] Thus, the focus of the paper is to evaluate the impacts of trade on wages on the export side.

Using the sampling weights available in the VHLSS 2004, out of 47.3 million people who had work in 2004 in Vietnam, about 14.6 million people (31.0 percent of total workers) held wage jobs of which 7.8 million (16.6 percent) and 6.8 million people (14.4 percent) worked in

[23] For instance, the trade weighted Nominal Rate of Protection (NRP) for manufacturing was relatively high at 29.2 percent in 2003 (Athukorala, 2006, Table 3). Although the estimated Effective Rate of Protection (ERP) for manufacturing decreased from 95.9 percent in 2001 to 43.9 percent in 2003, the decline came from an increase in input tariff introduced to protect SOE engaged in intermediate production rather than from the decrease in tariff rates for final goods (Athukorala, 2006, p.174).

"formal" and "informal wage" sectors respectively.[24] The remaining 32.6 million workers (69.0 percent) were self-employed. In 2004, Vietnam's workers on average had attained 7.7 years of education, and worked 34.8 hours per week,[25] and its wage workers earned .94 million dong per month. Formal sector workers worked longer hours (41.8 hours on average) than those who worked in the informal sectors (35.1 hours and 33.0 hours for those in the informal wage and self-employment sectors respectively). On average, workers in the formal sector were more educated with average total education of 11.1 years, whereas the corresponding figures were lower for the informal wage sector (6.6 years) and self-employed workers (7.1 years). In 2002, applying the sampling weight in the VHLSS 2002, only 29.6 percent of total workers had wage jobs: the increase in the proportion of wage workers in total workers is attributable to the rise in the proportion of workers employed in the formal sector from 14.2 percent in 2002 to 16.6 percent in 2004.

One limitation of using the VHLSS is that self-employed individuals cannot be included as they have no wage information. Whereas it is possible to calculate income at the household level, it turns out to be difficult to attribute household income to individual household members. However, as the VHLSS includes wage information for informal wage workers, this enables the researcher to extend the sample coverage beyond the formal sector. The data are also limited in that they are likely to exclude a substantial number of migrants who hold a temporary or no

[24] The classification of employment is based on the response to a question "for whom has [name] worked?" in the VHLSS 2004: those who responded to work in "foreign-invested sector", "state", "collective economic sector" and "private economic sector" are classified as "formal"; "informal wage" workers are assumed to be represented by those who responded to "work for other households"; "self-employed" includes those who answered "self-employment" and "working in his family owned company". For 2002, based on the VHLSS 2002, those who responded to work for "government agencies, police, military", "communist party, social organization", "state owned enterprises", "other state economic sector", "collective economic sector", "private capital economic sector", "state capitalist economic sector" and "foreign shared enterprise" are referred to "formal"; "informal wage" and "self-employed" are represented those who responded to be "self-employed" and "work for other households" respectively.

[25] The hours worked per week are computed by combining the hours worked for the first and second jobs.

registration status, since the sampling of the surveys is limited to persons who had permanent registration status.[26]

In order to trace the wage changes during the period 2002 and 2004, I construct a sample of the panel individuals interviewed both in the VHLSS 2002 and 2004 who were 15-59 years of age in 2004 and had wage jobs as the most time consuming job in both years.[27] This resulted in a sample of 1,746 individuals. Relative to using the repeated cross section data, there exist advantages in analyzing the panel data component of the VHLSS. First, since the panel data model traces the changes in wages of the same individuals between 2002 and 2004, it controls for any impacts on wages resulting from time-invariant observable and unobservable personal characteristics. Second, the panel data approach adjusts for the "composition effect", i.e., any impacts resulting from the difference in the composition of wage workers between two years. For instance, there is some evidence that the individuals who moved from a non-wage job in 2002 to a wage job in 2004 were less skilled on average than those who had a wage job in both years.[28] If the unobservable component of the selection process to wage employment and the export variable are correlated, the coefficient for the export variable using cross section data may be biased even controlling for observable personal characteristics.

[26] For instance, the number of workers employed by foreign firms computed from the VHLSS 2004 (0.7 million) in 2004 is smaller than that taken from the *Enterprise Survey* data (1.0 million), most likely because the VHLSS data exclude migrants who hold a temporary or no registration status. According to the *Vietnam Migration Survey* 2004 data, only 10.2 percent of the migrants who work for foreign firms possess permanent registration status (Fukase, 2013b).

[27] Since there exist some errors in the panel identifiers in the original dataset, I used the revised identifier codes provided by McCaig (2009) to match the individuals between 2002 and 2004. Then, I eliminated some observations whose information on gender, age and education are inconsistent. In order to mitigate further the measurement error, I dropped one percent of individuals who experienced the largest wage changes. However, the results are not sensitive to these adjustments.

[28] The data on panel individuals reveal that those who had a wage job in both years tend to be more educated (with 9.4 years of education on average) than those who moved from a non-wage job in 2002 to a wage job in 2004 (with 7.3 years of education) (VHLSS 2002, 2004). During the same period, the BTA might have accelerated the rate at which less skilled non-wage workers became wage workers. If that were the case, the wage workers who lived in a province more exposed to exports might have consisted disproportionately of "new" wage workers relative to other provinces.

It is common in the literature to classify skilled and unskilled workers either by educational attainment or by occupation (white- vs. blue-collar). There is some difficulty in differentiating Vietnamese individuals into a skilled and unskilled worker dichotomy by educational attainment, however, since it is actually the intermediately educated who are most likely to be engaged in export-oriented production.[29] I therefore use the occupation codes available in the VHLSS which are similar to the International Standard Classification of Occupations (ISCO) by the International Labour Organization (ILO) to categorize individuals into skilled and unskilled workers.[30] The summary statistics of demographic and economic characteristics for skilled and unskilled workers are reported in Appendix Table A.7 along with all the other variables used in my regressions. For my sample of the panel individuals for the period 2002-2004, the average wage growth rate of 27 percent for skilled workers was larger than that for unskilled workers (18 percent), suggesting that the skill premium increased for Vietnam's economy as a whole.

(ii) Export index

I first develop an index to represent the province-specific labor demand induced by exports as a mechanism through which trade affects wages. The increase in production for exports may increase wage levels in the location where export firms operate by raising the demand for labor in that location. In addition, it may influence wage levels indirectly, for instance, by increasing

[29] Winters (2002) points out that it is not clear that the least skilled workers are the most intensively used factor in the production of tradable goods in developing countries. Thus, it might be the case that the wages of workers with primary education increase with trade liberalization, those of the least educated workers may be left behind (Winters, 2002). The information on whether or not individuals work for exports is not available in the VHLSS. Using production workers who worked for formal firms in export-oriented sectors (namely apparel and textiles, footwear and leather, furniture and miscellaneous manufacturing and electronics) in 2004 as a proxy for those working for export-oriented production, a large majority of these workers were intermediately educated, as 28 percent, 39 percent and 26 percent of them have upper-secondary, lower-secondary and primary education respectively. The workers in these fields who had tertiary education and those who had no school degree were relatively small at 2 percent and 5 percent respectively.

[30] "Skilled" workers include leaders (11-19), top- and mid-level professionals (21-34), staff and other white-collar occupations (41-52), and skilled workers in agriculture, sylviculture, and aquaculture (61). "Unskilled" workers consist of production workers (71-83) and those generally classified as "unskilled workers" (91-93). The skill category is not assigned for those who served in "Army force" (00). Between parentheses are the occupation codes available in the VHLSS 2004.

the demand for inputs; by raising the demand for trade related services (e.g., transport); and through a multiplier effect if workers employed by exporting firms increase consumption in the area.

The data on the number of workers engaged in exports are not available directly at each province level. I construct a province-specific export index ($Export_{pt}$), using the exports data at the national level as well as the employment and output data at the firm level. The Export Index is the sum of the workers over each industry j aggregated at the province level p, multiplied by the export intensity of each industry, relative to the total economically active population in each province p at time t. Specifically,

$$Export_{pt} = \frac{\sum_j XS_{jt} \cdot Employment_{jpt}}{Employment_{pt}} \tag{1}$$

where XS_{jt} is the export intensity computed as the proportion of exports in gross output for industry j at time t at the national level;[31] $Employment_{jpt}$ is the number of workers employed by industry j in province p at time t; and $Employment_{pt}$ is the size of economically active population in province p at time t; j represents Vietnam's industries at the two-digit VSIC level (VSIC 10-41), p represents Vietnam's 61 provinces,[32] and t = 2002, 2004 in my regressions. Thus, the impact of exports on labor demand is likely to be larger, the higher is the export-intensity in the composition of industries, and the larger is the share of workers employed by industries relative to total employment in province p.

[31] Since the export intensity of each industry is not available at the province level, that at the national level is used. For some industries for some years, the export values from the Comtrade data exceed the production values from the *Enterprise Survey* data. As a potential source of this incompatibility, Jenkins (2004) points out that the gross output reported in the *Enterprise Survey* data may refer not to the value of the products produced, but to the processing cost. This is particularly the case of the garment and footwear industries, where exports are commonly contracted on a cut-make-trim (CMT) basis. Following Jenkins (2004), the reported figures for output in the garment and footwear industries are multiplied by 2.5 and 2.0 respectively.

[32] Between 2002 and 2004, some provinces were subdivided creating three new provinces, namely Dien Bien, Dac Nong and Han Giang. For the purpose of consistency, the definition of provinces is based on the 2002 configurations.

Equation (1) can be re-written as:

$$Export_{pt} = \frac{\sum_j XS_{jt} \cdot LaborCoeff_{jpt} \cdot Output_{jpt}}{Employment_{pt}} \qquad (1)'$$

where $LaborCoeff_{jpt} = \frac{Employment_{jpt}}{Output_{jpt}}$

is the employment coefficient, i.e., the number of workers required to produce one unit of output. Thus, given industrial output, the impacts of exports on labor demand are likely to be larger, the higher is the labor-intensity of the industrial composition in province *p*. Overall, the Export Index is roughly interpreted as the proportion of workers affected by exports in each province.

The employment and output data are taken from the annual *Enterprise Survey* data (GSO). The surveys cover all the registered "enterprises" in Vietnam but exclude household enterprises and agriculture and forestry cooperatives. In estimating the change in labor demand, the *Enterprise Survey* data have two advantages over the VHLSS 2002 and 2004. First, whereas the *Enterprise Survey* data are likely to include migrants, the calculation based on the VHLSS may underestimate the expansion of employment induced by exports, by excluding migrants who have no or temporary registration status.[33] Second, the pre-BTA comparable employment and production data, which are needed to construct an instrumental variable, are readily available in the *Enterprise Survey* data (for the year 2000 in my analysis).

The data for the size of the economically active population aged 15 years and over by province were extracted from the GSO website, since the latter data are not available in either the VHLSS or the *Enterprise Survey* data for the year 2000. The trade data for Vietnam were extracted from the U.N. Comtrade system at the Harmonized System (HS) (1996) 6-digit level and aggregated at

[33] When I use the VHLSS 2002 and 2004, the pattern of the change in industrial employment across sectors is less pronounced relative to the pattern resulting from use of the *Enterprise Survey* data.

the VSIC two-digit level using the correspondence file between HS 96 and ISIC (Rev. 3) which in turn was downloaded from the U.N. Statistics Division website.

