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Trade liberalization and the wage–skill premium[1]

Evidence from Vietnamese manufacturing

Mita Bhattacharya* and Kien Trung Nguyen**
*Department of Economics, Monash University, Australia.
E-mail: mita.bhattacharya@monash.edu
**School of Economics, The University of Danang, Danang, Vietnam. E-mail: kien.nt@due.edu.vn

Abstract

This paper examines the wage–skill premium in Vietnamese manufacturing since the reform programme. The effects of tariff reductions on the wage–skill premium are analyzed in the presence of exporting opportunities, foreign investment, and research and development. The findings with firm-level data reveal that a 10-percentage point fall in output tariffs is associated with a 4 percent increase in the wage–skill premium. The wage–skill premium in foreign-invested enterprises is 40 percent higher than that of domestic enterprises. Trade liberalization influences the wage–skill premium in the presence of foreign ownership and R&D, while its impact on the skill premium only works through exporting.

Keywords: Wage–skill premium, tariffs, firm ownership, liberalization, Vietnam.
JEL classifications: F14, F16, L60.

1. Introduction

Vietnam launched *Doi Moi* reforms in 1986, and since then the country has been shifting from a centrally planned economy to a mixed market economy. The growth

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rate of the country was significant during the last decade (growing from US$ 66 billion in 2006 to US$ 193 billion in 2015), with an average annual gross domestic product (GDP) growth rate of 6.12 percent.[2] Along with a series of market-oriented reforms, the country made significant policy changes in liberalizing trade and foreign direct investment (FDI). The introduction of legal innovations by the government in the early 1990s permitted the establishment and development of private enterprises, and sanctioned household businesses (CIEM, 2003). Inflow of FDI has increased considerably with a cumulative FDI stock of US$ 72.8 billion in 2011 (UNCTAD, 2016). For the year 2009, foreign firms accounted for 18.3 percent of GDP and 43.2 percent of industrial output according to the government statistical organization (GSO, 2010).[3] Employment in foreign affiliates increased from 0.4 million workers to 1.7 million between 2000 and 2007 (GSO, 2011).

Export response to these liberalization reforms has been impressive (Athukorala, 2009; Riedel, 1997). The value of total manufacturing exports (in current prices) quadrupled between 2000 and 2007 (from US$ 6 billion to US$ 26 billion) and reached US$ 130 billion in 2015. The gross domestic expenditures on R&D as a percentage of GDP (GERD) remained stable between 2002 (0.18 percent) and 2011 (around 0.2 percent), which placed Vietnam within the range of ASEAN countries (the highest was Singapore with 2.2 percent and the lowest was Indonesia with 0.08 percent). Business expenditures on research and development (BERD) increased to almost a third of GERD in 2011 (for example, in 2002 it was around 18 percent). Funding from abroad contributed 6.3 percent of GERD in 2010 (CRDS/JST, 2015; OECD, 2014). As part of the trade liberalization reforms, Vietnam bound the whole tariff schedule ranging from 0 percent to 40 percent, with an average bound rate of 11.5 percent. The simple average tariff rate declined from 16.4 percent in 2002 to 9.8 percent in 2010 (Nguyen, 2014).

In the new era of trade and investment liberalization, wage inequality has become a major area of research in most developing countries. The literature is unequivocal in explaining this wage gap due to the liberalization process. The Lewis–Fei–Ranis model does not make a distinction between skilled and unskilled labour, but it implies that the wage premium could continue to increase as long as surplus labour conditions prevail in the economy.[4] The standard Heckscher–Ohlin–Stolper–Samuelson (HOSS) (Krugman *et al.*, 2008) model predicts that in a labour-abundant economy there will be a rise in manufacturing wages of unskilled workers associated with an increasing export of manufacturing products.

[2] In 2009, the major economies of the Association of South East Asian Nations (ASEAN) experienced a significant decline in their GDP, whereas Vietnam only had a slight decline of 5.4 percent during that period (World Bank, 2016).

[3] FDI inward stock increased significantly from US$ 14.730 million in 2000 to US$ 102.791 million in 2015, placing Vietnam at fifth position after Singapore, Indonesia, Thailand and Malaysia (UNCTAD, 2016).

[4] Key references, which provide the theoretical framework of the Lewis–Fei–Ranis model, include Fei and Ranis (1964, 1997), and Lewis (1954, 1972).

In contrast, the Feenstra–Hanson extension (Feenstra and Hanson, 1996) to the HOSS model postulates that the engagement of developing countries in global production sharing could result in an increasing wage premium in these countries. This effect also rests on skill-biased technological change (SBTC), which accounts for the increased demand for skilled workers following a rise in imports of capital goods and technology from the developed world (Acemoglu, 2003).

The question remains whether a multilateral trade and investment environment, along with a reduction in import protection, play a large role in increasing wage and skill premium. Vietnam represents an ideal case study for exploring this research question. The waged labour market has turned into an important institution as Vietnamese economic development has progressed over the last two decades. Wage inequality is predominant, particularly in the non-agricultural sector since the 1990s. The country intensified trade and investment liberalization in the early 21st century in two notable aspects.[5] First, the accession to the World Trade Organization (WTO) in early 2007 has made the Vietnamese economy more open and competitive than in previous decades. Second, the united legislation on enterprise and investment in 2006 provided a consistent legal environment for all kinds of enterprises, irrespective of the form of ownership, by reducing numerous constraints on private firms. These liberalization reforms should have significant effects on the wages of unskilled workers.

Despite its importance in the debate on the gains from global economic integration, the issue of a wage premium between skilled and unskilled workers has received little attention in the studies in Vietnam. Although considerable research has been devoted to analyzing wage inequality in Vietnam over the first decade of the reforms in the 1990s, predominantly using the Household Surveys data (Brassard, 2004; Gallup, 2004; Liu, 2001, 2004; McCarty, 1999), rather less attention has been paid to the wage gap after opening up to international trade and investment (Fukase, 2013) at the enterprise level.

More specifically, we examine the effect of trade and investment liberalization on wage inequality between skilled and unskilled workers, considering a firm-level dataset from the Vietnamese manufacturing sector.[6] Our present analysis draws from literature on globalization and wage premium from the developing countries (Amiti and Konings, 2007; Goldberg and Pavcnik, 2007; Hahn and Choi, 2017; Harrison and Hanson, 1999).

