

Impacts of Minimum Wages on Employment and Wage Distribution in Viet Nam: Gender and Age Perspectives¹

The Centre for Analysis and Forecasting
Viet Nam Academy of Social Sciences

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Abstract

Since 2008, minimum wages in Vietnam have grown at about 15% annually. This growth has been considered as being higher than productivity growth of the economy. Employing data of Vietnam Labor Force Surveys and Household Living Standard Surveys from 2010 to 2014, the current paper aims at investigating impacts of the minimum wages on two inter-related issues: employment statuses of the whole population and the different population sub-groups in terms of gender and age; wage distributions for the wage earners in general and within these groups. The results imply that the minimum wages do not have significant impacts on the total employments of the whole population and its sub-groups. This result is somewhat different from those reported in previous studies for Viet Nam. Our different specifications detect that the differences in the results are attributed to inclusions of trends in the current study. Similar to the work of Hansen et al. (2015), the results indicate that the minimum wage positively affects the wage distribution in the formal sectors. However, we find that the effects do not stop at the median as the result of Hansen et al. but also on higher percentiles. In terms of difference between sub-groups, the effects are stronger for the sub-group of young laborers, compared with their adult counterparts. Meanwhile, the model does not work well for the male sub-group as well as wage earners in the informal sector.

Key words: minimum wage, employment, wage distribution, gender, age, Vietnam

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1. Introduction

As a part of economic reforms since Doi Moi (1986), minimum wages were introduced in Viet Nam by the early of 90s. According to the 2012 Viet Nam Labor Code, the minimum wage is “the lowest rate paid to laborers for performing the simplest work in normal working conditions, and that has to secure their and their families’ the minimal living needs”.

Since the first introduction, the minimum wage schemes have had a number of critical changes. Before 2008, the minimum wage scheme for the domestic sectors mainly played as a “basic salary” for wage calculation for whom having their payments from the state budget rather than the minimum wage itself. In 2008, the minimum wage scheme for the non-state domestic sectors was separated from the “basic salary” of the state sector and acted truly as the minimum wage. In subsequent years, the nominal minimum wages have increased drastically at rates of more than 15% annually. This increase has been higher than other countries in the region (Del Carpio and Pabon, 2014) and as well as higher than productivity that make the minimum wage in Vietnam is relatively high in comparison with a number of countries in the world (WB, 2015).

In addition, a study of Oudin et al. (2013) reports that the speed of expansion of employments in Foreign Direct Investment (FDI) and domestic private enterprises have been slowed down since 2010. Specifically, the proportion of employments in FDI enterprises decreased by 0.25% in the period of 2010-2012 compared with an increase of 1.46% increase in the period of 2007-2009. Although the proportion of employments in the domestic private enterprises still increased by 0.91% in the period of 2010-2012, it was significantly lower than an increase of 1.46% in 2007-2009 period. Consequently, whether the increases in the minimum wages have played a role in this slowdown in the expansion of employments in these types of firms is a question. This question is important to be answered as the relative expansion of employment in the enterprise sector is an indicator of modernization of the Vietnam’s labor market.

Initial works on the topic for Viet Nam (Nguyen, 2010; Del Carpio, et al., 2014; Nguyen, 2014, Hansen, et al., 2015) indicates a small but negative effect on employments and positive impacts on wage distributions. However, these studies only investigate the whole labor market or a very specific group of laborers of whom receiving lower than the minimum wage in FDI, state-owned and domestic private enterprises. Meanwhile, impacts on different groups in term of gender

and age have not been investigated. Furthermore, studies of employment impacts (Nguyen, 2010; Del Carpio, et al., 2013; Nguyen, 2014) are all for periods before 2010 and they do not capture the unification of the minimum wages across types of enterprises (FDI versus domestic private enterprises) in 2012 and the slowing down in the speed of the employment expansion in FDI and domestic private enterprises as noted in the context mentioned above.