(c) Impact of a change in exports on wage growth

(i) Model specification

This section investigates the effects of exports on *absolute* wages for skilled and unskilled workers running regressions separately by skill levels. I specify a model which relates wage growth rates to changes in the province-specific Exports Index.

$$\Delta Ln\ W_{ip} = \beta_0 + \beta_1\, \Delta Export_p + \beta_2\, \Delta X_{ip} + \beta_3\, Y_{ip} + e_{ip} \qquad (2)$$

where $\Delta Ln\ W_{ip}$ is the monthly wage growth rate during 2002-2004 of an individual *i* who lives in province *p*, $\Delta Export_p$ is the change in Export Index for province *p* between 2002 and 2004, ΔX_{ip} is a vector of differenced control variables, and Y_{ip} is a vector of other control variables which may affect wage growth rates. The monthly wage calculations are based on the annual wages earned and the hours worked by panel individuals during the twelve months prior to the survey.[34] Monthly wages rather than hourly wages are employed in the model as they reflect both the compensation per unit of time and hours worked by individuals. Taking account of hours of work is potentially important since the trade-oriented work may involve long hours and the working hours appear to vary substantially in Vietnam across economic sectors. For instance, the panel individuals in the VHLSS reveal some evidence that those who moved from an informal to the formal sector increased their hours of work.[35]

[34] The wages include bonus/award, social allowances, and trip subsidy. The wages are converted to January 2002 constant prices using the deflators available in the VHLSS.

[35] According to the panel individuals in the VHLSS, the workers who moved from the informal wage and self-employed sectors to the formal sector increased their hours worked by 8.3 percent and by 24.3 percent respectively. Unfortunately, the income changes for those who moved from self-employed to formal sector jobs are not reflected in the paper because no 2002 wage information was available for self-employed individuals.

An advantage of using a difference-difference specification relative to a model which relates the level of wage to the level of Export Index is that it controls for time invariant characteristics which are correlated both with wage levels and Export Index levels. For instance, there exist a number of variables which are likely to affect positively both wage levels and export levels such as better infrastructure, conducive business and investment climate, and favorable geographical conditions such as better access to seaports. Thus, one might find a spurious relationship between Export Index and wage levels in a level-level model. However, by differencing, all time-invariant province- and personal specific characteristics are controlled for.

The first three columns in Table 1 report the Ordinary Least Squares (OLS) regression results of a model which relates the wage growth rate to the change in Export Index and other variables (Model A). Since there are both individual and province level variables in Equation (2), the standard errors are adjusted for within province correlation (clustering). Columns 1, 2 and 3 report the results for the full sample, for the subset of unskilled workers, and for the subset of skilled workers respectively. The distinction between skilled/unskilled categories is based on individual workers' status in 2002. Between 2002 and 2004, some workers changed their skilled/unskilled status due to changes in their occupations. Thus, a variable reflecting their changes in skilled/unskilled status (= 1 if he/she moved from unskilled to skilled occupation; = 0 if his/her skilled/unskilled status remained unchanged; and = -1 if he/she moved from skilled to unskilled occupation) is included. Similarly, a variable to indicate the change in marital status (= 1 if his/her marital status changed from non-married to married; = 0 if marital status remained unchanged; and = -1 if his/her marital status changed from married to non-married) is added. Since education levels do not change much for adults and everybody is two years older in 2004, human capital variables such as education and potential experience are not included. In order to

capture potential trends of wage convergence or divergence, the lagged log of monthly wage is included (Topalova, 2010). For instance, because of wage convergence, individuals who enjoyed higher wage levels in 2002, who tended to reside in relatively high wage provinces, may have experienced slower wage growth. If such provinces were exposed to higher trade shock, without properly adjusting for this trend, β_1 would be biased downward.

For the full sample, the coefficient for the change in Export Index is found to be positive but statistically insignificant. The results of regressions run separately by the subsets of skilled and unskilled workers reveal differential impacts of exports by skill levels. The coefficient for the change in the Export Index for unskilled workers turns out to be positively significant at the five percent level implying that unskilled individuals who resided in a province which experienced more export expansion tend to experience higher wage growth rates. In contrast, the coefficient for the change in Export Index for skilled workers turns out to be insignificant. The coefficients for the lagged wages turn out to be negatively significant implying that Vietnam's workers appear to have experienced wage convergence, i.e., the individuals who had higher wages in 2002 experienced on average lower growth in wages.[36]

Whereas the differencing process controls for any time invariant characteristics that affect the *level* of wage, it does not rule out a possibility that these variables influence wage *growth* rates. Thus, I specify an alternative model which includes additional control variables which potentially affect wage growth (Model B). Although many personal characteristics variables do not change between 2002 and 2004, the level of these variables may influence the wage growth

[36] Some caution needs to be exercised for the inclusion of this variable since the coefficients for the change in the Export Index become insignificant without the lagged log of wage. However, a model with the latter variable is a better model because the coefficient for the lagged log of wage turns out to be highly significant and the addition of the variable improves the overall performance of my regressions; since the initial log wage and the change in Export Index is positively correlated, the coefficient for the change in the Export Index would be biased downward without the initial log wage; and controlling for the initial level of the variable of interest is common both in macro growth literature and in micro literature to adjust for convergence or mean reversion.

rates, e.g., when the dynamics in a labor market favor certain kinds of workers. Thus, a series of personal characteristics, namely, gender, ethnicity,[37] educational attainment (measured by total education years) and potential experience,[38] are included.

Changes in Export Index may be systematically correlated with province specific characteristics that affect wage growth (Topalova, 2010). For instance, if provinces which had more initial industrial base were enjoying higher wage growth even in the absence of exports and also experienced larger industrial exports expansion, the coefficient of the change in Export Index might capture a spurious relationship. In order to overcome this concern, I included the initial provincial employment composition at a more aggregate level, namely the proportion of workers in agriculture, construction, industry, government, and service sector in total workers constructed from the VHLSS 2002 (McCaig, 2011; Topalova, 2010). The growth path also may differ between rural and urban areas. Thus, Model B also includes a dummy variable for whether or not the individual lived in an urban area.

Columns 4 through 6 in Table 1 report the results of Model B. Relative to the results obtained by Model A, the inclusion of the additional control variables led to an increase in R^2. However, the coefficients for the changes in Export Index in Model B turn out to be similar to that obtained in Model A and the results appear to be robust to the inclusion of control variables. Some personal characteristics are found to have affected wage growth. For instance, the coefficients for education are found to be highly positively significant, highlighting the importance of educational attainment in wage growth. The positive impact of education on wage growth is also consistent with the rise in skill premium in Vietnam's economy as a whole.

[37] The minority is defined to represent all ethnic groups other than the Kinh majority and Hoa (the Chinese).
[38] Potential experience is calculated as age minus six minus education years.

Columns 7 through 9 in Table 1 considers an alternative Export Index (U.S. Export Index ($ExportUS_{pt}$)) which estimates the labor demand contained in Vietnam's exports to the U.S. (Model C).

$$ExportUS_{pt} = \frac{\sum_j USXS_{jt} \cdot Employment_{jpt}}{Employment_{pt}} \tag{3}$$

where $USXS_{jt}$ is the alternative export intensity computed as the proportion of exports to the U.S. in gross output for industry j at time t. By differencing, $\Delta ExportUS_p$ is designed to capture the change in labor demand created by exports to the United States. The results of Model C reveal a pattern similar to that obtained by Model B.

(ii) Instrumental Variables (IV) approach

The change in Export Index ($\Delta Export_p$) in Equation (2) may be endogenous and the endogeneity of explanatory variable may cause a bias in the parameter estimates obtained by OLS. For instance, many empirical studies focusing on firm heterogeneity find that exporting firms are systematically different from non-exporting firms as they tend to be larger and more productive and tend to pay higher wages (e.g., Bernard, Jensen, Redding, & Schott, 2007). Firms that achieve a higher level of productivity and that have other advantages may tend to self-select into export markets since such firms are better able to overcome the sunk costs of entering international markets (Melitz, 2003).

Productivity and wages may be correlated as productive firms may pay higher wages to attract better workers or firms may have invested in human capital among their workers and therefore pay higher wages to protect their investment. As greater productivity is associated with higher wages and with the likelihood of exporting, this may in turn cause a positive correlation between the change in Export Index and the error term. In this case, the coefficient estimate for the change in Export Index would be biased upward. Another potential source of endogeneity is that

wage growth may influence the change in exports, as a rise in wages may hamper export expansion. In the latter case, the change in Export Index and the error term would be negatively correlated, causing a downward bias in the coefficient estimate for the change in Export Index.

Whatever the source of endogeneity may be, I address the potential endogeneity problem using the province-specific measure of the U.S. tariff reduction as an instrumental variable. The U.S. tariff cuts that each province faces are calculated using a methodology similar to the one developed by Topalova (2010) and applied to Vietnam by McCaig (2011) and Coello (2009). Topalova (2010) examines the 1991 Indian trade liberalization episode and finds that rural districts, in which production sectors more exposed to import liberalization were concentrated, experienced slower reduction in poverty in India. Following Topalova (2010), McCaig (2011) constructs a provincial measure of U.S. tariff reductions and finds that provinces that were more exposed to the U.S. tariff cuts in the aftermath of the BTA experienced faster decreases in poverty. My approach differs from the previous studies in terms of explicitly modeling the rise in labor demand induced by exports as a channel through which exports influence wage growth.[39] In order to overcome potential endogeneity problems, I use the U.S. tariff cut measure as an instrument. Furthermore, I extend the tariff cut measure developed by Topalova by including a

[39] McCaig (2011) also examines the impacts of the BTA on provincial wages, but for different education groups. McCaig (2011) shows that the increase in the U.S. tariff cut measure is associated with an increase in the mean provincial hourly wage growth for workers with "at most a primary education" whereas the relationships are not statistically significant for the other education groups. His findings are consistent with a rise in labor demand for unskilled workers, but the study does not show or model a mechanism through which the tariff cut translated into the rise in wages for unskilled workers. Also, since the education groups of "no formal education" and "primary" are aggregated in McCaig (2011), one cannot know whether the U.S. tariff cut is associated with the rise in wages for the *least* educated workers (who are the most likely to be the poor). In terms of the data, whereas McCaig (2011) used cross section data aggregated at the province level, I used panel individual data. Finally, McCaig (2011) and most of previous studies used hourly wages in evaluating wage change, I used monthly wages which reflect both the compensation per unit of time and hours worked.

term representing the export intensity in 2000 since the pass-through from tariffs to prices in each sector is likely to be influenced by the sector's export orientation.[40]

Whereas Vietnam's provinces all face the same tariffs abroad, the impacts of tariff cuts differ across provinces due to differences in initial industrial composition. The provincial measure of the impacts from the U.S. tariff cuts is the tariff drop rate aggregated at the province level using the structure of employment prior to the BTA (t = 2000). Specifically,

$$TariffCut_p = \frac{\sum_j XS_{j,2000} \cdot Employment_{jp,2000} \cdot \Delta\tau_j}{Employment_{p,2000}} \tag{4}$$

where $\Delta\iota_j$ is the U.S. tariff drop at the two-digit VSIC level, which is taken from McCaig (2011, Figure 2); $XS_{j,2000}$ is the export intensity which in turn is computed as the share of exports in gross output for industry j in 2000 at the national level; $Employment_{jp,2000}$ is the number of workers employed by industry j in province p in 2000; and $Employment_{p,2000}$ is the number of economically active population in province p in 2000.[41] The rationale of using the provincial measure of the U.S. tariff cut as an instrument is that the U.S. tariff reduction ($\Delta\iota_j$) is likely to influence the change in Exports Index, but the change in wages does not influence the U.S. tariff reduction. The U.S. tariff reduction is also unlikely to affect the change in wages other than via trade. In addition, the lagged level of industry mix is likely to affect the change in Export Index by influencing the impacts of the U.S. tariff cut at the province level, but the change in wages cannot affect the past level of industry composition.

