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Minimum Wages and Firm Exports: Evidence from Vietnamese Manufacturing Firms*

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This paper investigates the relationship between the minimum wage and firm's export behavior by using firm-level data of Vietnamese manufacturing enterprises over the period 2010 through 2015. In this regard, I apply the logistic regression model for the probability of exporting and the differences-in-differences analysis to the data, and find that raising minimum wage standards drive no new exporters but a rise in a firm's export sales. Less productive and more labor-intensive firms raise their amount of exports in response to increasing minimum wage levels. Being exposed to increasing minimum wage levels makes a firm under-perform in terms of export sales compared to non-exposed firms.

Keywords: Wages, Exports, Vietnam

JEL Classification: J38, F16, F23, O14

I. Introduction

Vietnam has undergone profound structural changes since 1986 when Vietnam adopted its “*Doi Moi (economic reform)*” policy. Economic integration has been a pivotal element of Vietnam's strategy to “catch up” with neighboring countries. In addition to membership in the World Trade Organization (WTO) in 2007, the ASEAN Free Trade Area (AFTA) and several bilateral agreements, the recently approved WTO Trade Facilitation Agreement in 2013, the implementation of the ASEAN Economic Community (AEC) will urge Vietnam to develop an efficient and competitive market

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economy. With integration, and an increasingly sophisticated economy, demand for formal economic institutions increased. After the accession to the WTO in 2007, Vietnam has conducted various institutional reforms to create a level playing field for both local and foreign investors. According to the Vietnam's Trade Policy Report prepared by the World Trade Organization (WTO),¹ the institutional reform process helped boost investment, productivity and living standards, and resulted in a sharp decline in the level of poverty over the last 25 years.

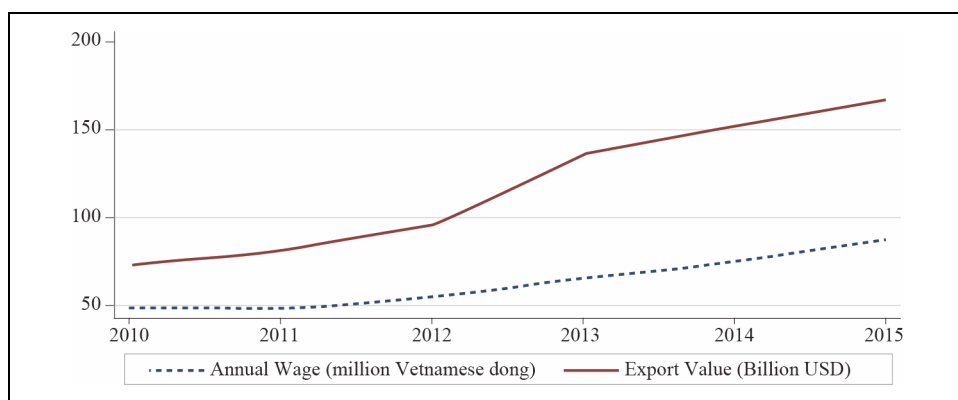
Over the past few years, the labor costs in Vietnam have significantly increased and there is an ongoing discussion on how firms' productivity are affected by these higher labor costs, resulting in changes in firms' export behavior. As can be seen from Figure 1, the average annual wage of an employee increased by about 77.4 percent from 2010 to 2015. In addition, there is a consistent increase in Vietnam's export. The export value in 2015 is about 2.3 times higher than in 2010. It seems that there is an apparent positive association between labor costs and exports at the aggregate level. One possible mechanism, through which labor costs in general and minimum wages in specific affect international trade, is the possibility that increases in labor costs might be quickly absorbed by growing labor demand in a country with strong growth rates and a growing export sales. However, to some extent, it also seems inconsistent with empirical findings about the negative association between minimum wages and firms' profitability in Vietnam (see Cuong, 2017 and Vu et al., 2018). This motivates a more detailed analysis combining both micro-level and macro-level data to explore the factors that may affect the relationship between minimum wages, which lead to rising labor costs, and firms' export behavior.

Recent studies have extended the scope of the minimum wage impact from macroeconomic outcomes such as employment (Fialová and Mysíková, 2009; Bauducco and Janiak, 2018 and Sauer, 2018) to firm performance indicators (Riley and Bondibene, 2017; Zhang and Liu, 2013; Mayneris et al., 2018; Bodnár et al., 2018 and Nguyen, 2019). An increase in minimum wages leads to a rise in labor cost, which, in turn, forces a firm have to adjust its resource reallocation to other inputs. Previous studies have demonstrated a mixed effect of the minimum wage on firm employment (Baek and Park, 2016; Caliendo et al., 2018; Clemens and Wither, 2019 and Pantea, 2020). This situation may have an indirect impact of the minimum wage on firm

¹ Vietnam's Trade Policy Review Report can be found at https://www.wto.org/english/tratop_e/tpr_e/s287_e.pdf (accessed January 21, 2021).

performance. The effect of the minimum wage via this channel has opposing views in the empirical studies (Draca et al., 2011; Riley and Bondibene, 2017; Nguyen, 2019; Dosi et al., 2020 and Du and Wang, 2020). A possible channel through which a firm may respond to changes in the minimum wage is the international trade that a firm may reap the benefits of the economies of scale to absorb the increasing labor costs. Thus, an investigation of the impact of the minimum wage regulation in Vietnam is relevant to get a better understanding of whether the goals of minimum wage policies in Vietnam have been achieved or not, as well as the minimum wage – export nexus.