This paper aims at investigating the effects of the minimum wages on wage distribution and the total employments in general as well as movements across types of employments of different groups in term of gender and ages. The results of the paper not only shed lights on negative impacts, if any, of the minimum wage policies in recent years but it also contribute to the current debate about impacts of minimum wages on the employment and income distribution in the literature in two-folds. Firstly, it enriches empirical evidence from a developing country of the topic which is now scale in the literature. Secondly, by breaking down the population into specific groups with potentially differences in impacts, the paper brings about detail evidence of impacts on different groups of the population which may be neutralized when the whole population is investigated.

Apparently, the potential impacts of changes in the minimum wages are different across groups of laborers. Given different in the income distribution and employments across gender and age groups that female laborers are often less paid compared to their male counterparts that results in higher probability of locating in the left hand side of the income distribution. Therefore, it is reasonable to predict that female laborers face a higher probability of negative effects, for example, laid out of the formal sectors. However, Nguyen (2014) finds contrary results that male workers have higher probability of dis-employing in the formal sectors when the minimum wages increase. It should be noted that Nguyen (2014) using firm data and answers for the question of impacts from laborer data have not yet investigated.

On another dimension, young labourers face significant obstacles when they enter the labor markets (for a descriptive picture of entry the labor market of Vietnamese young people, see Nguyen et al., 2015). They have higher probabilities of working for small business units with low incomes and high uncertainties. Consequently, they are also predicted to be more likely to be affected by increase in the minimum wages. The negative effects of the increases in the

minimum wages, if any, is more serious as employments in the initial state of entering the labour market of young laborers have long-term effects in their future.

To acquire the objectives, the paper is organized as follows: Section 2 briefly presents empirical evidence from literature; the context of the minimum wages in Vietnam is discussed in Section 3; empirical models for investigation of impacts of the minimum wages are given in Section 4; Section 5 presents data and results of descriptive analyses; Section 6 is devoted for estimation results; and the paper ends with conclusion.

2. Literature review

2.1.1. Impact of the minimum wage on employment

Theoretically, models predict differently the effects of the minimum wage on the total employment. In a competitive labor market, if an applied minimum wage is higher than the clear level of wage in the market- a binding minimum wage, it results in an increase in unemployment. The total employment decrease as a consequence. However, under the monopsony model, employment possibly increases if a binding minimum wage is imposed (Brown, 1999).

Empirical evidence of impacts of the minimum wage on employment in the US, the most intensively studied-economy, has not reached a consensus. A frequently cited paper of Card and Krueger (1994) reports no negative effects in term of employment on the fast-food industry in New Jersey and Pennsylvania of the US. No dis-employment impact is also found by Addison et al. (2009) for low-wage sub-sectors of the retail-trade sector of the U.S in the period of 1990-2005. However, Neumark and Wascher (2007) argue that results for specific industries may not be generalized for the economy. A recent revision of Neumark et al. (2014) finds a negative employment elasticity of 0.15 for teen laborers in the U.S.

For developing countries, the results are also somewhat diverse across countries. Maloney and Mendez (2004) find significant dis-employment effects of the minimum wages with for the case of Colombia. Meanwhile, Lemos (2009), reports of no impact of the minimum wages on employment for the period of 1982 to 2004 in Brazil. By contrast, Montenegro and Pages (2004) report positive impacts of the minimum wages on employments of Chile. With a careful review

of studies for developing countries, Betcherman (2015) concludes that the effects of the minimum wages on the employment are generally small.

With regard to formal and informal separation, Lemos (2007) finds that minimum wages have no negative effect on employments both informal and formal sectors in Brazil. Meanwhile, Alatas and Cameron (2003) find negative effect for small domestic firms in textile and clothing, footwear and leather industries in Indonesia. However, the small domestic firms are not identical to the informal sector. These firms still follows the minimum wage regulation.

2.1.2. Empirical evidence of impact of the minimum wage on wage and income

Empirical evidence of impacts of the minimum wage on income general and income distribution in particular are somewhat more concentrative. Lee (1999) study the impacts of the minimum wages on the distribution of wage in the U.S for a decade, from 1979 to 1989 and finds that increase in the inequality of the low end of the wage distribution can be attributed for the erosion of the minimum wages in the period, especially for the women. He also finds that the differences in wages across groups in term of gender, race or education are modestly affected by the changes in the real minimum wages in the period.