[40] The inclusion of the export intensity is consistent with Gonzaga, Filho, and Terra's (2006) study which shows that the pass-through from tariffs to prices in each sector depends on the sector's import penetration. For instance, the pass-through, measured by the share of trade relative to production, is obviously zero in sectors with no trade whereas the pass-through coefficient is one in sectors where all goods are traded. Investigating the impacts of trade liberalization implemented in Brazil from 1988 to 1995, Gonzaga *et al*. (2006) show that only after an adjustment of tariff changes for import penetration was the trade liberalization pattern with respect to skill intensity consistent with that of relative price changes.

[41] As a robustness test, I construct the alternative tariff measure considering only those employed in the industrial sector so that the variation in the tariff measure is independent of the size of the industrial sector within a province (Topalova, 2010). The results remain essentially unchanged.

Figure 8.1 and Figure 8.2 plot the relationship between the U.S. tariff cut measure and the change in Export Index (for Model A and B) and the change in U.S. Export Index (for Model C) respectively. The figures reveal strong positive relationship between the U.S. tariff cut measure and the changes in the Export Indices. The correlation appears to be stronger when the change in U.S. Export Index is used, which in turn reflects the estimated change in employment contained in the exports to the United States.

Finally, I repeat the same regressions in Table 1 using two-stage least square (2SLS) models. Table 2.1 demonstrates the results of the first stage regressions which relate the changes in Export Index ($\Delta Export_p$) and the U.S. Export Index ($\Delta ExportUS_p$) on the measure of the U.S. tariff cut ($TariffCut_p$) (excluded instrument (Bound, Jaeger, & Baker, 1995)) along with all the other exogenous variables included in the second stage. The coefficients for the tariff cut measure turn out to be highly positively significant confirming a strong positive relationship between the latter variable and the change in Export Indices. However, in Models A and B (except for the subset of unskilled workers in Model B), the first stage *F* statistics for excluded instrument are less than ten revealing a concern that 2SLS results may become unreliable (Staiger & Stock, 1997). In Model C, however, *F* statistics for excluded instrument turn out to be large, implying that the tariff cut measure is a strong instrument.

Table 2.2 shows the results of the second-stage 2SLS regressions. The coefficients for the change in Export Index for unskilled workers estimated by the 2SLS remain positively significant in all the models confirming that the unskilled individuals residing in a province which experienced a larger increase in exports tended to benefit from a larger wage growth. The coefficients for the Export Indices for the subset of skilled workers are either insignificant or negatively significant. The last row in Table 2.2 reports the Wu-Hausman test statistics. Whereas

the test results reject the hypothesis that OLS estimates are consistent for some specifications, the results for the subset of unskilled workers in Model B and Model C imply that 2SLS is not required. Interpreting the results obtained by OLS for these models, a one unit increase in the change in the Export Index and in the U.S. Export Index is associated with about 2.8 percentage point and 4.1 percentage point higher wage growth for unskilled workers, respectively.

Another way to deal with endogeneity is to relate the U.S. tariff cut measure to wage growth directly, which is a common approach in the previous literature (Castilho, Menéndez, & Sztulman, 2011; McCaig, 2011; Topalova, 2010). I repeat the same regressions replacing Export Indices by the U.S. tariff cut measure. The results reported in Appendix Table A.8 reveal a similar pattern. The coefficients for the U.S. tariff cut measure for a subset of unskilled workers turn out to be positively significant whereas those for a subset of skilled workers become either insignificant or negatively significant. I also re-run the same regressions using hourly wage growth instead of monthly wage growth as the dependent variable. The coefficients for the change in the Export Indices for the subset of unskilled workers remain positively significant for some models but the results are found to be sensitive to the inclusion of control variables (the regressions are not reported).

(d) Impacts on the skill premium

Many economists question the validity of the H-O-S theorem on empirical grounds. In particular, a number of Latin American countries drastically lowered their tariff and non-tariff barriers (NTBs) to trade pursuant to the GATT in the 1980s and 1990s. However, contrary to the prediction of the H-O-S theory, most Latin American countries experienced an *increase* rather than a decrease in the skill premium after episodes of trade liberalization (Goldberg & Pavcnik,

2007). This "puzzle" spurred the development of rich new theories which predict that trade may lead to a rise in wage inequality.[42]

Some authors explore the "Second Puzzle" (Robertson, 2007) after Mexico's entry into the NAFTA in 1994, i.e., why skill premium and other measures of inequality in Mexico began to fall or at least remained stable in the post-NAFTA period (Chiquiar, 2008; Goldberg & Pavcnik, 2007, Table 1, p.48; Robertson, 2004, 2007). A potential explanation is that Mexico's further economic integration with the United States and Canada after NAFTA might have strengthened the H-O-S type effects. For instance, investigating the direct link between changes in relative product prices and changes in relative wages in the context of GATT and NAFTA, Robertson (2004) finds that the changes in the structure of wages in Mexico seem to be consistent with the prediction of the Stolper-Samuelson theorem.[43] Comparing the export patterns before and after NAFTA, Acosta and Montes-Rojas (2008) show that Mexico significantly changed its manufacturing trade patterns after NAFTA, becoming a major exporter of goods with low-skill content such as clothing and automotive supplies (Figure 2, p.765).

In contrast to many Latin American countries, East Asian developing countries are generally viewed to have achieved both openness and relatively equitable development (e.g., World Bank, 1993). Some studies suggest that the experiences of East Asian Newly Industrializing Countries (NICs) are broadly consistent with the hypothesis that export-oriented industrialization reduces income inequality (Wood, 1999). For instance, based on time-series evidence, Wood (1999)

[42] These theories include outsourcing, increase in capital flows and complementarity of capital and skilled labor, trade-induced Skill-Biased Technological Change (SBTC) and firm heterogeneity models (Goldberg & Pavcnik, 2007). For instance, firm heterogeneity models pioneered by Melitz (2003) tend to predict that an increase in export opportunities may increase demand for skilled labor. This is because the production of exporters may be more skill-intensive than production for non-exporters (Goldberg & Pavcnik, 2007); because trade may induce an upgrading of the "product quality" in exporting plants *within* industries (Verhoogen, 2008); and because reduction in trade costs may induce some firms to switch to more advanced technologies (Yeaple, 2005).

[43] Whereas the relative prices of skill-intensive goods and the relative wages of skilled workers rose following Mexico's entrance to the GATT (as Mexico protected less-skill-intensive industries prior to GATT), they diminished after NAFTA as Mexico further liberalized its trade with relatively skill-abundant Canada and the United States.

observes that, following a switch to export-oriented industrialization in Korea and Taiwan, China, in the 1960s and in Singapore in the 1970s, the wage gap between skilled and unskilled workers of these economies declined. However, there exist few studies based on detailed micro data for East Asian NICs, perhaps due to the lack of data (Goldberg & Pavcnik, 2007) and because of difficulty in formulating empirical designs given potential endogeneity of their trade policies.[44] For East Asian NICs, whereas the positive association between openness and equality is consistent with the H-O-S theorem, a question remains whether the equalizing development in these economies was a consequence of trade liberalization or an outcome of national policies such as broad based education.

A number of studies report rising wage inequality in China since the introduction of market-oriented reforms in 1978 (e.g., Benjamin, Brandt, Giles, & Wang, 2005; Knight & Song, 2003). Many of them report that the Chinese wage structure was initially compressed under China's centrally-planned system, but that the return on education rose sharply under the reforms. As China progressively liberalized its trade regimes during the same period, one challenge of empirical studies for China (as for other transition economies) is to separate the trade-related impacts on income from the effects of other market-oriented reforms. Exploiting regional variation, Wei and Wu (2001) find that Chinese cities (urban areas and adjacent rural counties) that experienced a greater increase in the export-to-GDP ratio tend to demonstrate a greater decline in urban-rural income inequality. As a potential explanation, Wei and Wu suggest that export-oriented activities by the Township and Village Enterprises (the TVEs), which in turn were permitted to industrialize under the policy of "Li Tu Bu Li Xiang" ("leaving-the-farm-work-but-not-the-farmland"), might have contributed to a rise in income in the rural areas.

[44] With a combination of export subsidy and import protection, governments in East Asian countries intervened in trade and industrial policy in order to bring about "dynamic" comparative advantage. See Amsden (1989) for Korea and Wade (1990) for Taiwan, China.

In this sub-section, I investigate the impact of exposure to exports on skill premium introducing an interaction term between the skill status and the change in the Export Indices. Specifically,

$$\Delta Ln\ W_{ip} = \alpha_0 + \alpha_1\ Skill_{ip} + \alpha_2\ Skill_{ip} \cdot \Delta Export_p + \alpha_3\ \Delta Export_p + \alpha_4\ \Delta X_{ip} + \alpha_5\ Y_{ip} + v_{ip} \qquad (5)$$

where $Skill_{ip}$ denotes a dummy variable to indicate individual *i*'s skill status evaluated by his/her occupation in 2002 (= 1 if he/she is a skilled worker; = 0 otherwise), $Skill_{ip} \cdot \Delta Export_p$ is an interaction term between the skill status and the change in the Export Index, and the other variables are those defined in Equation (2).

Table 3 reports the results of the OLS regressions described above. In parallel to my regressions in Table 1 and in Table 2.2, regression (1) and regression (2) use the same control variables as those used in Model A and Model B respectively, and regression (3) re-estimates the same regressions using the change in the U.S. Export Index ($\Delta ExportUS_p$) and the interaction term between the change in the U.S. Export Index and the skill status $(Skill_{ip} \cdot \Delta ExportUS_p)$.

In all three models, the coefficients for the interaction terms between the skill status and the Export Indices turn out to be negatively significant at the one percent level, suggesting that individuals who lived in a province more exposed to exports experienced a decrease (or a slower increase) in the skill premium. The coefficient estimates of the interaction terms imply that a one unit increase in the change in the Export Index and in the U.S. Export Index is associated with 2.3 percentage point and 4.5 percentage point lower increases in the growth rate of the skilled workers relative to unskilled workers respectively.[45] To deal with a potential endogeneity of the Export Indices, I repeat the regressions using the U.S. tariff cut measure instead of the change in the Export Indices. The results reported in Appendix Table A.9 suggest a robustness of the result

[45] Evaluated at the sample means of the changes in the Export and US Export Indices, these figures correspond to 1.4 percentage point and 1.5 percentage point lower relative wage growth of skilled workers.

to the concern of endogeneity as the coefficients for the interaction term between skill status and the U.S. tariff cut measure turn out to be negatively significant at the one percent level. Finally, I repeat the same regressions measuring the wage growth with hourly wages rather than monthly wages and find no statistically significant relationship between the change in the exposure to exports and the change in skill premium (the regressions are not reported).

The results in this paper confirm the existence of a Stolper-Samuelson type effect, i.e., those provinces more exposed to the increase in export opportunities experienced a decline of (or a smaller increase in) the skill premium relative to other provinces for the period 2002-2004. During the same period, the skill premium increased at the national level for my sample of panel individuals.[46] Thus, the S-S type effect appears to have mitigated, but did not outweigh the impacts of other factors which contributed to the rise in skill premium. These results are consistent with Wei and Wu's (2001) study which finds a greater decline (or a smaller increase) in income inequality in the areas more exposed to exports, when China was experiencing a rise in skill premium at the national level.