Figure 1. Changes in Vietnamese Labor Costs and Exports, 2010-2015



Source: Author's own calculation using data collected from the General Statistics Office (GSO). Vietnam. Data are in constant 2010 price.

This analysis is related to the extensive theoretical work on minimum wages and trade. Most of these studies assume firm homogeneity and demonstrate that the effect of the minimum wage on export depends on a combination of factors, including the economic scale, industry and trade structure, and factor mobility in a country. Brecher (1974) demonstrates that an increase in the minimum wage in labor-intensive countries results in a drop in the price of capital, which increases (decreases) the exports of capital-intensive (labor-intensive) products by developing a model with two goods, two factors, wage distortions and the production technology of constant returns to scale. Similar results were found by Neary (1985) when extending this framework to a setting with more factors than goods. Egger et al. (2012) is one of the recent studies that incorporate minimum wages in a trade model with heterogeneous firms. They argue that in the trade model with heterogeneous firms, the negative spillover effects of an

increase in minimum wages are possible in open economies and on employment. Bai et al. (2018) develops a new model with heterogeneous firms under perfect competition in a Heckscher-Ohlin setting to show that a binding minimum wage raises product prices, encourages substitution away from labor, and creates unemployment. It reduces output and exports of the labor intensive goods, despite higher prices and, less obviously, selection in the labor (capital) intensive sector becomes stricter (weaker). An empirical analysis conducted by Gan, Hernandez and Ma (2016) is supportive of a negative impact of the minimum wage on firms' export behavior for the case of China. However, Ni and Kurita (2020) have demonstrated that Indonesian exports are not negligibly affected by higher labor costs caused by the minimum wage. A positive employment effect of the minimum wage has been also found for the case of Vietnam (Nguyen, 2021). This study is therefore a useful complement to growing literature on the channels through which the minimum wage has an impact on economic outcomes.

Previous studies on exports have mostly focused on the impacts of destination characteristics and transport costs, which suggests a gap in research on how producer costs affect export prices (Bastos and Silva, 2010 and Manova and Zhang, 2012). These producer cost effects may be relevant for firms that are more likely to be price-takers than price-setters, which may limit their ability to adjust prices in response to rising costs. This study examines how firms react to changes in local labor conditions which are measured through increases in minimum wage standards with respect to firm's export behavior. In this paper, I exploit an extensive firm-level dataset of manufacturing firms in Vietnam and restrict the analysis period to 2010-2015 due to the availability of firm's export data, considering the heterogeneous impact across different types of firms. During this period, I exploit the significant variation in local minimum wages across different districts in Vietnam to examine the impact of minimum wages on Vietnamese firm's exporting activity. The detailed dataset allows me to control in the analysis for the firm-level variables and macroeconomic conditions to assess the impact of minimum wages. The estimation results suggest that a rise in the regional minimum wage has no impact on the probability of a firm's becoming an exporter, but a positive impact on a firm's export sales. I also find surprising evidence that less productive (as measured by TFP) and labor-intensive firms raise their amount of exports. The difference-in-differences analysis points in the direction that the exposure to the rising minimum wage standards makes a firm under-perform in terms of export sales. Moreover, the gap in export sales between the firms which are exposed

and the firms which are not exposed to rising minimum wage standards was widening after the introduction of a uniform regional minimum wage system in Vietnam in 2012.

The remainder of this paper is organized as follows. Section II provides more details about the minimum wage system in Vietnam. Section III describes the data and empirical specifications to examine the effects of the minimum wage on firm's export behavior. Section IV presents and discusses the estimation results. Section V performs robustness checks and Section VI concludes.

II. The Minimum Wage System in Vietnam

The Labor Code of Vietnam was first adopted in June 1994 and entered into force in January 1995. Accordingly, Vietnam has introduced the minimum wage system since 1995 by adopting the Government Resolution No. 05/CP dated 26 January 1994 in accordance with this Labor Code. The minimum wage levels in Vietnam are subject to change upon the introduction of new decree or resolution by the Vietnamese government. Accordingly, the common minimum wage was applied to all enterprises of all economic sectors.² The Vietnamese Labor Code has been revised five times, in 2002, 2006, 2007, 2012 and 2019. The minimum wage system was also changed accordingly. The major change to the Vietnamese minimum wage system was the establishment of the National Wage Council in July 2013 in accordance with the revised Labor Code adopted in 2012. The National Wage Council consists of representatives from the Ministry of Labor, War Invalids and Social Affairs (five members), Vietnam General Confederation of Labor (five members) representing laborers and Vietnam Chamber of Commerce and Industry (five members) representing employers. The National Wage Council has made policy recommendations to the Vietnamese government on the regional minimum wage several times since 2014. Vietnam's minimum wage establishment mechanism was therefore switched substantially from the mechanism which was established and announced by the Government only in accordance with 1994 Labor Code to the mechanism which was established and based on the results of tripartite negotiations related to industrial relations in accordance with the 2012 Labor Code.³

² For more detailed analysis on the minimum wage system in Vietnam, see Brassard (2004).