Maloney and Menez (2004) study the case of Colombia and report that the increases in the minimum wages have significant effects on the wage, especially for whose income initially located around the minimum wages. Lemos (2006) documents compressions of wage distribution as affected by the minimum wages in Brazil. The same direction of impact but the minimum wage changes have attributed to the increase in inequality in Mexico for the period of 1989-2001 as the minimum wage had been deteriorated in the period (Bosch and Manacorda, 2010).

For Asian countries, Liu and Yun (2012) study impacts of the changes in the minimum wages in the period of 2002-2009 with the model in Lee (1999) for China and find that the increases of minimum wages has positive effects on the income distribution—particularly reducing the income gap between the median and the bottom decile—over the period of analysis. Hohberg and Jay (2015) find the minimum wage have positive effects on wages in the formal sector of Indonesia. Meanwhile, wages in the informal sector is not affected. The review of Betcherman

(2015) implies that there are compression effects for the wages of covered laborers but disadvantageous sub-groups in the labor markets may be excluded from the benefits.

2.1.3. Initial Evidence from Viet Nam

Nguyen (2010) use data from Vietnam Household Living Standard Surveys 2004 and 2006 to study impacts of the minimum wage increases on employment, wage and expenditures of laborers who worked in the formal sector but receiving payments below the minimum wages. Findings are that the increase in the minimum wages between the two years reduced employments in formal sectors which compensation was below the minimum wages but the increase has no significant effects on wage and expenditure of the workers having this type of employment.

With data from the enterprise censuses of Viet Nam in the period of 2008-2010, Nguyen (2014) investigates effects of the increase in the minimum wages on enterprises' labor and fixed asset. He finds the increase in the minimum wages would reduce employments, one percent increase in the real minimum wages results in 0.1 percent decrease in the firms' employment sizes. A counter-intuition result is that male workers and those without social insurance face higher probability of reduction although the decrease of male labor proportion in the total firm's employment is small at 0.06 percent if there is one percent increase in real minimum wage.

Del Carpio, et al. (2013) cited in Del Carpio, et al. (2014) using data from enterprise censuses in the period of 2006-2010 to investigate the impacts of the minimum wages on employment and wages. They find that increases in the minimum wages have negative impacts on wage employments. Self-employments increase but only a part of reduction in wage employment. Therefore, the total employment reduces as the minimum wage increases. In addition, the average wages of wage workers who retained their employments are positively affected by the increases in the minimum wages.

Hansen et al. (2015) using data from Viet Nam Labor Force Survey 2011-2013 to investigate association between the minimum wage and hourly wage in Viet Nam. They find that the relationship is positive for the formal sectors. Furthermore, the minimum wage increases has compressed the wage distribution of the sectors in Viet Nam. It compressed wages at the low end of the distribution closer to the median. Another finding is that the minimum wage setting

has not affected income distribution in the informal sector although the authors indicate that more representative data is needed to have proper conclusion on this finding.

3. The minimum wage context of Vietnam

The minimum wages in Vietnam for different sectors have been introduced at different points of time. The first minimum wage scheme was introduced for the FDI sector in 1992 with two levels for different regions in term of development. The first region included Ha Noi and Ho Chi Minh City and the second region were other provinces/cities. Just one year later, the provision for those received payments from the state budget was issued but it has been not the minimum wage in term of normal meanings. For civil servants and people who received salaries and benefits from the state budget, there has been a base called as “basic salary” for calculating their compensations with a system of numeraires depended on their positions, qualifications and seniorities. Meanwhile, the minimum wage for the domestic enterprises including state owned enterprises and enterprises operating under the enterprise law in all industries was introduced in 2000 under the Decree No. 10/2000/ND-CP dated 27th March 2010 and the rate of the minimum wage is the same as “basic salary” for the state sector. Since 1st October 2004 under a stipulation in the Decree No. 203/2004/ND-CP dated 14th December 2004, the regulation of the minimum wage has been extended to cover all kinds of employees including those working in cooperatives and household businesses.