4. CONCLUSION

This paper explored how the expansion of labor-intensive manufacturing exports resulting from the U.S.-Vietnam BTA in 2001 translated into wages of skilled and unskilled workers in Vietnam through the channel of labor demand. The results demonstrate the existence of a "Stolper-Samuelson type" effect: those provinces which are more exposed to the increase in export opportunities experienced a larger wage growth for unskilled workers and a decline of (or smaller rate of increase in) the relative wage of skilled and unskilled workers relative to the other provinces.

[46] The factors which may have contributed to the rise in skill premium include: the impacts of domestic reforms, SBTC, and other impacts of trade which might have occurred concurrently during the period studied.

Vietnam's experience in the aftermath of the BTA highlights the importance of economic integration of a developing country with developed countries, in particular, in terms of creating job opportunities for its abundant unskilled workers and its positive impacts on their wages. The rise in wages for unskilled workers in the process of export-oriented industrialization is consistent with the East Asian experience, in particular, the historical shift of production locations to lower wage countries as wages increase; and the recent rise of wages for production workers in China.[47] The findings of this study also support the view that improving access to developed country markets for developing countries, in particular for unskilled-labor intensive goods, is essential for the latter countries to reap the benefits predicted by traditional trade theory.

One limitation of this paper is that, whereas it focuses on identifying the S-S type effect exploiting regional variation, it does not analyze other factors which affected the wage structure. In fact, for the period 2002-2004, the skill premium increased at the aggregate level for the sample of panel individuals. Thus, the results imply that the S-S type effect mitigated, but did not outweigh the impacts of other factors which contributed to the rise in skill premium. It is also noted that the theory illustrated in this paper is not the pure version of the H-O-S whose simplified assumptions tend to be inconsistent with the complexity of the real world. For instance, the assumption of full employment would not strictly apply to Vietnam's economy where a large majority of workers tend to be underemployed (Fukase, Table 2, 2013c) in agricultural and other informal sectors. Nonetheless, this paper suggests that the basic insights from the H-O-S theory remain valid as an important *component* of globalization and that, given

[47] Several articles in *The New York Times* (e.g., February, 20, 2012) and *The Economist* (July 31, 2010) report the rising wages of production workers in coastal industrial areas in China. As labor costs have risen in China, some production of labor-intensive goods may be moving to lower-wage countries like Bangladesh, Vietnam and Cambodia (*The New York Times*, July 16, 2010; January 31, 2011).

their potential for economic development and poverty reduction, the Heckscher-Ohlin-Samuelson effects need to be addressed properly by policy makers in both developing and developed countries.

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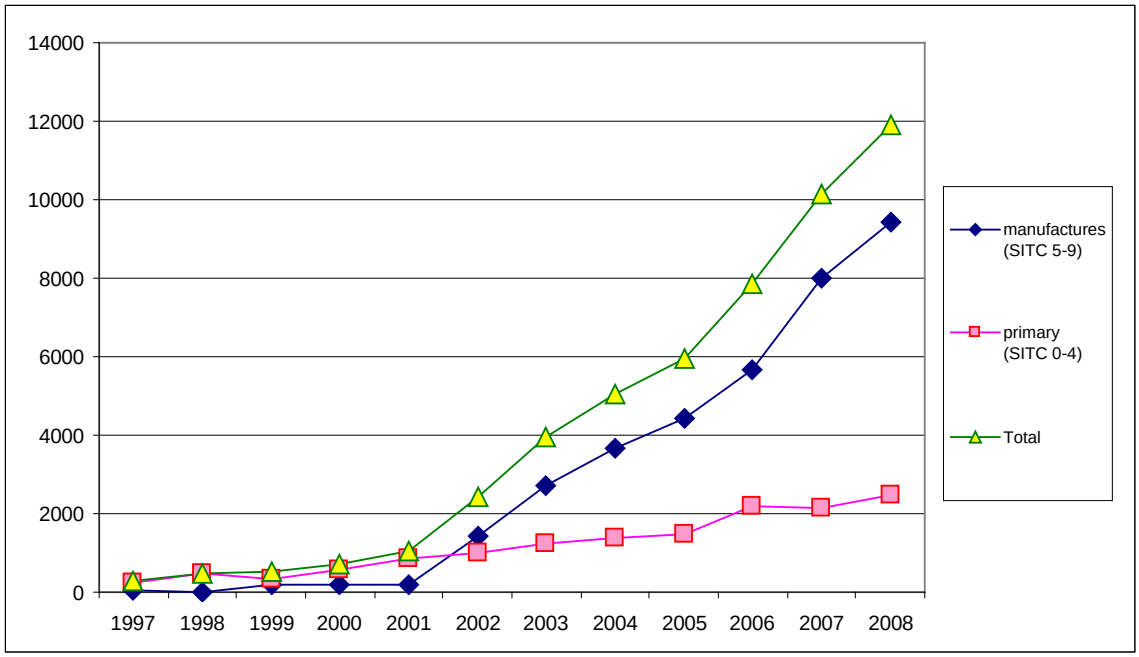


Figure 1. Evolution of Vietnam's Exports to the United States ($ million).
Source: the U.N. Comtrade System.

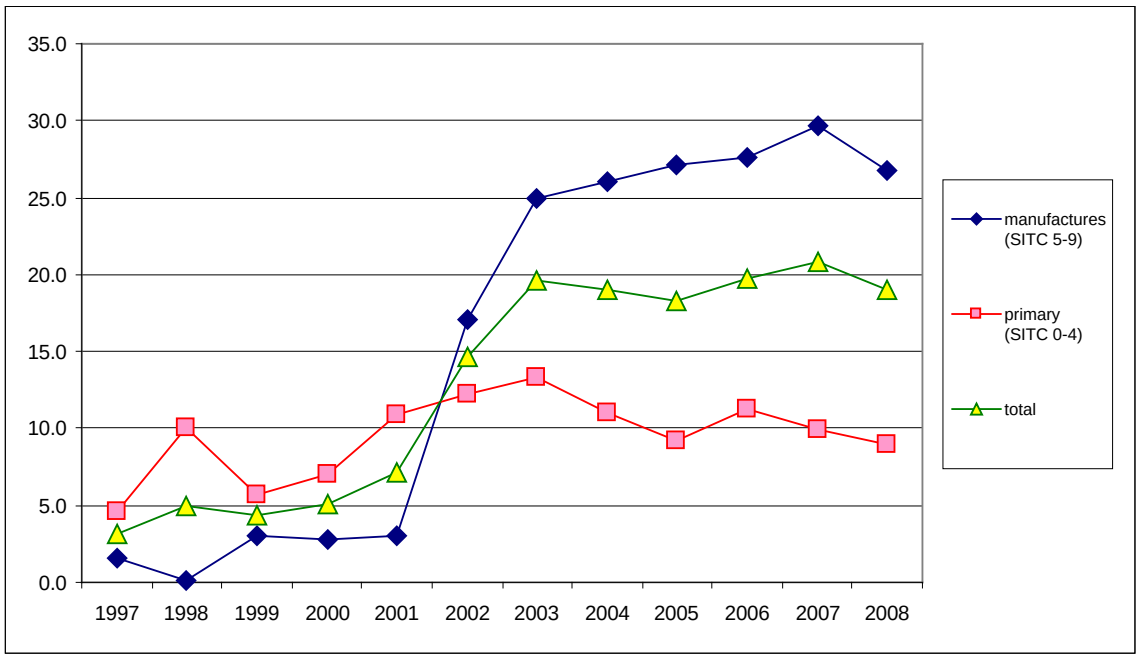
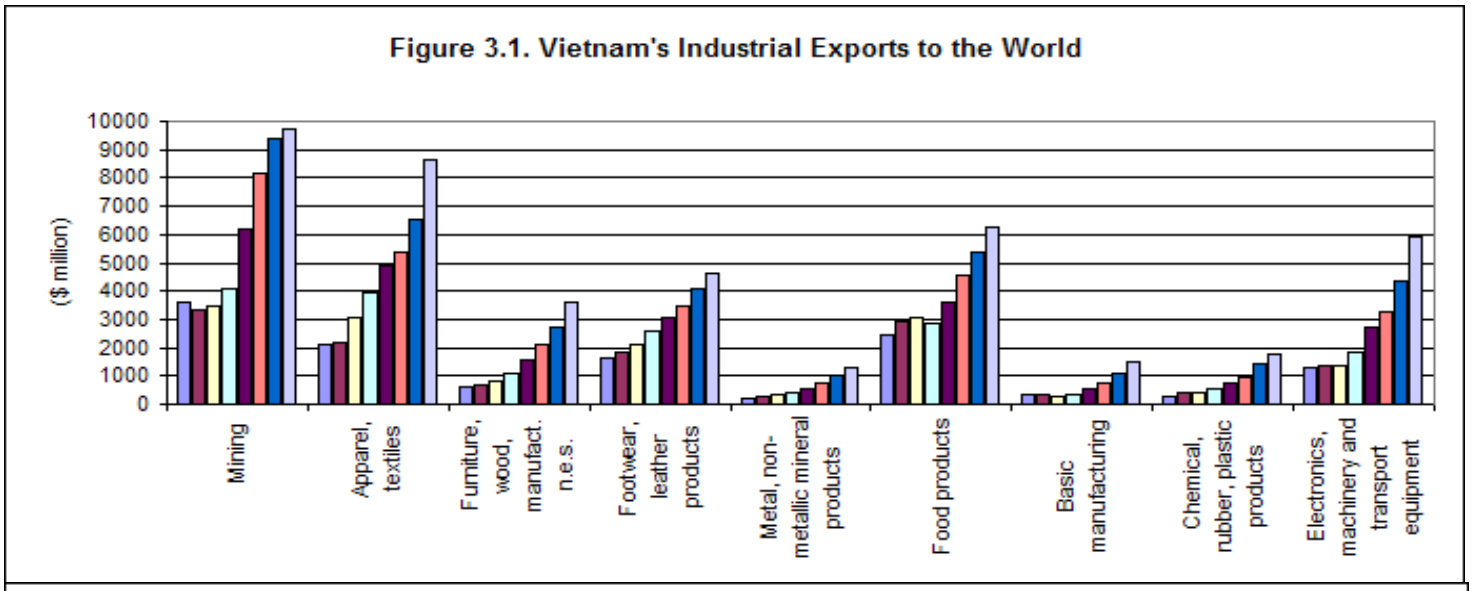
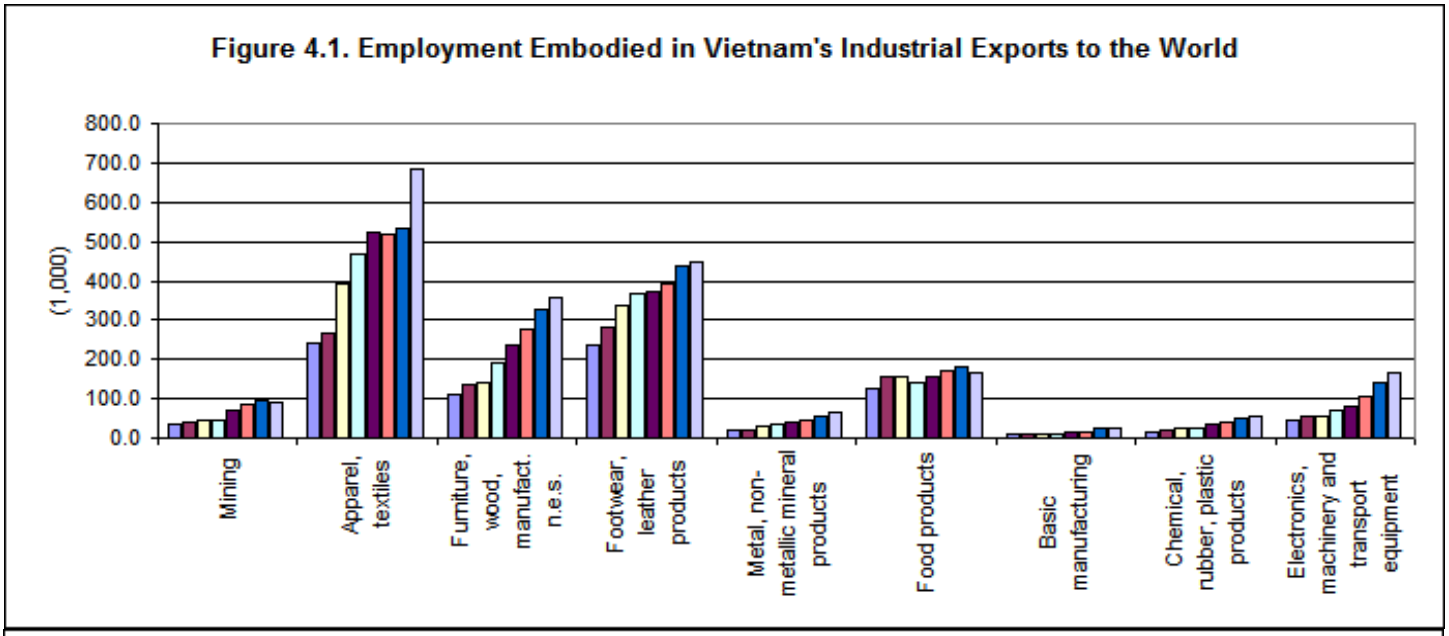
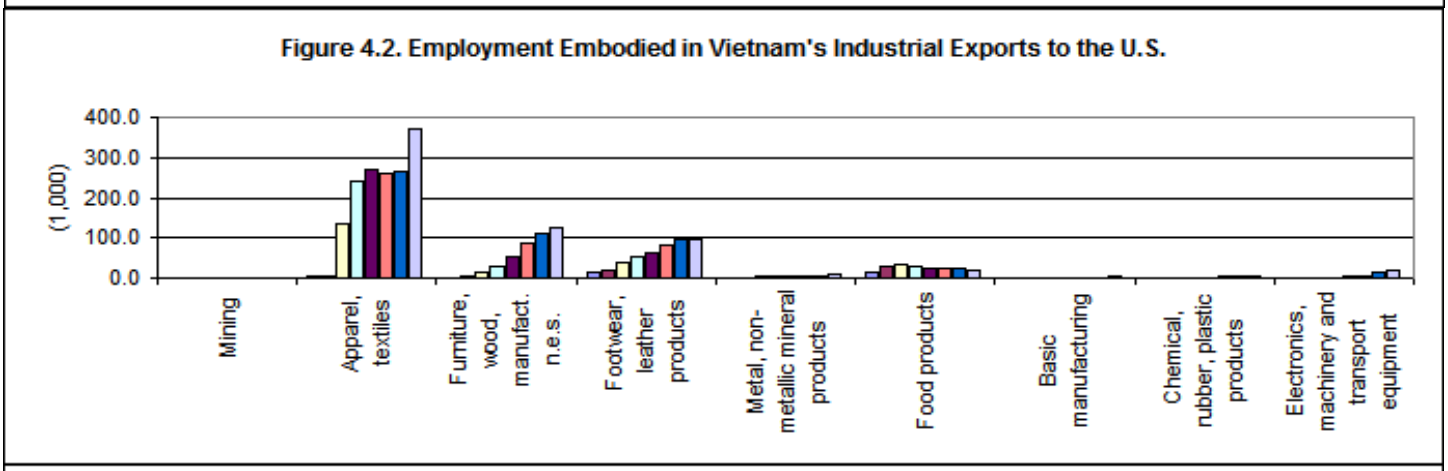