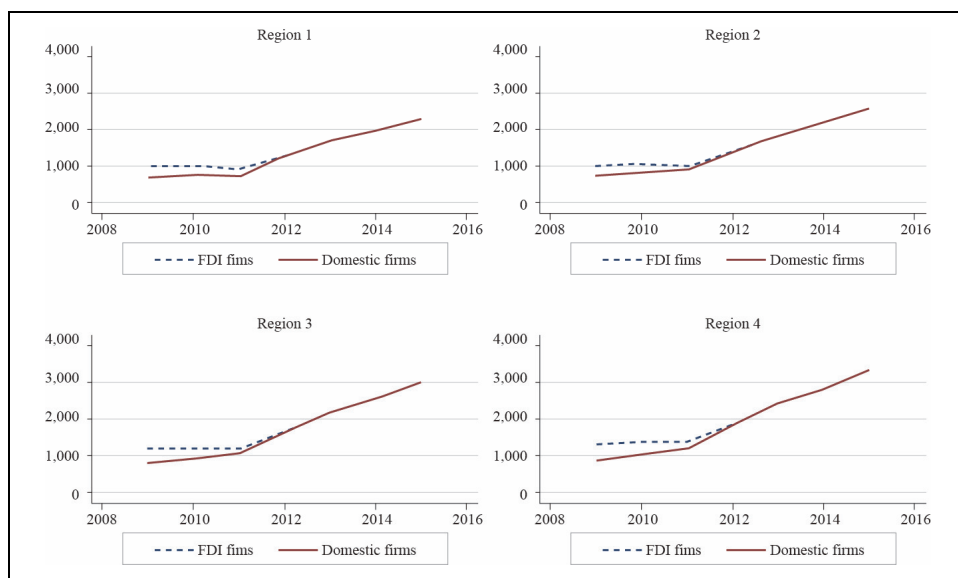
³ For more details on the changes to the minimum wage system in Vietnam, see news on National Wage Council at <http://baochinhphu.vn/Chinh-sach-moi/De-xuat-co-cau-to-chuc-hoat-dong-cua-Hoi-dong-tien-luong-quoc-gia/395097.vgp> (in Vietnamese language, accessed January 21, 2021).

The minimum wage system was officially introduced and applied in 2006. This system stipulated three levels of the regional minimum wage for domestic and foreign-invested enterprises, respectively. The regional minimum wages are always higher for foreign-invested firms than for domestic firms. The regional minimum wages are applied to different cities, urban and rural districts of 63 provinces/central cities in Vietnam according to their economic development. For example, urban and rural districts in Hanoi city are divided into three minimum wage levels. The system has changed its number of regional minimum wage levels to four regional levels since 2009 and applied discriminatively to the domestic and foreign-invested firms. Region 1 consists of centrally controlled cities (or municipalities) and districts with highest economic growth and development. Region 2 includes districts which belong to a certain province or municipality and achieve high economic growth and development. Region 3 is comprised of districts with relatively low economic growth and development and Region 4 includes districts with the lowest economic growth and development.

During the period of analysis, minimum wages were adjusted on an annual basis. More importantly, Vietnam has abolished its discrimination against the domestic and foreign-invested firms in terms of minimum wages since 2012.⁴ Consequently, the four regional minimum wage levels are applied commonly to both domestic and foreign firms depending on their location. Changes in the minimum wage system in Vietnam from 2012 presented challenges to the domestic firms due to the lack of differences in minimum wages applied to domestic and foreign firms as shown in Figure 2. On average, the minimum wage increases from 713 thousand Vietnamese dong in 2011 to 1,260 thousand Vietnamese dong in 2012 (in constant 2010 price), a rise by about 60.7 percent for domestic firms, whereas, foreign firms face a rise in minimum wages by about only 36.5 percent in 2012 compared to 2011. Overall, minimum wages in Vietnam increased substantially since 2009. In particular, the minimum wage applied to foreign firms in 2015 increased 2.5 times compared to 2009, while the minimum wage rose 3.6 times during this period for Vietnamese domestic firms.

⁴ For more details, see Hansen et al. (2016).

Figure 2. Vietnamese Minimum Wages, 2009-2015



Source: Author's own calculation (Data are in constant 2010 price)

III. Empirical Strategy and Data

1. Data

The main data source of this analysis is the firm-level data from the Vietnam Enterprise Census survey conducted by the General Statistics Office (GSO), Vietnam since 2000. However, due to the availability of firms' export data, this study places the focus on the period 2010 through 2015 and the firms with at least ten employees and present during the sample period. The dataset contains information on economic and financial characteristics of each of the surveyed firms. The information on firms' gross revenue, cost of sales, assets, depreciation, liabilities, inventories, profits, taxes, number of employees, etc. allows me to estimate the total factor productivity following a widely used Levinsohn-Petrin procedure proposed in Wooldridge (2009) as well as to control for other firm-level variables.⁵

⁵ The TFP estimation results are available upon request.

This firm-level dataset is complemented with the minimum wage standards adopted by the Vietnamese government between 2010 and 2015. The data on minimum wages are obtained by browsing the government's decrees on the internet to collect the minimum wage groups for rural and urban districts of each central city, and cities and districts of each province.⁶ The province-level data on the macroeconomic conditions come from various volumes of statistical yearbooks of each province.