Before the year 2000, the adjustment of the minimum wages for both FDI and the state sector² were on an irregular basic. Since 2000, the minimum wages for the domestic sectors including both the state sector and the domestic enterprises had been increased more frequently, almost on a yearly basic. Another feature of the minimum wage schemes for this period was the rates for FDI sector were significantly higher than that of the domestic sectors. For example, in 2000, the lowest rate for the FDI sector was more than double to that of the domestic sectors. In 2005, the last year of application of the 1999 scheme for the FDI sector, the lowest rate of the FDI sector was still about 20% higher than that of the domestic sectors.

There was another significant change in the minimum wage scheme in 2008. The minimum wage for the domestic non-state sector was separated from the “basic salary” of the state sector and differentiated across locations in term of levels of developments which were similar

² We denote civil servants and people whose compensations are from the state budget as the state sector.

to the scheme of the FDI sector. Within locations, the minimum wage applied for FDI firms were still significantly higher than that for domestic non-state sector. With this separation, there were three minimum wage schemes for FDI, the domestic non-state sectors and the “basic salary” for the state sector separately.

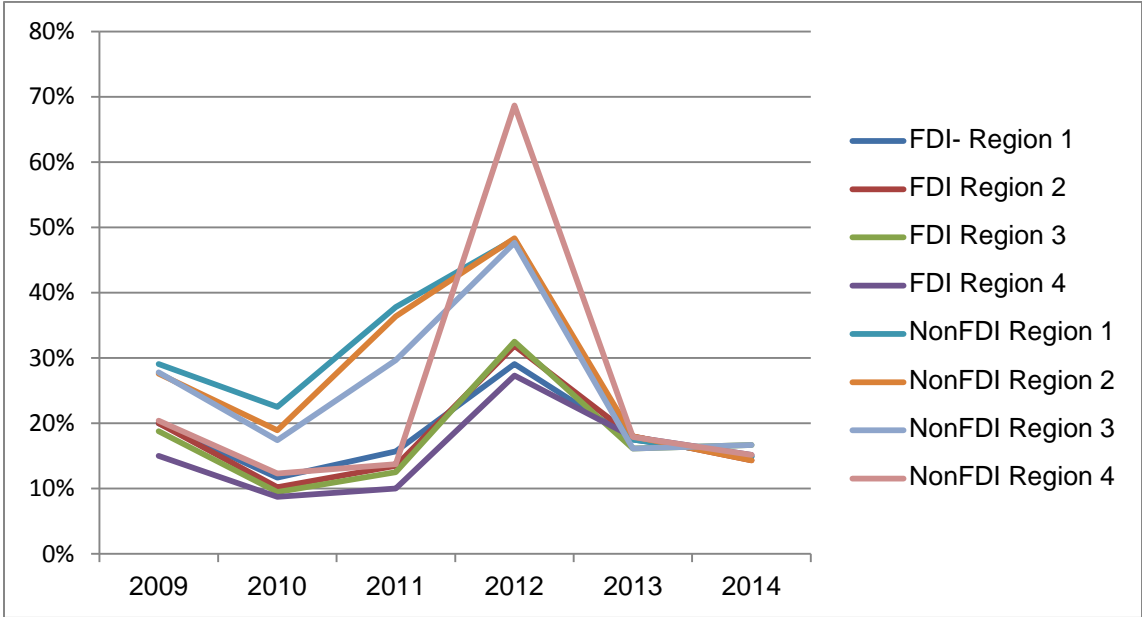
In subsequent years, the minimum wages in Viet Nam have increased rapidly with different growth rates between those for the FDI and those for the domestic non-state sector (see Figure 1). The gap between the minimum wages in the two sectors have been narrowed down as growth rates of the minimum wage for the latter sector have been relatively higher compared with those of the former sector since 2009. Large increases in the minimum wages for the domestic non-state sector in 2011 and have resulted in the unification of the minimum wages across sectors since October 2011. The relatively higher increases in the minimum wage for the domestic non-state sector in the period of 2009-2011, especially in the year 2011 was caused by the commitment of non-discrimination between foreign related and domestic sectors of Viet Nam under the WTO accession in 2007. However, the system of four minimum wage levels across locations in term of developments has been kept.