Figure 2. Share of the United States in Vietnam's Total Exports (%)
Source: the U.N. Comtrade System.



Source: Author's calculation based on the U.N. Comtrade System.





Source: Author's calculation based on the U.N. Comtrade System and the *Enterprise Survey* data.

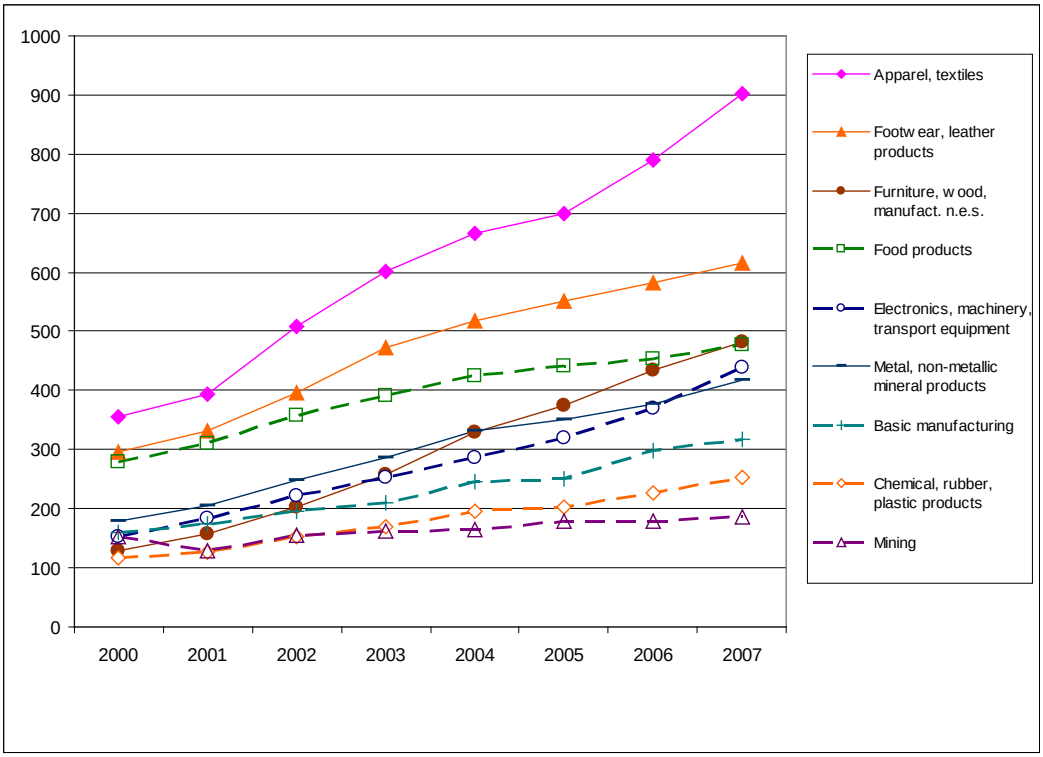


Figure 5. Evolution of Vietnam's Industrial Employment by the VSIC Sub-categories (1,000s). Source: the Enterprise Survey data (GSO).

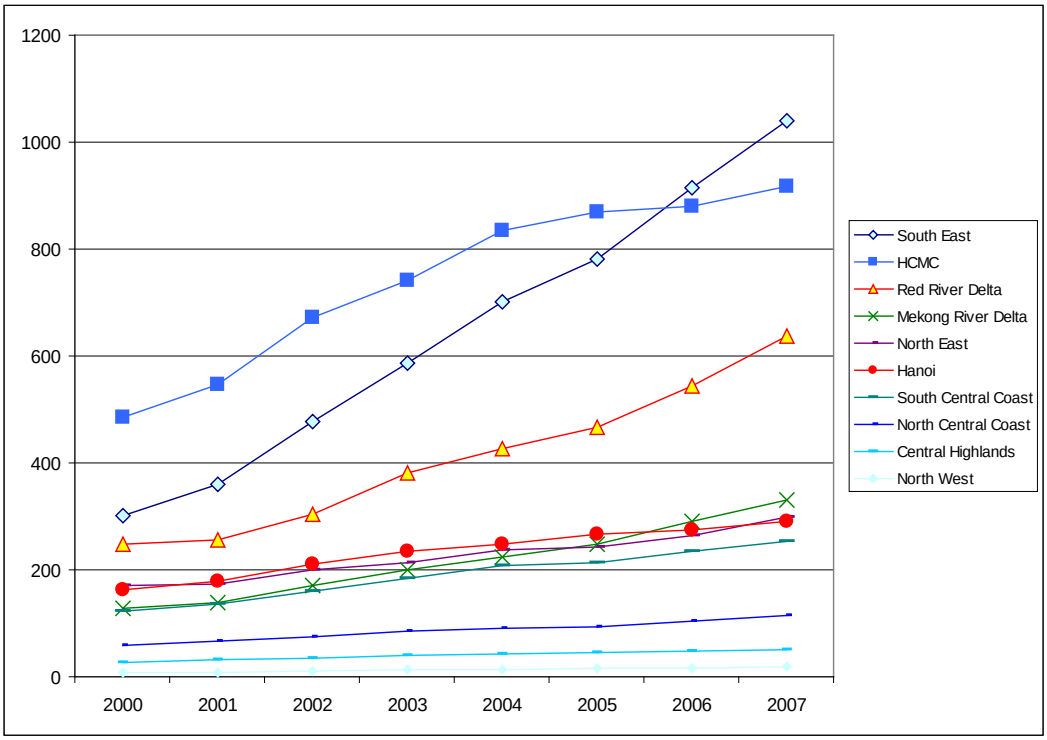


Figure 6. Vietnam's Industrial Employment by Regions (1,000s). Source: the Enterprise Survey data (GSO).

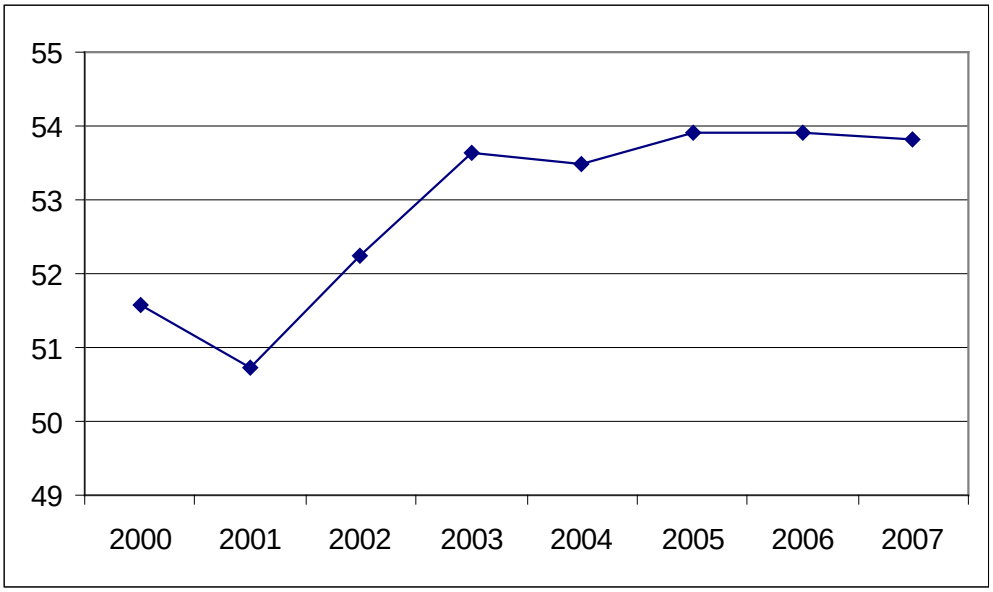


Figure 7.1. Proportion of Workers Employed in Labor-intensive Industries in Total Industrial Employment (%). Note: The industries whose employment coefficients are 6.5 or above in 2004 are classified as labor-intensive industries (see Appendix Table A.4 for the employment coefficients). Source: the Enterprise Survey data (GSO).