Table 1. Summary Statistics of Key Variables

Variables	Unit	Mean	Std. dev.	Min	Max
If firm exports		0.35	0.48	0	1
Log of export value	1000 USD	3.24	5.01	-0.23	22.96
Log of real minimum wages	1000 VND	7.30	0.35	6.52	8.00
If firm imports		0.38	0.49	0	1
Log of firms' normalized total factor productivity		-0.48	0.98	-7.35	3.78
Log of capital-labor ratio	Million VND per employee	4.31	1.45	-6.01	10.13
Log of firm size	Million VND	10.05	1.82	-0.24	19.93
Log of real provincial gross domestic products (RGDP)	Million VND	18.47	1.15	15.14	20.25
Log of provincial real annual wage	Million USD	8.27	0.24	7.54	9.01
Log of trade openness	%	5.01	0.89	-1.91	6.92
# observations					55,692

Notes: Firm's export value is deflated by export price index at the two-digit industry level. The minimum wage is also deflated by producer price index at the two-digit industry level. Firm age is an indicator variable which is comprised of start-up, young (no more than 5 years of establishment) and experienced (more than 5 years of establishment) firms. Firm ownership is also an indicator variable which is comprised of private domestic and foreign firms.

The microdata of firms and the macroeconomic data of the minimum wage at district-level are then combined for this analysis. The final working sample is a balanced panel of 55,692 observations, corresponding to 9,282 foreign and domestic private enterprises (72.5 percent are domestic and 27.5 percent are foreign firms) across 713 provincial cities/districts and 165 five-digit Vietnamese Standard Industrial

⁶ For more details on the minimum wage, see the government's decrees number 103/2014/NĐ-CP; 182/2013/NĐ-CP; 103/2012/NĐ-CP; 70/2011/NĐ-CP; 107/2010/NĐ-CP; 108/2010/NĐ-CP; 98/2009/NĐ-CP and 97/2009/NĐ-CP.

Classification (VSIC) manufacturing industries.⁷ On average, about 35 percent of the total number of firms are exporting firms. In addition, some of the firm-level control variables included in the analysis present missing values. The results presented below, however, are generally not sensitive to these firm entries, exits and missing values. Table 1 presents summary statistics of key variables used in the regressions. Both the real minimum wage and various variables exhibit substantial variations in the sample.

2. Empirical Specification

This paper seeks to analyze the impact of the minimum wage on firm's export behavior in terms of the extensive margin (or the number of exporting firms) and the intensive margin (or firm's amount of exports). As documented in Gan, Hernandez and Ma (2016), I conduct the following regression analysis to quantify the impact of the minimum wage on firm export.

$$DEXP_{ijpt} = \alpha_1 MW_{jpt} + \alpha_2 TFP_{ijp,t-1} + \alpha_3 X_{ijpt} + \alpha_4 Z_{pt} + \mu_i + \pi_j + \tau_p + \varphi_t + u_{ijpt} \quad (1)$$

$$VEXP_{ijpt} = \beta_1 MW_{jpt} + \beta_2 TFP_{ijp,t-1} + \beta_3 X_{ijpt} + \beta_4 Z_{pt} + \mu_i + \pi_j + \tau_p + \varphi_t + u_{ijpt} \quad (2)$$

where, i, j, p , and t denote firm, industry, province, and time, respectively. $DEXP_{ijpt}$ is a dummy variable which takes a value of unity if a firm exports, and zero otherwise (the extensive margin of export). $VEXP_{ijpt}$ is the log of value of firm exports deflated by the export price index, or the intensive margin of export, deflated by the export price index. MW_{jpt} is the minimum wage at the district level of each province, deflated by producer price index. X_{ijpt} is a vector of firm characteristics and the one year lag of financial variables are included to control for possible endogeneity and simultaneity problems. Z_{pt} is a vector of province characteristics to capture the macroeconomic conditions' effects on firms' export behavior. μ_i , π_j , τ_p , and φ_t captures the fixed effects to vary by individual firms, industry, province and time, thus eliminating the between-firm, industry, province and time variation and better

⁷ The state-owned enterprises are applying the common minimum wage system, which is different from the regional minimum wage system in Vietnam. Those firms are, therefore, excluded from the sample.

controlling for the specific economic shocks. And u_{ijt} is the error term. The regressions use $TFP_{ijp,t-1} = \log(tfp_{ijp,t-1}) = \log\left(\frac{tfp_{ijp,t-1}}{tfp_{j,t-1}}\right)$ as a control for firm-specific productivity.⁸ $TFP_{ijp,t-1}$ denotes the productivity of firm i which is lagged one year to control for potential endogeneity of firm's performance on the export behavior, especially as firms' total factor productivity (TFP) may also be improved as firms can learn from exporting. In the regressions, the firm-specific productivity is normalized by $\overline{tfp_{j,t-1}}$, the average productivity of the industry j .⁹ In this paper, I estimate equation (1) using fixed effects logistic regression model (nonlinear model), which enable me to analyze the between-firm differences with respect to the effects of minimum wages on the probability of a firm's becoming an exporter as well as a linear probability model as a robustness check.