Since the unification in 2011, the minimum wages for the enterprise sector still increase at about 15% annually. In 2015, the monthly minimum wage ranges from 2,150 thousand VND (\$100) in the fourth region to 3,100 thousand VND (\$144) in the first region. There has been an assessment that the speed of increase in the minimum wages has been significantly faster compared with increase in labour productivity for recent years (WB, 2015).

Viet Nam has applied the different minimum wage levels for different administrative locations based on their levels of developments. As noted in the previous paragraph, the initial scheme for the FDI sector included two levels. The number of levels was extended to three in year 1996 for the sector. The three levels of the minimum wage were kept up to 2008 and it has been splitted further to four levels in 2009. Districts are the basic level of administration for applying one level of the minimum wage that means in one province, there are more than one levels of the minimum wages. Since 2012, the stipulation of the application of the minimum wage levels for different locations has been stable. The highest level is applied for inner quarters of cities of Ha Noi, Ho Chi Minh, Hai Phong, selected districts of Dong Nai and Binh Duong provinces as well as Vung Tau town of Ba Ria-Vung Tau province. The second level is applied for remaining

districts of Ha Noi, Ho Chi Minh and Hai Phong, quarters of other cities as well as districts of some provinces with high levels of industrialization. The third level is applied for districts which are relatively high advance in term of development comparing with other districts of the same provinces. The fourth level is applied for remaining districts. In subsequent analyses, we call a level of the minimum wage as a minimum wage region.

Figure 1: Growth rates of nominal minimum wages in 2008-2014 (%)



Source: Authors’ calculation from the minimum wages stipulated in government’s legal documents

As noted above that the state sector follows a different system of payment. In 2015, the “basic salary” is 1150 thousand VND. A newly recruited employee who has a university degree is paid with the numeraire of 2.34 to the “basic salary” with application for the whole country. Consequently, the wage is still lower to the highest minimum wage in enterprise sector but it is legal.

To have more realistic picture of increase in the minimum wages in Vietnam, we deflate the nominal minimum wages by the Consumer Price Index (CPI) and adjusted for spatial differences with a Regional Price Index (RCPI) sourced from Viet Nam Household Living Standard Surveys (VHLSS)³. The figures are presented in Table 1. The increase trends are clear with an exceptional increase in 2012. However, the patterns of increase are not the same across regions since 2012.

³ We adjusted for the Regional Price Index as the nominal minimum wages are different across regions.

Region 1 and 3 increase higher in 2014 and 2015. Region 2, stable for 2013 and 2014 and higher increase in 2015 meanwhile region 4 is quite stable.

Table 1. Real minimum wage rates (000 VND)

Region	2011	2012	Change to previous year (%)	2013	Change to previous year (%)	2014	Change to previous year (%)	Change 2014 to 2011 (%)
1	1059	1513	42.82	1668	10.27	1941	16.32	83.29
2	1026	1461	42.34	1618	10.79	1794	10.86	74.85
3	926	1293	39.72	1411	9.08	1589	12.61	71.60
4	777	1203	54.85	1332	10.68	1467	10.13	88.80

Source: Authors' calculation with the minimum wages stipulated in government's legal documents, CPI of GSO and RCPI of VHLSSs

4. Estimation models

In this section, we shall present models for examining the impacts of the minimum wage on the total employment, movements across types of employments and wage distribution. Identification problems of the models as well as strategies for going over the problem are subsequently discussed.

4.1. Impact of the minimum wage on total employment and employment status

One of the most frequent questions of impacts of the minimum wage is the employment effect in general, i.e. the impacts on the total employment of the economy. Therefore, we shall firstly discuss the model for effects on the total employment.