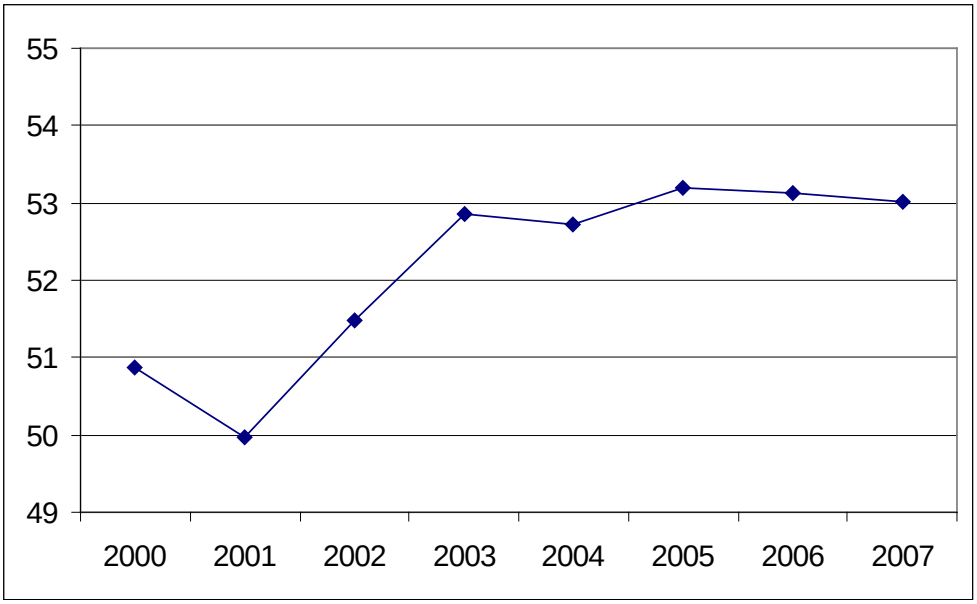


Figure 7.2. Proportion of Workers Employed in Unskilled-labor-intensive Industries in Total Industrial Employment (%). Note: The industries whose proportion of production workers is 85.7 or above in 1998 in the Industrial Survey (GSO, 2000) are referred to unskilled-labor-intensive industries (see Appendix Table A.4 for the proportion of production workers). Source: GSO, 2000.

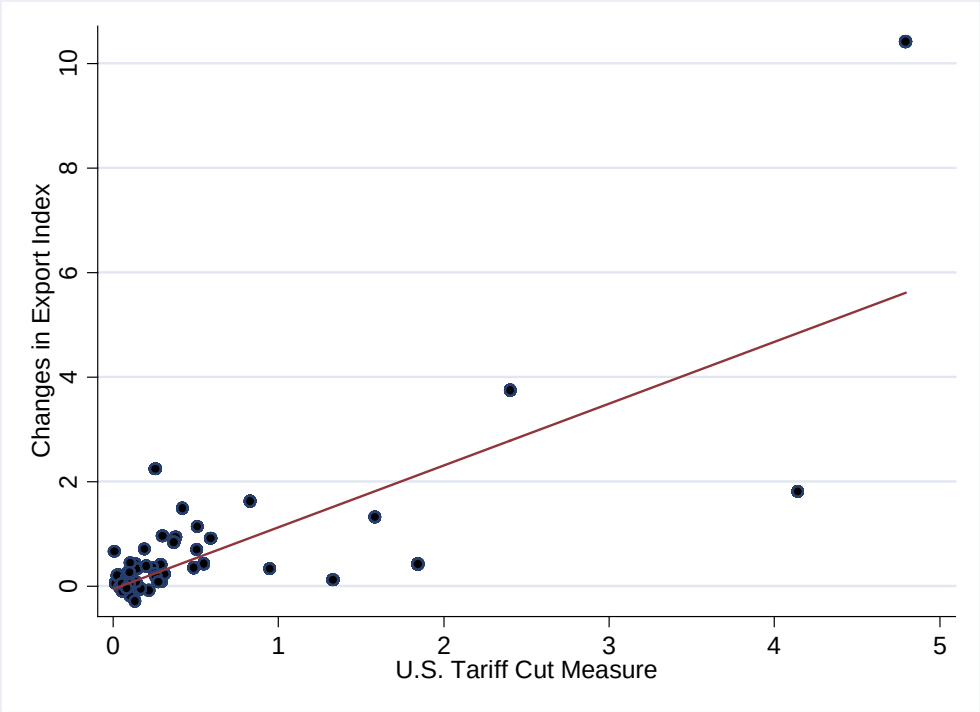


Figure 8.1. Change in Export Index (ΔExport) and U.S. Tariff Cut Measure

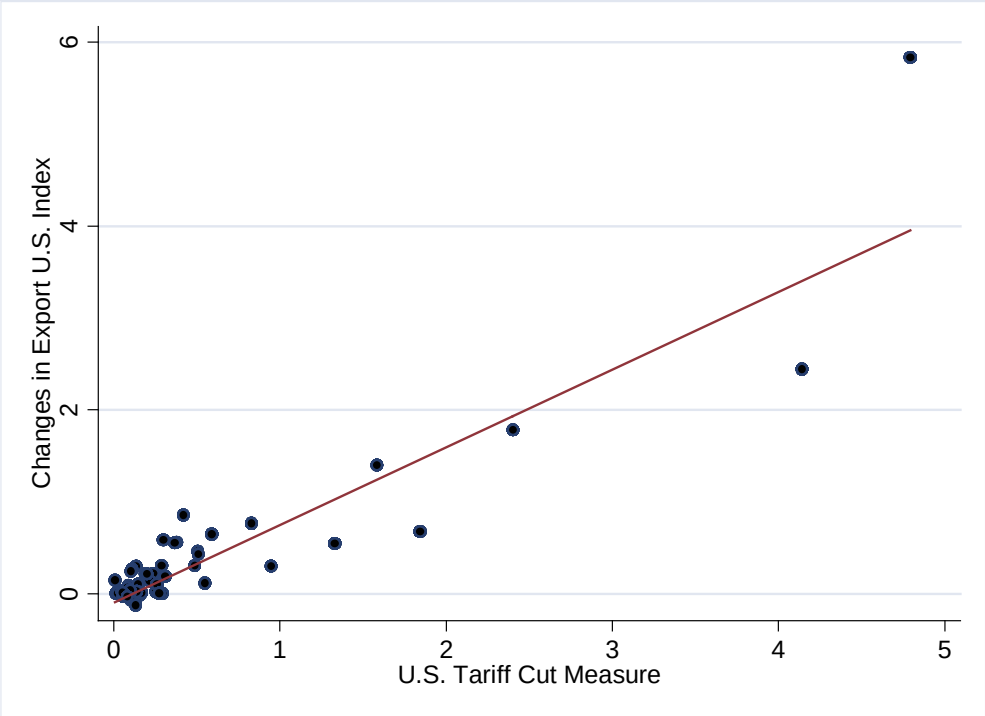


Figure 8.2. Change in U.S. Export Index (ΔExportUS) and U.S .Tariff Cut Measure

Table 1. OLS Regression Results: Explaining Wage Growth

	Model A			Model B			Model C		
	Total	Unskilled	Skilled	Total	Unskilled	Skilled	Total	Unskilled	Skilled
ΔExport Index	.012	.030**	-.0007	.017**	.028***	.0011			
	(.0098)	(.013)	(.0088)	(.0079)	(.011)	(.0079)			
ΔExport US Index							.019	.041**	-.010
							(.013)	(.017)	(.012)
ΔSkilled/unskilled status	-.054	.11	-.026	-.086	.055	-.071	-.085	.055	-.069
	(.062)	(.094)	(.063)	(.065)	(.092)	(.078)	(.065)	(.092)	(.078)
ΔMarital status	-.12*	-.15*	-.014	-.10*	-.14**	.0025	-.10	-.14*	.0016
	(.072)	(.079)	(.093)	(.063)	(.069)	(.091)	(.063)	(.069)	(.092)
Initial wage in log	-.25***	-.36***	-.26***	-.40***	-.49***	-.33***	-.40***	-.49***	-.33***
	(.020)	(.029)	(.034)	(.029)	(.033)	(.043)	(.030)	(.033)	(.043)
Female				-.097***	-.24***	.022	-.097***	-.24***	.021
				(.024)	(.034)	(.036)	(.024)	(.035)	(.036)
Minority				.0024	-.12	.099	-.00001	-.13	.099
				(.087)	(.12)	(.072)	(.088)	(.12)	(.072)
Education				.041***	.023***	.028***	.041***	.023***	.027***
				(.0035)	(.0045)	(.0068)	(.0035)	(.0046)	(.0067)
Potential Experience				.0015	-.00010	.00062	.0016	-.00006	.00058
				(.0015)	(.0016)	(.0018)	(.0015)	(.0016)	(.0018)
Urban				.044	.060	.0079	.043	.060	.0068
				(.031)	(.042)	(.042)	(.031)	(.042)	(.042)
Agriculture share 2002[a]				-.41*	-.27	-.72***	-.35	-.19	-.72***
				(.23)	(.30)	(.26)	(.23)	(.30)	(.25)
Industry share 2002[a]				-.28	.072	-.71	-.099	.28	-.61
				(.44)	(.63)	(.51)	(.47)	(.63)	(.45)
Construction share 2002[a]				.14	1.51	-1.08	-.0051	1.33	-1.15
				(.73)	(.97)	(1.07)	(.71)	(.97)	(1.07)
Government share 2002[a]				-1.27	-.20	-2.81**	-1.30	-.24	-2.85**
				(1.21)	(1.39)	(1.22)	(1.23)	(1.42)	(1.23)
Constant	3.50***	4.91***	3.85***	5.45***	6.53***	5.12***	5.39***	6.44***	5.10***
	(.27)	(.37)	(.46)	(.44)	(.48)	(.66)	(.44)	(.48)	(.65)
Observations[b]	1718	1051	647	1718	1051	647	1718	1051	647
R^2	.115	.182	.146	.210	.274	.184	.209	.272	.184

Notes: The dependent variable is the log difference of monthly wage ($\Delta Ln\ W$ in Equation (2)).
The classification between skilled and unskilled workers is based on the status in 2002.
*, **, *** indicate that the coefficients are significant at the 10, 5, and 1 percent level respectively.
The standard errors in parentheses are based on heteroskedasticity-consistent estimates of the variance-covariance matrix and corrected for within province correlation (clustering).
[a] The share of workers employed in the service sector is the omitted category.
[b] The total sample includes those who worked for "Army force". As the skill category is not assigned for the latter workers, the number of skilled and unskilled workers do not add up to total number.