First, the role of a reduction in trade protection is captured through the separate effects of output and input tariffs across firms on the wage–skill premium. The heterogeneity across firms in responding to liberalization effects is captured depending on various firm characteristics. Second, we focus on the following three different channels as the primary factors determining the effect of import tariff reductions on the within-firm wage–skill premium: exporting, foreign investment, and research

[5] See Auffret (2003) for detail of trade policies.

[6] The terms 'firm' and 'enterprise' are used synonymously throughout the text.

and development behaviour. We consider the interaction between trade and skill-based technological change as the mechanism through which trade and investment can influence the wage–skill premium. Third, we analyze whether differences in ownership among firms and the age of firms have significant effects in explaining the wage–skill premium in the presence of trade liberalization.

Our major findings are as follows. For the full sample, a reduction in output tariffs was associated with a widening wage premium, while a reduction in tariffs on intermediate inputs tended to help in narrowing the wage premium. This signifies that tariff reduction in the output market increases the wages of skilled workers, while tariff reduction in the input market expands the production of import-competing products and increases the demand for unskilled workers. From the sub-sampling results, we find that trade liberalization affects the wage premium in domestic private firms through the R&D channel, while it operates through the exporting activities for state and foreign-owned enterprises. Dividing the sample between old and new firms, R&D activities have larger effects on the wage premium for older firms compared to new ones. These findings are somewhat similar to other labour-abundant developing countries, such as Indonesia.

The structure of the paper is as follows. Section 2 surveys the empirical evidence of the wage premium following trade and investment liberalization in developing countries. Here, we restrict the literature to developing countries where possible. This section provides us with the background for our empirical model. Section 3 establishes our empirical model for examining the effect of tariff reduction on the within-firm wage–skill premium through the various trade and investment channels. This section also discusses data compilation, variables and estimation strategy. Section 4 analyzes empirical findings. The concluding section discusses some policy implications from our findings.

2. Trade and investment liberalization and the wage–skill premium

Here, we discuss empirical patterns from the existing literature for different key channels that we consider comprise trade and investment liberalization in Vietnam, and we link these with the wage–skill premium. We cover four strands of literature.

2.1 Linkage between tariff reduction and the wage–skill premium

Since the seminal paper published on firm heterogeneity by Melitz (2003), there has been a surge of research in this area. There has been an increased amount of research linking international trade and investment with the wage–skill premium in the case of heterogeneous firms (Goldberg and Pavcnik, 2007). For research incorporating firm heterogeneity on trade models linking with labour market outcomes, see Egger and Kreickemeier (2009) and Helpman *et al.* (2010).

The general view is that increasing import competition following the expansion of north–south trade causes an increase in demand for unskilled workers and therefore improves income distribution in developing countries. However, the experience is mixed in the case of developing countries, and therefore country-based research with micro-level data is warranted. For Colombian manufacturing firms, Attanasio *et al.* (2004) found that the increase in the skill premium was primarily driven by skilled-biased technological change; this has been encouraged due to significant reductions in tariffs. Sectors with larger tariff reductions have managed to lower wage premiums. In the case of Indian manufacturing, Kumar and Mishra (2008) established favourable effects on the wage premium after the 1991 reform period. Tariff reductions increased the share of unskilled workers, increasing their wages relative to the skilled workers. In the case of Indonesia, Amiti and Davis (2011) reported firm heterogeneity in explaining the wage premium. Larger productive firms engaging in exporting and importing activities are found to pay higher wages than the other firms. A fall in output tariffs lowers wages for import-competing firms but increases wages for exporting firms. Likewise, a fall in input tariffs raises wages at import-using firms relative to firms using indigenous inputs. Further empirical research by Amiti and Cameron (2012) in Indonesian manufacturing found the wage gap between skilled and unskilled workers narrowed in the presence of a reduced tariffs structure. In a recent study by Halliday *et al.* (2018), variations in the relative price between tradable and non-tradable goods has been identified as the key cause of decline in wage inequality in Mexico.

Our major hypotheses are as follows:

Hypothesis 1A. *Output tariffs will affect the wage–skill premium in Vietnam. We do not predict any prior expected sign.*

Hypothesis 1B. *Input tariffs will affect the wage–skill premium in Vietnam. We do not predict any prior expected sign.*

2.2 Linkage between exports and the wage–skill premium

Exporting sectors create opportunities for firms, and benefits may be passed on through higher employment and wages. Exporting firms may have inherent attributes such as access to skilled workers, high-tech machines, use of quality intermediates and higher productivity, which may help them pay a higher wage premium compared to a non-exporting counterpart. In the US, Bernard *et al.* (1995) reported that average wages are around 9 percent higher for exporting plants than for their non-exporting counterparts. In contrast, Bernard and Jensen (1997) established that wage differentials are modest between exporting and non-exporting firms in the case of German manufacturing; and similar results were found for UK manufacturing firms in Greenaway and Kneller (2004). Similar findings are reported

by Aw and Batra (1995) for Taiwan, Hahn (2004) for Korea, Isgut (2001) for Columbia, Bustos (2011) for Argentina, and Van Biesebroeck (2005) for sub-Saharan Africa.

Similar to the theoretical literature, the findings of empirical studies remain inconclusive (Frías *et al.*, 2009; Klein *et al.*, 2013). There is significant evidence to support the narrowing wage premium between skilled and unskilled workers in labour-abundant economies in East Asia after opening up to the international market. Throughout the 1960s and 1970s, export expansion narrowed the wage premium between skilled and unskilled workers in East Asian economies (Galenson, 1992; Kim and Topel, 1995; Kuo, 1989; Wood, 1997). In Taiwanese manufacturing, the wage inequality between white collar and blue collar employees reduced over the period of export promotion (Kuo, 1989). Similarly, a reduction in the wage premium was significant in South Korea during the same period (Galenson, 1992; Wood, 1997). These findings are quite consistent with the prediction of HOSS trade models. In contrast, the wage premium was not significantly narrowed in the Philippines' manufacturing sector during the 1980s, because the wages of unskilled workers in labour-intensive industries were not affected due to the country's unskilled labour abundance (Hasan and Chen, 2004). Also, several middle-income developing countries in the Latin American region have experienced a rise in the wage premium following trade liberalization (Attanasio *et al.*, 2004).

Despite its prominence in empirical works, the association of trade and investment liberalization and the wage–skill premium remains a sparsely researched subject in Vietnam. Gallup (2004) examined wage inequality in Vietnam during the 1990s, using two rounds of the Vietnam Household Living Standards Survey (VHLSS) between 1992 and 1997. Employing the same rounds of a household-level dataset, Liu (2004) investigated the changing wage structure following economic reform, focusing on the gender wage gap and the overall wage inequality between skilled and unskilled workers. Both studies suggested a moderate decline in wage inequality between these two-time points; however, they did not consider specific channels for trade and investment liberalization, such as firm ownership or tariff reductions.