One may investigate employment statuses of individuals to learn whether the employment statuses are affected by changes in the minimum wage. This approach is quite straightforward by estimation of a logit model with the dependent variable of working or not, explained by individual characteristics and the minimum wage applied in their locations. However, this is not easy to separate the effects of the minimum wages from other factors of the labor markets. In Vietnam, we have two dimensions of variances of the minimum wage schemes which are expected to have differentiated effects on employments of individuals, variances over time and variance across regions as discussed in Section 3. However, there are factors which are possibly coincidence or mitigate the variances under the models of individuals. Firstly, the net incremental of the working-age population have decreased considerably in the study period as

we discuss in more detail later. Consequently, it increases the working opportunities of all existing people given a momentum of the economy in term of absorbing significantly higher net increases in the working-age population in previous years. Therefore, this trend compromises the negative effects of the minimum wage increases over time, and it is difficult to separate the effects of the two factors when we investigate employment statues of individuals. Secondly, locations with differently applied levels of the minimum wages are quite close to each other, just borders of districts. Therefore, laborers are easy move across districts with different levels of the minimum wages. This fact shall mitigate the effects of the minimum wage variances on the dimension of spatiality.

Therefore, we employ an aggregation model, effects of the minimum wage increases on the total employments of locations over years. This specification shall help use to partially reduce mitigation of the second variance. Meanwhile, inclusions of both total working-age population and proportion of immigrated people of locations as explanatory variables shall partially capture the effects of demographic changes. In more detail, we aggregate employments of each group of districts with the same level of the minimum wages within provinces and estimate this variable against the minimum wages applied for that group of districts and other employment characteristics of the group such as average education of people, ethnicity composition and proportion of immigrants.

Specifically, numbers of employments, S_{djt} , of group of districts d of province j at time t are explained by the following function:

$$S_{djt} = \beta_0 + \text{pop}_{djt}\beta_1 + X_{djt}\beta_2 + MW_{djt}\beta_3 + \pi_{dj} + \tau_{dj} + u_{idjt} \quad (1)$$

pop_{djt} and X_{djt} are number of working-age population and other characteristics of groups of district d in province j and time t ; MW_{djt} is the minimum wage applied for the group of districts at time t . π_{dj} , τ_{dj} are fixed effects of groups of districts, and time fixed effects respectively.

With this aggregation, we have 140 units over the country. Given the availability of LFS over years, we can calculate the data and construct panel data for the units over year. Consequently, fixed effect panel models can be employed.

To capture the possibilities of difference in time trends across groups, interaction between years and groups shall be also included in the models.

$$S_{djt} = \beta_0 + \text{pop}_{djt}\beta_1 + X_{djt}\beta_2 + \ln(\text{MW}_{djt})\beta_3 + \pi_{dj}\beta_4 + \tau_{dj}\beta_5 + \tau_{dj}dj\beta_6 + u_{ijt} \quad (2)$$

The second question deals with transitions across types of employment for who have a job. Ideally, different types of employments based on institutional sectors, statues at work and sectors can be defined. For example, there is a classification of four types of employments of (1) wage work in formal sectors of FDI sector, domestic formal private enterprises and SOE; (2) self-employment in agriculture; (3) self-employment in non-agriculture; and (4) wage work in household businesses is relatively good in capture the context of the economy. However, the short period of study and low frequencies of changes across types of employments cause difficulties in estimations, especially when we work in sub-groups in term of age and gender⁴. Therefore, we only investigate two types of: (1) wage work in the formal sectors; and (2) other type of employments. This classification is still meaningful in two aspects. Firstly, it can answer a question of whether the minimum wage regulation have negative effects on the modernization process, i.e. increase in the proportion of employment in formal sectors, of Viet Nam's labor market. Secondly, it can capture different impacts on different sectors in term of level of exposing to regulations. The formal sectors are normally defined as the covered sector which is directly regulated by the minimum wage schemes. Indeed, wage works in the household business are also objectives of the minimum wage schemes. However, compliance of the regulation in the household businesses is very weak, less than 5% of wage workers in the sector have written contracts. Therefore, exposing to regulation is distinct between the formal sectors and the household businesses.

The approach for the total of employment discussed above can be also applied for this question, for example, we can estimate the numbers of workers working in the formal sectors with the same set of explanatory variables for the case of the total employment. However, this approach shall hide an important component of the modernization process of Viet Nam labor market.