Table 2.1. First Stage Regression Results

	Model A			Model B			Model C		
	Dependent Variable: ΔExport Index			Dependent Variable: ΔExport Index			Dependent Variable: ΔExport US Index		
	Total	Unskilled	Skilled	Total	Unskilled	Skilled	Total	Unskilled	Skilled
U.S. tariff cut measure	1.21***	1.39***	.94***	1.39***	1.60***	1.02***	1.03***	1.07***	.93***
	(.026)	(.033)	(.042)	(.034)	(.043)	(.055)	(.013)	(.017)	(.020)
Observations	1718	1051	647	1718	1051	647	1718	1051	647
R^2	.567	.648	.448	.708	.760	.636	.885	.893	.873
F test of excluded instrument	5.29	6.99	4.09	6.40	10.51	3.14	28.76	33.28	24.91
[p-value]	[.025]	[.011]	[.048]	[.015]	[.0022]	[.083]	[.000]	[.000]	[.000]

Notes: At the first stage, I regress the change in Export Indices on the measure of the U.S. tariff cut (excluded instrument) and on all the other exogenous variables included in the second stage.
The regressions are estimated using STATA's ivreg2 command with the robust and cluster options (Baum, Schaffer, & Stillman, 2007).
The classification between skilled and unskilled workers is based on the status in 2002.
*** indicate that the coefficients are significant at the one percent level.
The standard errors in parentheses are based on heteroskedasticity-consistent estimates of the variance-covariance matrix and corrected for within province correlation (clustering).

Table 2.2. 2SLS Regression Results: Explaining Wage Growth

	Model A			Model B			Model C		
	Total	Unskilled	Skilled	Total	Unskilled	Skilled	Total	Unskilled	Skilled
ΔExport Index	.024	.047*	.0072	.0076	.028*	-.027			
	(.021)	(.027)	(.017)	(.011)	(.016)	(.023)			
ΔExport US Index							.010	.042*	-.029*
							(.017)	(.023)	(.017)
ΔSkilled/unskilled status	-.056	.11	.028	-.083	.055	-.060	-.083	.055	-.064
	(.062)	(.093)	(.062)	(.064)	(.090)	(.077)	(.064)	(.090)	(.077)
ΔMarital status	-.13*	-.16**	-.017	-.10	-.14**	.0069	-.099	-.14**	-.00035
	(.070)	(.078)	(.092)	(.061)	(.068)	(.091)	(.062)	(.069)	(.091)
Initial wage in log	-.25***	-.38***	-.27***	-.40***	-.49***	-.33***	-.40***	-.49***	-.33***
	(.023)	(.031)	(.036)	(.030)	(.034)	(.041)	(.030)	(.033)	(.041)
Female				-.096***	-.24***	.018	-.096***	-.24***	.020
				(.024)	(.034)	(.036)	(.024)	(.034)	(.036)
Minority				.0024	-.12	.093	.0012	-.13	.10
				(.087)	(.12)	(.073)	(.087)	(.12)	(.071)
Education				.041***	.023***	.025***	.041***	.023***	.026***
				(.0035)	(.0044)	(.0066)	(.0035)	(.0045)	(.0066)
Potential Experience				.0015	-.00010	.00057	.0016	-.000063	.00052
				(.0014)	(.0016)	(.0018)	(.0014)	(.0016)	(.0017)
Urban				.044	.060	.0029	.043	.060	.0052
				(.030)	(.041)	(.042)	(.030)	(.041)	(.042)
Agriculture share 2002[a]				-.38	-.27	-.62**	-.35	-.19	-.72***
				(.24)	(.30)	(.25)	(.23)	(.30)	(.25)
Industry share 2002[a]				-.074	.084	-.16	-.0059	.27	-.48
				(.54)	(.66)	(.57)	(.48)	(.65)	(.40)
Construction share 2002[a]				-.039	1.50	-1.46	-.090	1.34	-1.26
				(.74)	(1.00)	(1.06)	(.71)	(.99)	(1.07)
Government share 2002[a]				-1.34	-.20	-2.89**	-1.34	-.24	-2.90**
				(1.22)	(1.36)	(1.21)	(1.23)	(1.39)	(1.22)
Constant	3.57***	5.04***	3.89***	5.40***	6.52***	4.99***	5.37***	6.44***	5.08***
	(.30)	(.39)	(.47)	(.46)	(.50)	(.62)	(.44)	(.48)	(.64)
Observations[b]	1718	1051	647	1718	1051	647	1718	1051	647
R^2	.114	.178	.145	.210	.274	.179	.209	.272	.184
Wu-Hausman F test	2.52	7.26	.59	.76	0.00	4.43	1.36	.000	3.59
[p-value]	[.118]	[.0092]	[.447]	[.386]	[.966]	[.040]	[.248]	[.966]	[.063]

Notes: The dependent variable is the log difference of monthly wage ($\Delta Ln\ W$ in Equation (2)).
The regressions are estimated using STATA's ivreg2 command with the robust and cluster options (Baum *et al*., 2007).
The classification between skilled and unskilled workers is based on the status in 2002.
*, **, *** indicate that the coefficients are significant at the 10, 5, and 1 percent level respectively.
The standard errors in parentheses are based on heteroskedasticity-consistent estimates of the variance-covariance matrix and corrected for within province correlation (clustering).
[a] The share of workers employed in the service sector is the omitted category.
[b] The total sample includes those who worked for "Army force". As the skill category is not assigned for the latter workers, the number of skilled and unskilled workers do not add up to total number.

Table 3. Impact of Change in Exports on Skill Premium

	(1)	(2)	(3)
Skill*ΔExport Index	-.023***	-.023***	
	(.0067)	(.0080)	
ΔExport Index	.027**	.022**	
	(.012)	(.0089)	
Skill*ΔExport US Index			-.045***
			(.014)
ΔExport US Index			.032**
			(.014)
Skill status	.29***	.21***	.22***
	(.033)	(.033)	(.034)
ΔSkilled/unskilled status	.080	.023	.023
	(.065)	(.068)	(.068)
ΔMarital status	-.12	-.12*	-.12*
	(.070)	(.064)	(.064)
Initial wage in log	-.33***	-.41***	-.41***
	(.022)	(.029)	(.029)
Female		-.12***	-.12***
		(.026)	(.026)
Minority		-.016	-.018
		(.087)	(.088)
Education		.026***	.026***
		(.0037)	(.0036)
Potential Experience		-.00023	-.00024
		(.0013)	(.0013)
Urban		.040	.039
		(.030)	(.030)
Agriculture share 2002[a]		-.36	-.33
		(.22)	(.22)
Industry share 2002[a]		-.053	.082
		(.43)	(.43)
Construction share 2002[a]		.53	.41
		(.74)	(.72)
Government share 2002[a]		-1.32	-1.35
		(1.16)	(1.17)
Constant	4.44***	5.63***	5.58***
	(.29)	(.44)	(.43)
Observations	1698	1698	1698
R^2	.173	.228	.228

Note: The dependent variable is the log difference of monthly wage ($\Delta Ln\ W$ in Equation (5)). The standard errors in parentheses are based on heteroskedasticity-consistent estimates of the variance-covariance matrix and corrected for within province correlation (clustering). *, **, *** indicate that the coefficients are significant at the 10, 5, and 1 percent level respectively.
The classification between skilled and unskilled workers is based on the status in 2002.
[a] The share of workers employed in the service sector is the omitted category.

Appendix Table A.1. Vietnam's Exports to the World by the VSIC Sub-categories ($ million)

Industry	2000	2001	2002	2003	2004	2005	2006	2007	2008
Apparel, textiles (17, 18)	2104	2186	3045	3933	4890	5392	6547	8608	10163
Footwear, leather products (19)	1647	1829	2115	2562	3030	3437	4049	4623	5689
Furniture, wood, manufact. n.e.s. (20, 36, 37)	580	670	848	1115	1596	2117	2713	3574	4232
Food products (15, 16)	2463	2900	3066	2874	3620	4559	5352	6255	8634
Electronics, machinery, transport equipment (29-35)	1299	1366	1339	1832	2687	3274	4350	5892	7835
Metal, non-metallic mineral products (26, 28)	201	267	338	427	556	725	998	1279	1533
Basic manufacturing (21, 22, 23, 27, 40, 41)	360	351	300	349	537	739	1077	1505	3826
Chemical, rubber, plastic products (24, 25)	256	379	439	550	771	979	1414	1797	2547
Mining (10, 11, 13, 14)	3628	3309	3485	4086	6179	8172	9403	9714	12046
Agriculture, forestry, fishery (1-5)	1479	1407	1556	2255	2499	2915	3772	4972	5753
Others	464	365	174	166	119	139	151	343	429
Total	14483	15029	16706	20149	26485	32447	39826	48561	62685

Appendix Table A.2. Vietnam's Exports to the U.S. by the VSIC Sub-categories ($ million)

Industry	2000	2001	2002	2003	2004	2005	2006	2007	2008
Apparel, textiles (17, 18)	50	48	1040	2020	2550	2691	3148	4576	5241
Footwear, leather products (19)	92	117	236	352	502	702	893	1003	1208
Furniture, wood, manufact. n.e.s. (20, 36, 37)	11	22	81	173	381	672	927	1276	1448
Food products (15, 16)	304	488	678	617	560	588	682	771	801
Electronics, machinery, transport equipment (29-35)	5	8	33	88	117	240	484	740	983
Metal, non-metallic mineral products (26, 28)	9	11	30	36	62	82	117	146	186
Basic manufacturing (21, 22, 23, 27, 40, 41)	1	5	12	9	8	16	34	71	156
Chemical, rubber, plastic products (24, 25)	1	3	10	17	36	63	88	178	243
Mining (10, 11, 13, 14)	92	234	148	201	407	468	1030	798	1017
Agriculture, forestry, fishery (1-5)	151	129	182	422	403	404	446	542	617
Others	16	0	2	3	1	1	0	11	2
Total	733	1066	2453	3940	5027	5927	7850	10111	11903

Appendix Table A.3. Vietnam's Imports from the World by the VSIC Sub-categories ($ million)

Industry	2000	2001	2002	2003	2004	2005	2006	2007	2008
Apparel, textiles (17, 18)	1676	1620	2215	2582	3111	3509	3943	4998	5628
Footwear, leather products (19)	500	562	656	784	950	978	947	1107	1165
Furniture, wood, manufact. n.e.s. (20, 36, 37)	161	211	376	478	634	788	1027	1298	1382
Food products (15, 16)	629	795	922	1224	1487	1765	2065	3027	4347
Electronics, machinery, transport equipment (29-35)	4844	5025	5913	8102	9030	9621	11406	18545	23431
Metal, non-metallic mineral products (26, 28)	314	448	595	851	881	1065	1310	1921	2321
Basic manufacturing (21, 22, 23, 27, 40, 41)	3571	3739	4476	5848	8793	10966	14485	19216	26571
Chemical, rubber, plastic products (24, 25)	2879	3041	3610	4426	5717	6469	7720	10220	12597
Mining (10, 11, 13, 14)	142	130	183	166	280	300	330	415	541
Agriculture, forestry, fishery (1-5)	412	456	575	688	941	1152	1470	1785	2333
Others	508	192	224	109	145	147	188	233	398
Total	15637	16218	19746	25256	31969	36761	44891	62765	80714

Source: the U.N. Comtrade System.
Note: Between parentheses are the VSIC codes at the two digit level.