A recent cross-country study by Brambilla *et al.* (2017) considered enterprise-level data and reported that an average exporter pays 31 percent higher wages than their non-exporting counterpart. Using the Vietnam Household Living Standards Survey (VHLSS) data, Fukase (2013) examined the wage premium in the aftermath of the 2001 Bilateral Trade Agreement (BTA) with the US. The endogeneity of export intensity was addressed by using the reduction of provincial tariffs as an instrument. The findings suggested that increasing exports led to increasing wages for unskilled workers in the provinces with intensive liberalization programmes. This increase in wages is consistent with the East Asian economies in the process of an export-oriented strategy.

Our major hypothesis is as follows:

Hypothesis 2. *Exporting activities will have positive effects on the wage–skill premium in Vietnam.*

2.3 Linkage between foreign ownership and the wage–skill premium

There are numerous previous studies that have reported higher average wages in foreign-owned firms compared to domestic firms.[7] The reasons behind this wage premium may be the location of foreign firms in high-wage sectors and geographic regions, the nature of industries, various other firm characteristics, and the average educational level of the labour force. Foreign firms may pay premium wages to workers to protect technological spillovers, as reported in Fosfuri *et al.* (2001). In the case of Swedish firms, Heyman *et al.* (2007) confirmed that heterogeneity among workers and selection bias in foreign acquisitions are key determinants for a high wage premium.

Foreign investment is also significant in affecting the relative demand for skilled workers and has mixed effects on the wage premium. Foreign investment causes a widening of the wage premium in Mexico's *maquiladoras* (Feenstra and Hanson, 1997, 1999). Foreign ownership directly raises the wage level of any firm in the case of Chinese firms, and the effect is stronger in the presence of more existing foreign firms in a cluster, as suggested in Girma *et al.* (2016).

In contrast, in Indonesia this had an opposite effect (Suryahadi *et al.*, 2001). After trade liberalization in the 1970s and 1980s, the relative demand for unskilled labour increased in the manufacturing sector, while the wages of unskilled relative to skilled workers declined. Te Velde and Morrissey (2003) considered this relationship in five sub-Saharan Africa (SSA) countries and found that foreign-owned firms pay wages that are between 8 percent and 23 percent higher than their domestic counterparts. This was supported by Strobl and Thornton (2004) for the same sample of SSA countries. Görg *et al.* (2007) emphasized that human capital accumulation helps in a higher wage premium in Ghana. Another study by Milner and Tandrayen (2007) argued that foreign-owned exporting firms in SSA countries had higher wages.

Our major hypothesis is:

Hypothesis 3. *Foreign investment will increase the wage–skill premium in Vietnam.*

2.4 Linkage between research and development and the wage–skill premium

In developing countries, technology plays a vital role in shaping the inter-firm structure of wages. The technology-intensive activities include investments in research and development (R&D), foreign technology and know-how licences, training of workers and exporting effects. These can influence the size structure of wage and labour market outcomes. A growing body of empirical evidence, primarily from industrial countries, emphasizes technological change as a key factor behind wage

[7] Lipsey (2004) has a survey of the earlier literature on FDI and wages.

inequality. Increasing wage inequality in the US has been attributed to skill-biased technology, as reported in Katz and Murphy (1992) and Davis and Haltiwanger (1991). Dunne and Schmitz (1995) suggested that the use of advanced manufacturing technology causes significant wage differentials. The roles of exporting and R&D by employers were jointly examined in Bernard *et al.* (1995), and both activities were found to be associated with wage differences.

Caselli *et al.* (2006) studied cross-country differences in skilled and unskilled labour efficiencies in an imperfect labour market. Technology-induced changes are skill-biased in nature and help to cause dramatic change in the relative supply of skills and the skill premium. In Indonesia, Lee and Wie (2015) identified that direct foreign investment and the diffusion of imported technologies had caused an increase in skilled workers and resulted in wage inequality since 2000.

Our major hypothesis is as follows:

Hypothesis 4. *Research and development investment will have a positive influence on the wage–skill premium.*

In summary, the literature is vast and reflects various aspects of the labour market, workers and firm characteristics. Findings vary across countries, depending on the flexibility and adaptation of the labour market, effects of liberalization and within and across-industry characteristics in determining the skill–wage premium.

3. Model, data and empirical strategy

In the following sub-sections, we describe the data, variables and the empirical model; this is followed by a description of the empirical strategy we follow in estimating the model.

3.1 Data, measures of variables and empirical model

This study employs the firm-level dataset compiled from the Enterprise Surveys data produced by the General Statistical Office (2011). To date, there is only one Enterprise Survey for 2009. This dataset has comprehensive information on employment and wages by education and production/non-production workers. Here, workers are classified by their educational attainment and non-production/production activities, and wages are reported for non-production and production workers.[8]

The Enterprise Survey of 2009 provides employment and wage data for four major occupational categories: managers, professionals and technicians, direct production workers, and clerical and support workers. As guided by the wage premium model, the managers and the professionals and technicians are defined as

[8] The Enterprise Surveys in some other years such as 2007 contain only information on workers by educational attainment.

skilled labour. Direct production workers and clerical and support workers are treated as unskilled labour. From this, the ratio of the average wages of skilled labour to unskilled labour is used as a measure of the skill–wage premium.[9]

The firm-level dataset contains all registered formal firms, and observations with non-positive values are eliminated, along with outliers. For each firm, the dataset also provides information on gross output, capital stock and profits. All data in nominal values were converted into real values, using year 2000 constant prices. The deflators for the output series are taken from the current and constant price series of manufacturing outputs at the two-digit VSIC level from the GSO. The capital deflators are computed from the current and constant values of fixed-capital formation from the national account category. Additionally, the dataset has four-digit industry classification codes (VSIC) consisting of 108 manufacturing industries, which allow us to match industries with the tariffs data. Note that many small firms report implausible or unrealistic data due to inadequate information and weak accounting systems.[10] Therefore, this analysis focuses on examining the wage premium among firms that employ ten or more employees.