IV. Estimation Results

This section presents the estimation results. This paper aims to examine the effects of minimum wages on firm's export behavior in terms of the extensive and intensive margins. The key variable of interest is the minimum wage. Table 2 summarizes the estimation results for the baseline specifications. The first two columns correspond to the regression results for the Linear Probability Model (LPM) and Fixed Effects Logistic Regression Model and the third column presents the results for the intensive margin of export.¹⁰ As one can see from the first column, the coefficient of minimum wages is statistically insignificant and positive, and of a relatively small magnitude of 0.001. An insignificant and positive coefficient of the minimum wage is also found for the fixed effect logistic regression model in the second column at the magnitude of 0.018. These results suggest that the minimum wage has no impact on the probability of exporting. The third column reports a statistically significant and positive coefficient for the minimum wage, pointing to a direction that a one percent increase in the minimum wage led to 4.443 percent rise in firm's export sales. The estimation result

⁸ The Total Factor Productivity (TFP) is estimated following the IV-GMM modified Levinsohn-Petrin procedure proposed in Wooldridge (2009).

⁹ This method is proposed in a seminal paper by Berman et al. (2012).

¹⁰ In this paper, the marginal effects of explanatory variables are reported for all the Fixed Effects Logistic Regression Models.

indicates that the minimum wage exerts a positive impact on the extensive margin of a firm's exports. These findings conflict with previous findings for the case of China

Table 2. Minimum Wages and Firm's Export: Baseline Models

Coefficient	Exporting status		Amount of exports
	(1) Linear Probability Model (LPM)	(2) Fixed Effects Logit Model	(3)
Log of minimum wages	0.001 [0.022]	0.018 [0.038]	4.443*** [0.798]
Lag log normalized firms' TFP	-0.005 [0.003]	-0.004 [0.007]	-0.060 [0.053]
Lag of Capital-labor ratio	0.005 [0.004]	0.005 [0.010]	0.263*** [0.025]
Lag of firm size	0.015*** [0.003]	0.016 [0.029]	0.008 [0.043]
If firm imports	0.221*** [0.020]	0.109*** [0.004]	2.158*** [0.191]
Firm age (old firms)	-0.003 [0.004]	-0.004 [0.004]	-0.171 [0.103]
If domestic private firms	-0.041 [0.039]	-0.027 [0.028]	-0.358 [0.560]
Log of provincial real GDP	0.027 [0.043]	-0.010 [0.029]	3.220*** [0.946]
Log of provincial average annual wage	0.032 [0.032]	0.024 [0.048]	-0.170 [0.703]
Log of provincial trade openness	-0.021 [0.014]	-0.028 [0.051]	-0.180 [0.333]
Firm fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes
# observations	44,947	10,596	44,947
Log likelihood		-5,312	
Adj. R-squared	0.764		0.746

Note: ***, ** and * denote significance levels at the 1%, 5% and 10%, respectively. Robust standard errors are in brackets and clustered at the province level.

in which Gan, Hernandez and Ma (2016) find a negative impact on firm export. However, the result to some extent points to such a similar direction as the case of Indonesia in which Ni and Kurita (2020) find an increase in the probability of exporting. The positive impact of the minimum wage on export becomes plausible in the case that an increase in the amount of exports would lead to an increased profit margin of the incumbent exporters, thus mitigating pressure from increasing labor cost due to the raising of the minimum wage standards.

Regarding firm-specific productivity, the estimates for the normalized total factor productivity reveal that the productivity has no significant impact on either the intensive margin or the extensive margin of a firm's exports. These results are contrary to the findings of the previous case studies for Vietnam (Newman et al., 2017) that firms actually learnt by exporting. The coefficient for the capital-labor ratio is positive and statistically significant for the case of the extensive margin regression. This allows us to believe that a firm can increase its export sales as it becomes more capital-intensive. The coefficient for other controls such as firm size, firm age, firm ownership, provincial average wage and trade openness is insignificant, indicating no impact on firm exports. The estimates for the importing status and provincial GDP reveal that a firm increases its export in both the extensive and intensive margin if it imports, and that the provincial GDP has a positive impact on the amount of firm exports.

V. Robustness Check

The estimation results suggest a non-trivial impact of changes in the Vietnamese regional minimum wage on firm's export behavior. In this section, alternative estimations are performed to further assess the validity of the estimated results. I examine the potential heterogeneous impacts across firms with different wage and productivity levels. Second, I exploit the significant differentiated variations in minimum wages before and after introduction of the uniform regional minimum wage system in 2012 by implementing a difference-in-differences framework.

1. Heterogeneous Impact

Changes in the minimum wage may also have a differential impact across different firms (Draca et al., 2011 and Riley and Bondibene, 2017). Gan, Hernandez and Ma (2016) provide supportive evidence that rises in the minimum wage seems to have a

stronger negative effect on low-wage and labor-intensive firms in China. Hence, the impact of minimum wages on firm's export behavior may also differ across different types of firms. The following specification is therefore considered to evaluate this heterogeneous impact.

$$\begin{aligned} \text{DEXP}_{ijpt} = & \gamma_1 MW_{jpt} + \gamma_2 D_{ijpt} + \gamma_3 MW_{jpt} * D_{ihjkt} + \gamma_4 \text{TFP}_{ijp,t-1} + \gamma_5 X_{ijpt} \\ & + \gamma_6 Z_{pt} + \mu_i + \pi_j + \tau_p + \varphi_t + u_{ijpt} \end{aligned} \quad (3)$$

$$\begin{aligned} \text{VEXP}_{ijpt} = & \delta_1 MW_{jpt} + \delta_2 D_{ijpt} + \delta_3 MW_{jpt} * D_{ijkt} + \delta_4 \text{TFP}_{ijp,t-1} + \delta_5 X_{ijpt} \\ & + \delta_6 Z_{pt} + \mu_i + \pi_j + \tau_p + \varphi_t + u_{ijpt} \end{aligned} \quad (4)$$

where D_{ijpt} is the grouping variables to distinguish among different types of firms. The parameters of interest are γ_3 in equation 3 and δ_3 in equation 4, which capture the potential differences in the impact of the regional minimum wages on different firm groups. The other variables are as defined as in equations 1 and 2. In this section, the heterogeneous effects are allowed for on the basis of firms' average wage and total productivity as well as capital intensity levels.