Appendix Table A.4. Exports, Employment Coefficients and Proportion of Production Workers By VSIC 2-digit Level

VSIC categories[a]	Exports Value 2004 ($ million)	Share in Total Exports 2004 (%)	Employment coefficient 2004[b] (person/bn dong)	Share of production workers 1998 (%)
Crude petroleum (11)	5671	21.4	.1	88.9
Apparel (18)	3633	13.7	6.7	88.5
Food and beverages (15)	3492	13.2	2.8	81.7
Footwear and leather products (19)	3030	11.4	7.9	92.3
Furniture and manufacturing n.e.s. (36)	1276	4.8	9.1	88.7
Textiles (17)	1257	4.7	6.8	89.7
Electronics (31)	771	2.9	2.3	79.3
Office machinery (30)	655	2.5	.6	79.8
Radio, TV and communication machinery (32)	537	2.0	1.8	74.7
Rubber and plastics products (25)	454	1.7	3.5	81.0
Mining of hard coal lignite and peat (10)	354	1.3	6.5	86.9
Wood products (20)	320	1.2	10.4	85.7
Chemical products (24)	317	1.2	1.9	73.2
Non-metallic mineral products (26)	291	1.1	5.0	84.8
Transport equip. other than motor vehicle (35)	289	1.1	2.1	75.7
Metal products (28)	265	1.0	4.1	78.6
Machinery and equipment (29)	237	.9	4.1	74.3
Basic metals (27)	212	.8	1.4	85.6
Coke and refined petroleum products (23)	209	.8	.6	30.8
Tobacco products (16)	128	.5	1.1	85.3
Mining of metal ores (13)	120	.5	9.4	81.4
Motor vehicles (34)	102	.4	1.3	70.3
Medical, optical instruments, watches and clocks (33)	98	.4	4.8	78.1
Paper and paper products (21)	80	.3	4.2	81.7
Publishing and printing (22)	36	.1	4.0	72.2
Other mining and quarrying (14)	34	.1	11.8	92.7
Recycling (37)	0	.0	5.1	89.4
Electricity, gas, steam and hot water (40)	0	.0	2.4	54.3
Collection, purification and distribution of water (41)	0	.0	7.5	78.0
Exports other than industrial exports	2618	9.9		
Total	26485	100.0		

Sources: the *Enterprise Survey* Data 2004; Jenkins (2004); the UN Comtrade System.
Notes: [a] Between parentheses are the VSIC codes at the two digit level.
[b] Employment coefficient reflects the number of workers needed to produce one billion dong worth of goods. Following Jenkins (2004), output for apparel (18) and footwear and leather products (19) are multiplied by 2.5 and by 2 respectively, assuming that the gross output recorded in the *Enterprise Survey* data refers not to the value of the products but to the processing costs. Without this adjustment, the employment coefficients for apparel (18) and footwear and leather products (19) are 13.7 and 11.4 respectively.

Appendix Table A.5.Evolution of Industrial Employment by the VSIC Sub-sectors (1000s)

	2000	2001	2002	2003	2004	2005	2006	2007
Apparel, textiles (17, 18)	355	394	509	602	666	700	789	901
Footwear, leather products (19)	297	332	397	472	518	551	582	615
Furniture, wood, manufact. n.e.s. (20, 36, 37)	129	157	203	257	329	376	435	483
Food products (15, 16)	280	311	358	392	425	442	454	478
Electronics, machinery, transport equipment (29-35)	153	183	221	253	287	319	370	440
Metal, non-metallic mineral products (26, 28)	179	206	248	287	332	350	378	418
Basic manufacturing (21, 22, 23, 27, 40, 41)	161	175	195	211	245	250	297	316
Chemical, rubber, plastic products (24, 25)	117	127	153	170	195	204	227	253
Mining (10, 11, 13, 14)	153	129	155	163	166	178	180	186
Total	1823	2014	2441	2807	3162	3370	3711	4091

Source: the *Enterprise Survey* data 2000-2007 (GSO).

Appendix Table A.6. Evolution of Industrial Employment by Regions (1,000s)

	2000	2001	2002	2003	2004	2005	2006	2007
HCMC	485	547	672	742	836	869	879	918
Southeast[a]	300	359	478	586	702	782	916	1041
Hanoi	163	178	210	235	248	267	275	291
Red River Delta[b]	248	255	305	381	427	466	545	637
Northeast	171	173	200	214	238	244	265	298
Northwest	7	8	10	14	14	15	17	19
North Central Coast	58	66	75	85	91	93	103	114
South Central Coast	122	137	160	183	207	215	234	253
Central Highlands	26	31	35	40	43	46	47	51
Mekong River Delta	127	139	170	199	224	249	290	332
Others	115	122	126	128	131	125	140	138
Total	1823	2014	2441	2807	3162	3370	3711	4091

Source: the *Enterprise Survey* data 2000-2007 (GSO).
Notes: [a]The Southeast region excludes HCMC.
[b]The Red River Delta region excludes Hanoi.

Appendix Table A.7. Summary Statistics

	Total			Unskilled			Skilled		
	2002	2004	Change 2002-2004	2002	2004	Change 2002-2004	2002	2004	Change 2002-2004
Personal Characteristics									
Observations	1746	1746		1065	1065		656	656	
Female (%)	.36	.36		.31	.31		.46	.46	
	(.48)	(.48)		(.46)	(.46)		(.50)	(.50)	
Minority (%)	.073	.073		.066	.066		.087	.087	
	(.26)	(.26)		(.25)	(.25)		(.28)	(.28)	
Education (years)	9.25	9.38		7.21	7.30		12.41	12.61	
	(4.23)	(4.26)		(3.55)	(3.59)		(3.08)	(3.03)	
Potential Experience	18.63	20.45		18.01	19.86		19.58	21.33	
(years)	(10.26)	(10.32)		(10.66)	(10.75)		(9.64)	(9.66)	
Married (%)	.68	.71	.025	.60	.63	.030	.80	.82	.015
	(.47)	(.45)	(.20)	(.49)	(.48)	(.21)	(.40)	(.38)	(.18)
Urban (%)	.40	.40		.30	.30		.55	.55	
	(.49)	(.49)		(.46)	(.46)		(.50)	(.50)	
Monthly wage	735.16	922.31		576.26	695.17		976.34	1260.19	
(1,000 dong)	(596.44)	(715.31)		(415.99)	(504.16)		(745.21)	(848.34)	
Log monthly wage	13.27	13.49	.22	13.06	13.24	.18	13.59	13.86	.27
	(.70)	(.72)	(.51)	(.66)	(.67)	(.55)	(.64)	(.63)	(.44)
Province-specific Characteristics									
Observations	61	61	61						
Export Index	2.35	2.93	.59						
	(4.76)	(6.10)	(1.44)						
Export US Index	.42	.76	.34						
	(.82)	(1.65)	(.84)						
US tariff cut measure			.45						
			(.87)						
Share of agriculture 2002 (%)	.620								
	(.178)								
Share of construction 2002 (%)	.041								
	(.022)								
Share of government 2002 (%)	.053								
	(.018)								
Share of industry 2002 (%)	.113								
	(.075)								
Share of service 2002 (%)	.174								
	(.096)								

Sources: Author's calculation based on the VHLSS 2002, VHLSS 2004 and the *Enterprise Survey* data.
Note: Between parentheses are the standard deviations.

Appendix Table A.8. OLS Regression Results:
Explaining Wage Growth with the U.S. Tariff Cut Measure

	Model A			Model B and Model C		
	Total	Unskilled	Skilled	Total	Unskilled	Skilled
U.S. tariff cut measure	.029*	.066***	.0068	.010	.045*	-.027*
	(.015)	(.017)	(.014)	(.018)	(.024)	(.014)
ΔSkilled/unskilled status	-.057	.096	.028	-.082	.058	-.067
	(.062)	(.093)	(.063)	(.065)	(.091)	(.078)
ΔMarital status	-.12*	-.14*	-.015	-.10	-.14*	-.0022
	(.072)	(.077)	(.094)	(.063)	(.069)	(.093)
Initial wage in log	-.26***	-.38***	-.27***	-.40***	-.49***	-.33***
	(.025)	(.031)	(.037)	(.031)	(.034)	(.042)
Female				-.096***	-.24***	.021
				(.024)	(.034)	(.036)
Minority				.00016	-.13	.10
				(.089)	(.12)	(.071)
Education				.041***	.023***	.027***
				(.0035)	(.0046)	(.0067)
Potential Experience				.0016	-.000014	.00046
				(.0015)	(.0016)	(.0018)
Urban				.043	.059	.0076
				(.031)	(.042)	(.042)
Agriculture share 2002[a]				-.34	-.13	-.77***
				(.23)	(.28)	(.25)
Industry share 2002[a]				-.0041	.29	-.52
				(.48)	(.43)	(.38)
Construction share 2002[a]				-.067	1.44	-1.31
				(.73)	(1.06)	(1.14)
Government share 2002[a]				-1.40	-.52	-2.77**
				(1.24)	(1.42)	(1.20)
Constant	3.60***	5.07***	3.90***	5.37***	6.43***	5.10***
	(.32)	(.39)	(.40)	(.44)	(.46)	(.65)
Observations[b]	1718	1051	647	1718	1051	647
R^2	.118	.187	.146	.209	.272	.186

Notes: The dependent variable is the log difference of monthly wage ($\Delta Ln\ W$).
The classification between skilled and unskilled workers is based on the status in 2002.
*, **, *** indicate that the coefficients are significant at the 10, 5, and 1 percent level respectively.
The standard errors in parentheses are based on heteroskedasticity-consistent estimates of the variance-covariance matrix and corrected for within province correlation (clustering).
[a] The share of workers employed in the service sector is the omitted category.
[b] The total sample includes those who worked for "Army force". As the skill category is not assigned for the latter workers, the number of skilled and unskilled workers do not add up to total number.

Appendix Table A.9. Impact of Change in Exports on Skill Premium with the U.S. Tariff Cut Measure

	(1)	(2) (3)
Skill*U.S. tariff cut measure	-.038***	-.047***
	(.012)	(.012)
U.S. tariff cut measure	.058***	.026
	(.016)	(.016)
Skill status	.30***	.23***
	(.038)	(.035)
ΔSkilled/unskilled status	.075	.022
	(.063)	(.068)
ΔMarital status	-.11	-.12*
	(.069)	(.064)
Initial wage in log	-.34***	-.41***
	(.027)	(.030)
Female		-.12***
		(.025)
Minority		-.019
		(.088)
Education		.025***
		(.0036)
Potential Experience		-.00031
		(.0013)
Urban		.038
		(.030)
Agriculture share 2002[a]		-.33
		(.22)
Industry share 2002[a]		.16
		(.43)
Construction share 2002[a]		.33
		(.75)
Government share 2002[a]		-1.44
		(1.17)
Constant	4.57***	5.57***
	(.34)	(.43)
Observations	1698	1698
R^2	.177	.228

Note: The dependent variable is the log difference of monthly wage ($\Delta Ln\ W$). The standard errors in parentheses are based on heteroskedasticity-consistent estimates of the variance-covariance matrix and corrected for within province correlation (clustering).

*, **, *** indicate that the coefficients are significant at the 10, 5, and 1 percent level respectively.

The classification between skilled and unskilled workers is based on the status in 2002.

[a] The share of workers employed in the service sector is the omitted category.