Keeping the above discussion as the backdrop, we specify the following model to examine how different channels of trade and investment can be linked with the wage premium:

$$\ln\left(\frac{W_s}{W_u}\right)_i = \beta_0 + \beta_1 OT_i + \beta_2 IT_i + \beta_3 OT_i \times TC_i + \beta_4 IT_i \times TC_i + \Gamma X_i + \tilde{}\varepsilon_i. \quad (1)$$

Our dependent variable $(W_s/W_u)_i$ is the wage premium measured by the ratio of the average wage of skilled workers to that of unskilled workers for firm i. Following Hanson and Harrison (1999) and Pavcnik *et al.* (2004), non-production workers are a proxy for skilled labour and production workers are a proxy for unskilled labour. We use an alternative measure, namely, the skill premium: the proportion of the number of skilled workers to the number of unskilled workers in each firm. Although the non-production/production classification does not capture skill levels that are most accurately measured by education attainment, the usage of either measure as a dependent variable on the wage premium model brings about comparable results in many empirical studies (Krueger, 1997; Slaughter, 2000).

On the right-hand side of the equation, we consider both output tariffs (*OT*) and input tariffs (*IT*). However, *TC* denotes three different channels that can interact with trade and investment liberalization: exporting activity (*EXP*), foreign direct investment (*FO*) and research and development (*RD*); *X* represents firm-specific activities such as age (*AGE*), capital (*K*) and firm size (measured by output *O*). We

[9] Ideally, it should be the ratio of real wage rate per hour. Unfortunately, the dataset does not have the number of working hours.

[10] These small firms account for about 2 percent of the total sample firm, which are predominately private.

use interactions of output and input tariffs with three different channels of trade and investment.

Output tariffs (*OT*) are tariffs on final products at the four-digit VSIC level, while input tariffs (*IT*) are calculated as $input\ tariffs_i = \sum_{i=1}^{n} a_{ij} \times tariffs_i$, where *tariffs* are output tariffs on the final product. The weights a_{ij} are based on input coefficients that we have taken from the 2007 input-output table (GSO, 2007). Tracing concordance between industry codes based on the input-output table and the Vietnam Standard Industry Classification (*VSIC*), we obtain the input tariff for each industry. Therefore, the tariffs on both final products and intermediate inputs are constructed at the four-digit VSIC level in order to merge them with the firm-level data. First, tariff variables are used to examine the wage premium following trade liberalization. Both output (*OT*) and input (*IT*) tariffs are incorporated separately, because wage outcome for a specific tariff reduction depends on whether the firm has been involved in exporting or importing (Bernard *et al.*, 2007). The reduction in output tariffs in a developing country will increase wages in export firms that have a higher proportion of unskilled workers. On the other hand, in an import competing sector, wages will fall, resulting in a decline in the wage premium. To summarize, reductions in output tariffs are in line with the standard HOSS theory.

In a similar manner, lowering input tariffs will affect wages in firms relying on intermediate inputs relative to the firms predominantly using indigenous inputs. In general, intermediate inputs are relatively skill-intensive compared to the final products in developing countries. Therefore, reducing input tariffs is likely to increase imported intermediates. As a result, firms will reallocate resources to the production process with more skilled to unskilled workers. This helps in narrowing the wage premium. Moreover, the inclusion of the input tariffs is quite relevant for a labour-abundant developing economy like Vietnam. Here, the labour-intensive export sector is strongly reliant on imported intermediates (Riedel, 1975).

Other explanatory variables include three channels of trade and investment: *EXP* is export intensity at the four-digit industry level; *FO* counts total number of foreign enterprises; and *RD* expenditure is the total research and development expenses related to science and technology activities. Within the firm characteristics, we add the total age of each firm (*AGE*), total fixed asset (*K*), and total turnover (*O*) for each firm.

In some specifications we add a regional and industry dummy. There are seven regions: Hanoi (used as reference dummy), the Red River Delta, the North Mountainous Area, the Central Coast and Central Highland Area, the South East Area, Ho Chi Minh City and the Mekong Delta. We add 21 industry dummies defined at a two-digit level following the VSIC industry classification. The analysis excludes two industries with very few foreign-owned enterprises (i.e., petroleum and gas, and miscellaneous manufacturing and recycling). Tables 1 and 2 present the description of the data with descriptive statistics for all variables.

Table 1. Definition and measurement of variables

Variables		Measurement
WP	Wage premium	Ratio of average real wage of non-production workers to that of production workers
SP	Skill premium	Proportion of the number of skilled workers to the number of unskilled ones in each firm
OT	Output tariffs	Tariffs on the final product at the four-digit VSIC industry
IT	Input tariffs	Tariffs on intermediates which is derived by the process described in the text
O	Firm size	Total output of each firm measured in turnover (adjusted with price index)
EXP	Exporting activity	Export intensity at the four-digit VSIC industry.
FO	Foreign direct investment	A dummy variable equal to one for foreign owned enterprise, and zero otherwise
RD	R&D expenditure	A share of R&D cost in the total cost of science and technology activities in each firm in 2004
AGE	Firm age	The number of years since the firm was established
K	Capital stock	Total capital stock for each firm measured in real terms
O	Firm size	Total output of each firm measured in turnover (adjusted with price index)

***Note*:** All variables except *FO* were transformed in natural logarithm for our empirical models.

Table 2. Descriptive statistics for the full sample

Variables	Observations	Mean	SD	Min	Max
Wage premium (*WP*)	11,283	2.186	2.225	0.139	48.538
Skill premium (*SP*)	11,283	0.258	0.307	0.004	5.818
Output tariffs (*OT*)	11,283	0.190	0.129	0	0.813
Input tariffs (*IT*)	11,283	0.066	0.032	0.021	0.200
Export intensity (*EXP*)	11,283	0.320	0.289	0	1
Foreign ownership (*FO*)	11,283	0.256	0.436	0	1
Research and development (*RD*)	11,283	0.545	0.291	0	1
Age (*Age*)	11,283	7.385	8.124	0	63
Capital (*K*)	11,283	32,726.070	169,036.800	1	7,175,559
Output (*O*)	11,283	67,905.440	414,647.200	4.094475	2.97E+07

3.2 *Estimation strategy and endogeneity issues*

We start with the ordinary least squares (*OLS*) estimation technique. Given that we analyze the effects of various trade and investment liberalization channels on the wage premium, we also consider the fixed effect (*FE*) estimation technique. This controls all observable and time-invariant unobservable characteristics. However, there remains a fundamental problem in identifying the wage differences across firms, due to the presence of various trade and investment channels. Therefore, endogeneity issues must be considered in analyzing the wage–skill premium.