First, I focus on the heterogeneous impact across different levels of firms' average wage. Table 3 reports on the estimation results of the coefficients of interest only. As can be seen from this table, the coefficient of minimum wages is statistically insignificant for the linear probability model and the fixed effects logistic regression model. This suggests that the minimum wage has no impact on the probability of exporting. However, the estimates for the amount of exports regression yield a positive and significant coefficient of the minimum wage, and its magnitude indicates that a one percent increase in the minimum wage leads to 5.598 percentage point increase in export sales. In the third columns, the coefficients of the interaction terms are statistically significant and positive. Their magnitudes become smaller and smaller as we move to the higher quintiles of firm's average wage. As presented in the table, the estimate for the interaction is 5.259, 4.489, 3.460 and 1.951 for the second, third, fourth and fifth quintiles, respectively. These estimates suggest that firms, which pay a higher wage, do not increase their amount of exports as much as firms which pay a lower wage. The possible mechanism is that firms the minimum wage exerts stronger pressure on the

firms which pay lower than or just around the minimum wage level so that those firms have to find the solutions to absorb the adverse impact of minimum wage policies. Some possible mechanisms that firm may take are: (i) to increase their labor productivity (as documented in Nguyen, 2019); (ii) to increase their sales revenue, to raise profit margin, and (iii) to increase investment in research and development (R&D) activities to strengthen their competitive edges. An increase in export sales in the case when a firm opts for the stability of its export commodity's price to avoid losing the incumbent customers is equivalent to a rise in firm's profit margin.

Table 3. Firm's Export Regressions by Quintiles of Firms' Average Wage

Coefficient	Exporting status		Amount of export
	(1) Linear Probability Model (LPM)	(2) Logistic Regression Model	(3)
Log of minimum wages	-0.007 [0.023]	0.310 [0.538]	5.598*** [1.003]
Log of minimum wages * Quintile 2	0.021 [0.024]	0.739** [0.365]	5.259*** [0.820]
Log of minimum wages * Quintile 3	0.006 [0.024]	0.364 [0.358]	4.489*** [0.793]
Log of minimum wages * Quintile 4	-0.005 [0.026]	-0.078 [0.355]	3.460*** [0.845]
Log of minimum wages * Quintile 5	-0.003 [0.022]	0.030 [0.349]	1.951** [0.872]
Firm-level controls	Yes	Yes	Yes
Province-level controls	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes
# observations	44,933	10,583	44,933
Log likelihood		-5,302	
R-squared	0.764		0.751

Note: ***, ** and * denote significance levels at the 1%, 5% and 10%, respectively. Robust standard errors are in brackets and clustered at the province level.

As a robustness check for the differential impact of the minimum wage, instead of the minimum wage level, I include a log difference between the minimum wage and

the mean wage in the region as the main explanatory variable as employed in Lee (1999). The estimation results are summarized in Table 4. As can be seen from the table, the coefficient of the log difference is also statistically insignificant for the probability of exporting regression, however statistically significant and positive for the amount of exports regression. These estimates suggest that the raising minimum wage standards have a positive impact on firm's export sales (about 6.249 percentage point increase). The interaction term between the log difference and different quintiles of average wage is strongly significant and its magnitude is 2.230, 2.157, 1.564, and -0.793 for the second, third, fourth and fifth quintiles of average wage, respectively. These findings also support evidence that low-wage firms increase their amount of exports much more than high-wage firms.

Table 4. Firm's Export Regressions by Quintiles of Firms' Average Wage (Robustness Check)

Coefficient	Exporting status		Amount of export
	(1) Linear Probability Model (LPM)	(2) Fixed Effects Logit Model	(3)
Log difference between the minimum wage and the region's mean wage	0.009 [0.034]	0.028 [0.057]	6.249*** [0.787]
Log difference * Quintile 2	0.019 [0.013]	0.014 [0.029]	2.230*** [0.395]
Log difference * Quintile 3	0.030** [0.014]	0.009 [0.021]	2.157*** [0.228]
Log difference * Quintile 4	0.026*** [0.010]	-0.017 [0.035]	1.564*** [0.176]
Log difference * Quintile 5	0.015 [0.016]	-0.003 [0.015]	-0.793*** [0.238]
Firm level controls	Yes	Yes	Yes
Province-level controls	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes
# observations	44,933	10,583	44,933
Log likelihood		-5,302	
R-squared	0.764	0.276	0.754

Note: ***, ** and * denote significance levels at the 1%, 5% and 10%, respectively. Robust standard errors are in brackets and clustered at the province level.