Moreover, our dataset is cross-sectional and preconditioned with a heteroscedasticity problem. To incorporate these issues, in addition to the above estimation techniques, we consider an instrumental variable (IV) based estimation technique developed by Lewbel (2012). This technique is similar to the conventional two-stage least square (2SLS) method in dealing with endogeneity issues in the absence of weak or non-availability of external instruments. This estimation can achieve identification without any exclusion restriction, as long as some exogenous variables exist in structural equations and error terms are heteroscedastic. Following this method, instruments are internally generated using residuals of auxiliary equations, which are multiplied by the included exogenous variables (X_i) in mean-centred form ($\bar{X}$) (see Baum *et al.*, 2012; Lewbel, 2012).[11] Besides the endogeneity problem, this estimation technique captures the unobserved factors that may affect our liberalization channels and wage–skill premium.[12] In addition, because of high possibility of heteroscedasticity in this estimation, the statistical significance of the regression coefficients are tested in terms of consistent variance-covariance robust standard errors, derived from the Huber–White 'sandwich' estimator.

4. Empirical findings with discussion

Table 3 provides the findings from the full sample, considering wage and skill premium as dependent variables, respectively. The regression results of the wage premium (*WP*) are shown in Columns (1)–(4), while the findings from the skill premium (*SP*) are shown in Columns (1′)–(4′). In each case, the first column shows the findings from the OLS estimation; the second column presents FE results; and the third and fourth columns consider the findings from the Lewbel estimation (without and with industry and regional dummies) for robustness checks.

In the case of the wage premium and the findings from the *OLS* and the *Lewbel* estimation (Table 3, Columns (1) and (3)), the coefficient of output tariff (*OT*) is negative and significant ($P < 0.10$), implying that the reduction in output tariffs is associated with a widening of the wage premium. The coefficient of input tariffs (*IT*) is

[11] $(X_i - \bar{X})\bar{\varepsilon}$ is used as a new instrument to run the 2SLS regressions.

[12] For full derivation of the equations, see Lewbel (2012). For applications, see Lin (2018) and Churchill and Farrell (2018).

Table 3. Determinants of wage and skill premiums for the full sample

Explanatory variables	Wage premium				Skill premium			
	OLS (1)	FE (2)	LB (3)	LB (4)	OLS (1′)	FE (2′)	LB (3′)	LB (4′)
Output tariffs (*OT*)	−0.372*	0.521*	−0.472*	0.363	0.137	−0.162	1.130***	−0.051
	(0.190)	(0.276)	(0.246)	(0.257)	(0.278)	(0.385)	(0.367)	(0.391)
Input tariffs (*IT*)	0.175***	0.025	0.187***	0.049	0.130**	0.316***	0.006	0.299***
	(0.041)	(0.064)	(0.045)	(0.061)	(0.060)	(0.089)	(0.063)	(0.090)
Export intensity (*EXP*)	−0.200	0.006	−0.235	−0.046	−1.984***	−2.088***	−1.638***	−2.051***
	(0.255)	(0.307)	(0.268)	(0.304)	(0.373)	(0.429)	(0.396)	(0.435)
Foreign ownership (*FO*)	0.370***	0.361***	0.363***	0.349**	−0.242	0.216	−0.168	0.225
	(0.117)	(0.122)	(0.135)	(0.136)	(0.170)	(0.170)	(0.185)	(0.187)
Research & development (*RD*)	−1.160***	0.112	−1.251***	−0.019	1.671***	−0.117	2.571***	−0.025
	(0.278)	(0.346)	(0.304)	(0.330)	(0.406)	(0.482)	(0.445)	(0.489)
OT × *EXP*	0.289	0.031	0.347	0.098	−1.593***	0.029	−2.165***	−0.018
	(0.366)	(0.462)	(0.385)	(0.444)	(0.535)	(0.645)	(0.569)	(0.660)
IT × *EXP*	−0.111	−0.012	−0.118	−0.026	−0.422***	−0.540***	−0.351***	−0.531***
	(0.071)	(0.085)	(0.074)	(0.085)	(0.103)	(0.119)	(0.108)	(0.119)
OT × *FO*	−0.349**	−0.301*	−0.334**	−0.280*	−0.410*	−0.331	−0.559***	−0.346
	(0.146)	(0.154)	(0.162)	(0.166)	(0.213)	(0.215)	(0.232)	(0.237)
IT × *FO*	−0.019	−0.003	−0.020	−0.005	−0.118**	0.058	−0.106**	0.060
	(0.033)	(0.035)	(0.039)	(0.039)	(0.049)	(0.049)	(0.052)	(0.053)
OT × *RD*	1.322***	−0.061	1.476***	0.183	−2.396***	−1.578**	−3.917***	−1.749**
	(0.362)	(0.485)	(0.430)	(0.461)	(0.529)	(0.677)	(0.666)	(0.699)

Table 3. (Continued)

Explanatory variables	Wage premium				Skill premium			
	OLS (1)	FE (2)	LB (3)	LB (4)	OLS (1′)	FE (2′)	LB (3′)	LB (4′)
IT × *RD*	−0.313***	0.028	−0.333***	−0.001	0.318***	−0.171	0.518***	−0.151
	(0.080)	(0.099)	(0.084)	(0.095)	(0.117)	(0.138)	(0.12)	(0.141)
Age (*AGE*)	−0.031***	−0.028***	−0.031***	−0.028***	0.042***	0.003	0.042***	0.003
	(0.007)	(0.007)	(0.007)	(0.007)	(0.011)	(0.010)	(0.010)	(0.010)
Capital (*K*)	0.039***	0.039***	0.039***	0.039***	−0.033***	−0.013**	−0.034***	−0.013**
	(0.004)	(0.004)	(0.004)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)
Output (*O*)	−0.013***	−0.015***	−0.013***	−0.014***	−0.037***	−0.070***	−0.036***	−0.070***
	(0.004)	(0.004)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)
Regional dummy		Yes		Yes		Yes		Yes
Industry dummy		Yes		Yes		Yes		Yes
Constant	0.842***	0.171	0.900***	0.266	−0.571***	0.606**	−1.149***	0.539*
	(0.151)	(0.220)	(0.172)	(0.208)	(0.220)	(0.306)	(0.267)	(0.307)
J-statistic			0.84	0.36			0.38	0.00
Observations	11,283	11,283	11,283	11,283	11,283	11,283	11,283	11,283

***Notes*:** Standard errors adjusted for arbitrary heteroscedasticity are given in parentheses.
*, **, *** denote that the estimated coefficients are significant at 10 percent, 5 percent and 1 percent level, respectively.
FE = fixed effects, LB = Lewbel, The Hansen *J* statistics are from the IV equations.
Wage premium is the natural logarithm of average wage of non-production workers to production workers. Skill premium is the natural logarithm of proportion of the number of skilled workers to the number of unskilled ones in each firm.

positive and strongly significant. This indicates that a reduction in tariffs on intermediate inputs tends to help in narrowing the wage premium. This is consistent with the key findings from the Indonesian case, as reported in Amiti and Cameron (2012). However, in Vietnam, it seems that trade liberalization (that is with the reduction in output and input tariffs) had mixed effects on the demand for skilled labour.

Next, we explore various channels (exporting activity, foreign direct investment and R&D investment) through which trade liberalization affects the demand for skilled labour. In doing so, we include the variable itself and its interaction terms with output and input tariffs. There was no significant effect of exporting activities on the wage premium, because none of the coefficients of the *EXP* variable were significant.

The coefficient of foreign ownership (*FO*) was significant ($P < 0.01$), with the expected positive sign in all cases. The estimates suggest that the presence of direct foreign investment is highly likely to be associated with a widening of the wage premium. The coefficient of the interaction between foreign ownership with output tariff is negative and significant ($P < 0.05$). This reflects that the foreign-invested enterprises are likely to increase the demand for skilled workers in response to output tariff reductions; therefore, it widens the wage premium. We did not find any significant effect of the reduction in intermediate input tariffs on foreign-owned enterprises.

Regarding the R&D channel, the coefficient of R&D was estimated to be significant ($P < 0.10$) and negative, implying that expanding the R&D investment is likely to reduce the wage premium. The coefficient of the interaction of output tariffs and R&D was positive and significant ($P < 0.10$). This suggests that the reduction in output tariffs is likely to have an effect of reducing the wage premium within R&D-intensive firms compared to low-R&D firms. Similarly, a reduction in intermediate input tariffs had a widening effect on the wage premium within R&D-intensive firms, since the coefficient of the interaction of input tariffs and R&D expenses was negative and significant ($P < 0.10$). These findings reflect that, with liberalization effects, R&D investment should be targeted in export sectors that create jobs for unskilled workers through the importing of intermediate inputs.

However, the results change when we include both regional and industry dummies in the estimation (Table 3, Columns (2) and (4)). Only through the channel of foreign direct investment, is the impact of trade liberalization on the wage premium found to be significant. The coefficient of foreign ownership is positive and highly significant ($P < 0.05$). The coefficient of its interaction with output tariffs is negative and significant ($P < 0.10$). Again, this suggests that the presence of foreign-invested enterprises is likely to widen the wage premium.

Among other determinants of the wage premium, the age of firm, capital and output are statistically significant and have the predicted signs. The coefficient of age is negative and significant, indicating that older firms help in narrowing the wage premium. The coefficient of capital is positive and significant. This reflects that capital-intensive firms will recruit more skilled workers. As a result, an increase in

demand for skilled workers results in an increase in the wage premium. Output as a proxy for firm size is negative and significant at the 1 percent level. *Ceteris paribus*, larger firms tend to narrow the wage premium.

Columns (1′)–(4′) of Table 3 present the estimation results for the skill premium. For the OLS estimation, only the coefficient of input tariffs is positive and weakly significant, suggesting that the reduction in input tariff is likely to reduce the demand for skilled labour. The export intensity variable is estimated to be negative and strongly significant. Increasing export activities for Vietnamese manufacturing seems to have a decreasing effect on the demand for skilled labour (i.e., a rise in demand for unskilled labour). The findings are plausible because most Vietnamese exports are concentrated on unskilled labour-intensive products. The coefficients of these interaction terms between export intensity and output–input tariffs are negative and significant at the 1 percent level. The findings indicate that tariff reductions are associated with expanding the demand for unskilled labour. This reflects that trade liberalization has increased the demand for unskilled workers in the exporting sectors in Vietnam.

The coefficients of the interaction terms for foreign ownership with output and input tariffs are estimated to be negative and weakly significant. This reflects that the foreign-invested enterprises are associated with a lower demand for skilled workers in response to trade liberalization. However, we could not establish any significant effect of foreign-invested enterprises on the skill premium.

The effect of foreign ownership on the skill premium becomes insignificant when the regional and industry dummies are incorporated. In this context, we find that the impact on the skill premium through the reduction of input tariffs on export activity is significant. This indicates that lowering input tariffs is likely to increase the demand for unskilled labour. Trade liberalization, measured by reduction in output tariffs, is associated with expanding the demand for skilled labour in the case of R&D-intensive firms.

We found that increasing R&D activities is likely to increase the demand for skilled workers, because the coefficient of R&D intensity was positive and highly significant ($P < 0.10$). The coefficient of the interaction of R&D and input tariffs is significant ($P < 0.10$) and positive, implying a reduction in input tariffs is likely to reduce the demand for skilled labour in R&D-intensive firms. Reductions in output tariffs are associated with an increase in demand for skilled workers in R&D-intensive firms.

Compared to the findings from the wage premium, the findings from the skill premium yield better results for all three channels. Reductions in both output and import tariffs increases demand for skilled labour for exporting firms and boosts foreign investment, while for R&D the effects are slightly different. For R&D-intensive firms, reductions in output tariffs enhance demand for skilled labour and R&D activities, while reductions in input tariffs have opposite effects.

Among the other firm characteristics analyzed, firm age and capital had opposite signs compared to the WP equation. The coefficient of age was positive and

significant, indicating older firms help in increasing the skill premium. However, considering the region and industry dummies, there were no significant results. The coefficient of capital was negative and significant. This shows that capital-intensive firms will recruit fewer skilled workers. As a result, a decrease in demand for skilled workers results in a decrease in the wage premium.

Signs and significance levels for most of the variables were similar for both the wage and the skill premium, except for the variables that we have explained above. Elasticity values are generally high for the Lewbel estimations compared to the OLS and FE models. The presence of region and industry dummies resulted in differences in estimated findings. For further empirical analysis, we only consider the Lewbel estimation as the preferred estimation method.

In Table 4, we present the findings by classifying firms according to their ownership: domestic private (DP), state-owned (SOE) and foreign-owned enterprises (FOE). The regression results on the wage premium are given in the first three columns (1)–(3), while the last three columns (1′)–(3′)) show the results for the skill premium. As for the wage premium, we find that the trade liberalization (in the form of reductions in tariffs for final goods and imported intermediates) affects the wage premium through the R&D channel in domestic private firms, while it works through the exporting activities for the two other ownership groups.