I now turn to examine the differential effects across firms with different levels of total factor productivity. The key variable of interest is the interaction term between minimum wages and firm-specific productivity. The results of the coefficient of interest are summarized in Table 5. The coefficient of the minimum wage is statistically insignificant for the linear probability model and fixed effects logistic regression model. This again confirms no impact of the minimum wage on the probability of exporting. The coefficients of the minimum wage and firm-specific productivity are both positive and statistically significant for the export sales. However, the interaction term between minimum wage and normalized firm-specific productivity is statistically significant and negative. Note that the estimate for the minimum wage variable is the impact of minimum wages for firms with an average level of total factor productivity. The coefficient of the interaction is negative, indicating that less total factor productive firms are increasing their export sales in response to raising minimum wage standards. To some extent, this points to a direction contrary to the findings by Newman et al. (2017) that firms actually learnt by exporting.

Table 5. Minimum Wages, Firm's Export and Firm's Specific Productivity

Coefficient	Exporting status		Amount of exports
	(1) Linear Probability Model (LPM)	(2) Fixed Effects Logit Model	(3)
Log of minimum wages	-0.001 [0.025]	0.016 [0.035]	2.193** [0.844]
Lag log normalized firms' TFP	-0.004 [0.037]	0.017 [0.044]	11.363*** [0.976]
Log of minimum wages * Lag log normalized firms' TFP	-0.001 [0.005]	-0.003 [0.007]	-1.556*** [0.134]
Firm level controls	Yes	Yes	Yes
Province-level controls	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes
# observations	44,947	10,596	44,947
Log likelihood		-5,311	
R-squared	0.764	0.276	0.753

Note: ***, ** and * denote significance levels at the 1%, 5% and 10%, respectively. Robust standard errors are in brackets and clustered at the province level.

Table 6 reports the estimates for the heterogeneous impact of the minimum wage across different level of capital intensity. As shown in the table, the coefficients of the minimum wage and the interaction term between the minimum wage and capital intensity are statistically insignificant for the linear probability model and the fixed effects logistic regression model. The coefficients of these variables for the amount of exports regression are positive and statistically significant. These results indicate that the minimum wage and capital intensity have a positive impact on firm's export sales. However, the interaction term of these two variables is also statistically significant but negative. The magnitude of the interaction leads us to believe that a one percent increase in capital-labor ratio results in 0.481 percentage point decrease in the positive impact of the minimum wage on export sales. In other words, the minimum wage positive impact is stronger on labor-intensive firms. These findings conflict with the results found by Gan, Hernandez and Ma (2016) that the rising minimum wage levels have a stronger negative effect on labor-intensive firms.

Table 6. Minimum Wages, Firm's Export and Firm's Capital Intensity

Coefficient	Exporting status		Amount of exports
	(1) Linear Probability Model (LPM)	(2) Fixed Effects Logit Model	(3)
Log of minimum wages	0.001 [0.023]	0.018 [0.040]	6.733*** [0.879]
Lag Capital-labor ratio	0.007 [0.017]	0.005 [0.022]	3.822*** [0.801]
Log of minimum wages * Lag Capital-labor ratio	-0.001 [0.002]	0.001 [0.003]	-0.481*** [0.084]
Firm level controls	Yes	Yes	Yes
Province-level controls	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes
# observations	44,947	10,596	44,947
Log likelihood		-5,312	
R-squared	0.764	0.275	0.747

Note: ***, ** and * denote significance levels at the 1%, 5% and 10%, respectively. Robust standard errors are in brackets and clustered at the province level.

2. Difference-in-differences Estimation

This section draws on the important change in the Vietnamese regional minimum wage system. As opposed to the discrimination against foreign and domestic private firms, a uniform regional minimum wage rate has been applied to firms on a non-discriminatory basis since 2012. The rise in the regional minimum wage in 2012 is about 61 percent for domestic firms, while only 37 percent for foreign firms, compared to the rate applied in 2011. To reveal the causal effect of the introduction of a uniform regional minimum wage, I apply a difference-in-differences framework. I partition the manufacturing firms into a treatment group and a control group based on the average monthly wage in the period $t-1$, prior to the enforcement of the regional minimum wage rate in the period t .¹¹ Accordingly, the treatment group consists of firms which are exposed to the treatment (hereinafter referred to as “exposed firms”), and the control group is comprised of firms which are not exposed to the treatment (hereinafter referred to as “non-exposed firms”). Comparing the outcomes for the exposed firms with those for the non-exposed firms, I can capture the effect of the introduction of a regional minimum wage rate during this period. Thus, the following specification is considered.

$$\begin{aligned} \text{DEXP}_{ijpt} = & \alpha + \varphi \text{Exposed}_{ijpt} + \omega \text{Exposed}_{ijpt} * \text{Uniform}_t + \eta_3 \text{TFP}_{ijp,t-1} \\ & + \eta_4 X_{ijpt} + \eta_5 Z_{pt} + \mu_i + \pi_j + \tau_p + \varphi_t + u_{ijpt} \end{aligned} \quad (5)$$

$$\begin{aligned} \text{VEXP}_{ijpt} = & \alpha + \varphi \text{Exposed}_{ijpt} + \omega \text{Exposed}_{ijpt} * \text{Uniform}_t + \varepsilon_3 \text{TFP}_{ijp,t-1} \\ & + \varepsilon_4 X_{ijpt} + \omega_5 Z_{pt} + \mu_i + \pi_j + \tau_p + \varphi_t + u_{ijpt} \end{aligned} \quad (6)$$

where Uniform_t is a dummy variable for periods after the initial uniform regional minimum wage rate was applied, i.e. for observations coming from the post-Uniform 2012-2015 period. Exposed_i is a dummy variable for firm’s average wage at $t-1$ being below the regional minimum wage rate at t . The coefficient of interest is ω . This

¹¹ A more proper measure would be the proportion of employees whose monthly wage is below the minimum wage rate prior to the implementation of the policy (Dube et al., 2007). Unfortunately, due to the data availability, I cannot use this measure.

measures the gap in export performance between exposed and non-exposed firms in the post-Uniform period, relative to the exposed versus non-exposed gap in the pre-Uniform period. However, note that the total export performance differential between exposed and non-exposed firms after the Uniform rate is applied, is measured by the sum of $\varphi + \omega$.

Table 7. Firm's Export Regressions: Exposure to Treatment

Coefficient	Exporting status		Amount of export
	(1) Linear Probability Model (LPM)	(2) Fixed Effects Logit Model	(3)
Exposed	-0.006 [0.008]	-0.008 [0.012]	-0.680*** [0.180]
Exposed * Uniform	0.003 [0.007]	0.003 [0.012]	1.116*** [0.276]
Firm-level controls	Yes	Yes	Yes
Province-level controls	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes
F-test $\alpha+\beta=0$	0.36	1.29	8.16
Prob > F	0.702	0.526	0.001
# observations	44,947	10,596	44,947
		-5,312	
R-squared	0.764	0.278	0.744

Note: ***, ** and * denote significance levels at the 1%, 5% and 10%, respectively. Robust standard errors are in brackets and clustered at the province level. The F-test is to test the equality in absolute terms of the estimated coefficients on Exposed and Exposed x Uniform. The probabilities (below 0.01) indicate that this equality is rejected at the 1% confidence level.

The estimates are presented in Table 7. As can be seen from this table, the coefficient of the exposure to the raising minimum wage standards is not statistically significant for the probability of exporting regression. However, it is strongly significant and negative for the amount of exports regression. Controlling for initial firm characteristics, the negative and significant coefficients of the exposure to an increase in the minimum wage on its own reveal that exposed firms under-performed before the 2012 reform compared to non-exposed firms in terms of export sales. However, the 2012 reform

reversed the situation as demonstrated by the significant and positive coefficient on the interaction between Exposed and Uniform dummies. Concretely, the uniform wage rate introduction led to a relative rise in export sales of the exposed firms. All else equal, the gap in export sales between exposed and non-exposed firms rose by 1.116 percent following the reform compared to its pre-uniform level. The F-test shown at the bottom of each column is to test the difference in trends between exposed and non-exposed firms after the introduction of uniform minimum wage rate. The null hypothesis is that the sum of the estimated coefficients on the exposure dummy and the interaction term equals zero. The probabilities which are below 0.01 indicate that the null hypothesis is rejected at the 1% significance level. The estimated results clearly indicate that the introduction of uniform minimum wage system in 2012 was binding and put more wage pressure on low-wage firms than before. Consequently, the increases in regional minimum wages allowed laggard firms to achieve wage growth trends that are superior to those experienced by the other firms.

VI. Conclusions

The continuous rise of minimum wage standards in Vietnam in recent years has received a lot of attention in academic and policy forums. This paper provides a useful complement to the growing literature on the impact of the minimum wage. I use extensive firm-level data of Vietnamese manufacturing firms in 2010 through 2015 to explore the linkage between rising minimum wages and firm's export in terms of both the extensive and the intensive margins. The estimation results suggest that the rising minimum wage standards have no impact on the probability of a firm's becoming an exporter. In contrast, the effect on the intensive margin of firm's export is statistically significant and positive. The estimates provide evidence that raising minimum wage standards urge the incumbent exporting firms to raise their export sales to make the most of economies of scale rather than to become a new exporter.

I then conduct additional alternative regressions to validate these findings. I observe no association between the minimum wage and the probability of exporting, but a positive impact of the minimum wage on the export sales. Low-wage firms increase their amount of exports much more than high-wage firms do. However, a surprising finding is that less productive and more labor-intensive firms raise their export sales more. This supports the intuition that low-wage firms are more vulnerable, thus more sensitive to the raising minimum wage level and one of possible mechanism is to

increase their export sales to realize an increased profit margin. This impact is also reaffirmed when I further introduce a difference-in-differences framework analysis to the data. The estimates points in the direction that a firm that pays its workers lower than the regional minimum wage level under-performed in terms of export sales compared to non-exposed firms. Moreover, the gap in export sales between the firms which are exposed and the firms which are not exposed to a rising minimum wage standards was widening after the introduction of a common regional minimum wage system in 2012 Vietnam.

In summary, the regression analysis suggests that confronted with substantial increases in labor costs from policies to raise the pay of low wage workers, the manufacturing firms in Vietnam had to raise their amount of exports to increase their profit margins as well as to make the most use of the economies of scale. However, the rising minimum wage standards did not drive any new exporters. In this study, the availability of the data does not allow me to analyze a possible channel that a firm may invest in R&D activities to become more productive, have higher markup as well as strengthen its competitiveness to absorb the adverse impact of rising production costs. The drivers of new exporters and this R&D channel as well would be therefore a useful venue for future research on firms' behavior.

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