Within domestic private firms, a reduction in output tariffs has the effect of reducing the wage premium in R&D-intensive firms, because the coefficient of the interaction of R&D and output tariffs is positive and significant ($P < 0.05$). Lowering tariffs on intermediate input is likely to widen the wage premium among those domestic private firms that are R&D intensive. For a subsample of the SOEs and FOEs, the coefficients of the interaction of export intensity and input tariffs were negative and significant. It implies that a reduction on intermediate input tariffs is associated with an increase in demand for skilled labour in the exporting sector in these enterprises.

Regarding the impact on the skill premium, trade liberalization affected the skill premium of domestic private firms through two channels: exporting activities and R&D activities. The coefficients of export-intensive and R&D-intensive firms were significant ($P < 0.10$). Within FOEs, we find that only reducing output tariffs affects the skill premium in those foreign firms that are R&D intensive.

Findings are mixed with regard to the effect of different forms of ownership on the wage and skill premiums. A reduction in output tariffs had a significant widening effect on the wage premium only in foreign-owned enterprises; whereas reductions in input tariffs narrowed the wage premium for both domestic private and foreign-owned enterprises. For the interaction terms with three channels, the effects on the wage premium were weaker than on the skill premium for domestic private enterprises.

Table 5 presents the estimation results for the wage premium and skill premium, dividing each sample into old and new firms. We define firms as old when their age is more than five years; firms under five years are considered new. Coefficients of

Table 4. Wage and skill premiums for firms with different ownerships

Explanatory variables	Wage premium			Skill premium		
	DP	SOE	FOE	DP	SOE	FOE
Output tariffs (*OT*)	−0.361	−1.101	−0.816*	0.072	1.418	1.327
	(0.297)	(0.732)	(0.486)	(0.420)	(1.415)	(1.415)
Input tariffs (*IT*)	0.180***	0.227	0.192*	0.037	−0.197	−0.180
	(0.047)	(0.175)	(0.112)	(0.069)	(0.296)	(0.295)
Export intensity (*EXP*)	0.410	−2.447**	−0.852	−1.780***	−1.461	−1.534
	(0.296)	(0.981)	(0.648)	(0.440)	(1.557)	(1.554)
Research and	−1.738***	−0.376	−0.415	1.966***	2.921	2.818
development (*RD*)	(0.346)	(1.135)	(0.681)	(0.513)	(1.896)	(1.895)
OT × *EXP*	0.363	2.895*	−0.846	−1.732***	0.531	0.668
	(0.428)	(1.554)	(0.855)	(0.656)	(2.442)	(2.436)
IT × *EXP*	0.121	−0.635**	−0.449**	−0.437***	−0.221	−0.236
	(0.083)	(0.253)	(0.181)	(0.122)	(0.402)	(0.402)
OT × *RD*	1.312**	0.982	2.127**	−1.991**	−4.782**	−4.675**
	(0.548)	(1.013)	(0.947)	(0.796)	(1.926)	(1.926)
IT × *RD*	−0.507***	−0.062	−0.023	0.460***	0.500	0.473
	(0.093)	(0.335)	(0.189)	(0.142)	(0.540)	(0.540)
Age (*AGE*)	−0.008	−0.010	−0.098***	0.009	−0.027	−0.026
	(0.008)	(0.023)	(0.020)	(0.012)	(0.032)	(0.032)
Capital (*K*)	0.051***	0.004	0.008	−0.012*	−0.017	−0.017
	(0.005)	(0.017)	(0.011)	(0.007)	(0.028)	(0.028)
Output (*O*)	−0.023***	−0.008	0.014	−0.065***	−0.044	−0.045
	(0.005)	(0.019)	(0.011)	(0.008)	(0.030)	(0.030)
Regional dummy	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.833***	1.238*	1.255***	−0.511*	−1.627	−1.553
	(0.184)	(0.675)	(0.425)	(0.266)	(1.196)	(1.193)
Observations	7,765	629	2,889	7,765	629	629

***Notes*:** Standard errors adjusted for arbitrary heteroscedasticity are given in parentheses.
*, **, *** denote that the estimated coefficients are significant at 10 percent, 5 percent and 1 percent level, respectively. Three kinds of ownerships are domestic private (DP), state-owned (SOE) and foreign-owned enterprises (FOE).
FE = fixed effects, LB = Lewbel, The Hansen *J* statistics are from the IV equations.
Wage premium is the natural logarithm of average wage of non-production workers to production workers. Skill premium is the natural logarithm of proportion of the number of skilled workers to the number of unskilled ones in each firm.

Table 5. Determinants of wage and skill premiums between old and new enterprises

Explanatory variables	Wage premium		Skill premium	
	Old	New	Old	New
Output tariffs (*OT*)	−0.348	−0.232	1.225**	0.031
	(0.323)	(0.378)	(0.511)	(0.557)
Input tariffs (*IT*)	0.099	0.218***	−0.020	0.092
	(0.061)	(0.063)	(0.091)	(0.087)
Export intensity (*EXP*)	0.077	−0.207	−0.813	−2.326***
	(0.386)	(0.377)	(0.566)	(0.548)
Foreign ownership (*FO*)	0.254	0.453**	−0.172	−0.187
	(0.192)	(0.192)	(0.278)	(0.247)
Research and development (*RD*)	−0.953**	−1.248***	2.108***	2.010***
	(0.401)	(0.449)	(0.618)	(0.657)
OT × *EXP*	0.570	−0.343	−2.575***	−1.571**
	(0.546)	(0.547)	(0.824)	(0.776)
IT × *EXP*	0.024	−0.173	−0.065	−0.535***
	(0.105)	(0.106)	(0.155)	(0.151)
OT × *FO*	−0.252	−0.344	−0.563	−0.556*
	(0.231)	(0.230)	(0.347)	(0.313)
IT × *FO*	−0.030	0.016	−0.087	−0.108
	(0.054)	(0.056)	(0.078)	(0.070)
OT × *RD*	1.159**	1.321*	−3.617***	−2.246**
	(0.540)	(0.693)	(0.885)	(1.083)
IT × *RD*	−0.254**	−0.339***	0.358**	0.454**
	(0.111)	(0.124)	(0.170)	(0.178)
Capital (*K*)	0.030***	0.044***	−0.033***	−0.010
	(0.007)	(0.006)	(0.010)	(0.008)
Output (*O*)	−0.015**	−0.014**	−0.024**	−0.073***
	(0.007)	(0.006)	(0.010)	(0.009)
Regional dummy	Yes	Yes	Yes	Yes
Constant	0.608***	0.816***	−1.093***	−0.265
	(0.235)	(0.245)	(0.354)	(0.346)
Observations	5,473	5,810	5,473	5,810

***Notes*:** Standard errors adjusted for arbitrary heteroscedasticity are given in parentheses.
*, **, *** denote that the estimated coefficients are significant at 10 percent, 5 percent and 1 percent level, respectively.
FE = fixed effects, LB = Lewbel, The Hansen *J* statistics are from the IV equations.
Wage premium is the natural logarithm of average wage of non-production workers to production workers. Skill premium is the natural logarithm of proportion of the number of skilled workers to the number of unskilled ones in each firm.

R&D and its interaction terms with output and input tariffs were significant (at least $P < 0.01$) in the wage premium equation. This indicates that the impact of trade liberalization on the wage premium worked only through the R&D channel. In addition, the magnitude of the estimated coefficients of the R&D variable and its interaction terms with output and input tariffs were larger in old firms than in new firms. This finding indicates that, through R&D activity, the trade liberalization had a larger effect on the wage premium for older firms than for the new ones.

As for the skill premium, we also found that R&D contributes to increasing the demand for skilled labour for both groups. The coefficients of the interaction of R&D and input tariffs are positive and significant ($P < 0.05$), indicating that lower input tariffs are likely to reduce the demand for skilled labour for the R&D-intensive firms. The estimated coefficient was slightly higher for old firms. The reduction in output tariffs was only associated with expanding the demand for skilled labour in R&D-intensive firms. In general, signs and significance for most of the variables were different between old and new firms.

In summary, our detailed analysis using various estimation techniques, considering full samples and dividing samples according to ownership and age of firms, showed some interesting findings for Vietnamese manufacturing firms. A reduction in tariffs on final goods had a significant widening effect on the wage premium, however, the effect is opposite with the skill premium. This has been the case for full sample and sub-sample analysis, albeit the significance level was lower in some cases. Among the three channels, exporting activities were prominent in influencing the skill premium, while the presence of foreign ownership and R&D activities was prominent in both the case of wage and skill premium, due to the reduction in output tariffs. Firm heterogeneity was prominent in influencing the sign and significance of our key variables.

On the other hand, a reduction in tariffs on intermediates has the effect of reducing both the wage and skill premium. This was true for full sample and sub-sample analysis, albeit the significance level dropped in some cases. Among the three channels, exporting activities were prominent in influencing the skill premium, while the presence of foreign ownership and R&D activities was prominent in both the wage and skill premiums, due to the reduction in input tariffs. Our findings are similar to Amiti and Cameron (2012), who reported differential effects of tariff reductions on the wage–skill premium, and considered whether liberalization through reduction in trade protection occurs for final goods or imported intermediates.

5. Conclusions and policy implications

Vietnam initiated major economic reforms during the 1990s and has been liberalizing international trade and investment since the early 2000s. There is significant evidence that the wage premium has increased substantially in the last two decades. Our findings reflect that trade openness in the form of reduction in tariffs, both on

final goods and intermediates, has played a role in shaping relative wages in Vietnam. In this respect, we consider whether various trade and investment channels (exporting activities, foreign ownership, and research and development activities) can have a positive or negative influence on the wage–skill premium in the presence of tariff reductions. We use a general form of compensating wage differentials to build a framework to analyze the effect of trade shocks on firm-specific return of skilled and low-skilled labour. To examine this relationship, we combine aggregate data compiled at the industry level with micro-data collected from enterprise surveys. We consider two alternative measures of wage inequality, considering the differences in average wages between skilled and unskilled workers and the ratio of the number of the skilled workers to that of unskilled ones. These alternative measures capture the full spectrum of wage inequality, covering both income and employment aspects of skilled and unskilled workers. This study examines determinants of the wage–skill premium in Vietnamese manufacturing, using firm-level data. The wage–skill premium was explored in the context of the outward-oriented liberalization paying special attention to tariffs reduction, foreign investment, export intensity and R&D initiatives.

The results from a cross-section estimation of the wage premium are, by and large, consistent with our prior expectation. The findings consistently reflect the mixed effects of trade liberalization on the wage and skill premium. Output tariff reduction is likely to contribute to widening the wage gap between skilled and unskilled workers, but help in narrowing the skill premium. This result is particularly relevant in the case of the Vietnamese economy, where a massive pool of unskilled workers has not been depleted. Trade liberalization has stimulated resource reallocation towards unskilled labour-intensive industries. Consequently, export expansion resulting from the reduction of tariffs on final products has increased the demand for skilled workers, causing a rise in wages of skilled workers. However, reduction in tariffs in input markets lowers the difference between the average wages of skilled and unskilled workers, and narrows the skill premium among them. Considering the trade and investment channels, exporting activities are prominent in influencing skill premium, while the presence of foreign ownership and R&D activities is prominent in both wage and skill premiums, due to the reduction in output and input tariffs. As for the Lewbel estimation results, output tariffs have opposite effects on the wage premium and skill premium. These combined findings reflect that reductions in tariffs on final products are encouraging productive, skilled workers to join the labour force and receive a higher income. The effects of input tariffs help to reduce both wage and skill premium.

Our findings reflect that increasing foreign investment is strongly associated with a widening of the wage premium between skilled and unskilled workers. The wage gap between skilled and unskilled workers is about 40 percent greater in foreign-invested enterprises than domestic firms, in the case of final goods. These enterprises pay higher wages for both skilled and unskilled workers compared to

domestic firms, but the wage premium of foreign enterprises is higher for skilled workers than for unskilled workers.

Therefore, we conclude that there is mixed evidence to support the view that trade liberalization has increased wage inequality in Vietnam. This depends on whether the reduction of protection happens in the output or input market, and on various other channels, particularly foreign ownership and research and development initiatives. Heterogeneity across firms with respect to ownership, age and other firm characteristics is somewhat significant in implementing liberalization policies. A liberalized climate of trade reform will be a key ground to promote export, foreign investment and research and development initiatives, along with reform in labour markets in reducing wage inequality in coming decades.

On a final note, our study is based on a cross-sectional analysis. Although we have considered appropriate robustness checks to cover heterogeneity, endogeneity and issues on omitted variable bias, our results have some caveats and should therefore be interpreted with caution. First, the dataset covers the formal sector of Vietnamese manufacturing firms, we do not consider the informal sector. Second, our empirical findings rely on cross-sectional data. In future, the availability of firm-level data, with matched employer-employee information over a longer time period, will capture the dynamics of the various reform programmes and transitional changes over time.

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