There are two main sources of increasing in the share of wage workers in the total employments in the context of Viet Nam. Firstly, the replacement and net increase of young

⁴ We have tried to estimate the individual fixed effect multinomial logit model with method of Chamberlain (1980). However, estimation results cannot be retrieved for a majority of specifications.

laborers who is often have higher share of working in the formal sectors. Given share of other age groups, for example, over 30 year olds, this process is still result in increase in the higher total share of the wage workers in the formal sector. Secondly, the movements of older workers who initially entered the labor markets with other types of employments to the formal sectors. The first source is relatively natural in the case of Viet Nam but it takes time to replace all current age cohorts. In addition, the net increase of the working age population is slow down, i.e. less young people entering the labor market per year. Therefore, the second source is gradually more important.

As a result, there is a question of whether the increases in the minimum wage have effects on the transition process of employment to formal sectors. This question is better answered with individual data. Fortunately, the panel data of individuals from VHLSS perfectly meet the requirements.

Specifically, employment statuses P_{ikjt} on different types of employment of individual i of type k of group of district d within province j at time t are explained by the following function:

$$P_{ikdjt} = \beta_0 + X_{idjt}\beta_2 + MW_{djt}\beta_3 + \pi_{idj} + \tau_{dj} + u_{idjt} \quad (3)$$

X_{idjt} is characteristics of person i at groups of district d in province j and time t ; MW_{djt} is the minimum wages applied for group of district d in province j and time t . π_{idj} , τ_{dj} are individual, and time fixed effects respectively. Because we introduce the individual fixed effects in the models as discussed in more detail later, we cannot include any location fixed effects. u_{idjt} is unobservable time-variant variables.

To capture the possibilities of differences in time trends across locations, interaction between time and locations shall be included in the models.

$$P_{ikdjt} = \beta_0 + X_{idjt}\beta_2 + \ln(MW_{djt})\beta_3 + \pi_{idj}\beta_4 + \tau_{dj}\beta_6 + \theta_{ir}\tau_{dj}\beta_7 + u_{ijt} \quad (4)$$

Where θ_{ir} is location of individual i . Under this model, k take 1 if the person working as wage earner in the formal sectors and 0 for other types of employments. Consequently, a logit model is suitable for estimation. Given availability of panel data of individuals, the individual fixed effect model is applicable. It is standard to estimate the fixed effect logit model with conditional logit model.

Some economic environmental variables are included in (2) in a number of studies of the same topic. For example, Hohberg and Lay (2015) include provinces' GDP as a control for economic condition differences across locations or Gindling and Terrell (2007) add the value added at industry level to control changes in demand overtime. However, our sample includes people, who initial did not work in previous periods, working environmental variables are impossible. Meanwhile, effects of locational economic conditions are partially captured by the trends.

4.2. Impact of the MW on wage distribution

To answer the second research question, we employ the model of Lee (1999) and the explicit form is from Bosch and Manacorda (2010), Hansen et al. (2015) and Autor et al. (2016).

Intuitively, the functional form of (4) with dependent as the wage of individuals can be applied to investigate impacts of the minimum wages on income distribution by estimating the impacts at different quintiles. However, the observed wages are already affected by the minimum wages. Therefore, the conditional quintiles (on the observed wages) do not reflect the true effects of the MW on the wages at specific quintiles. Consequently, we need the wages without effects of the minimum wages, but it is impossible to observe this wages. Therefore, we face a challenge of missing counterfactual if we evaluate impacts of the minimum wages on the wage distribution. To solve this problem, Lee (1999) develops an approach to estimate the relative ratios across quantiles of the "latent" wage distribution, the distribution without effects of the minimum wage.

The underlining assumption of this approach is that the "latent" distributions of income does not varies in term of shape across times, locations, and types of ownerships. The differences are the means and variances.

Let assume that w_{kdjt}^{*q} is q-th percentile of the latent log wage distribution of sector k of group of districts d in province j and time t, the distribution without the effect of the minimum wages; w_{kdjt}^q is q-th percentile of the observed wage distribution of the same sector, group of districts in the province and time.

It is assumed that there is an existence of a sufficiently high percentile p that at that percentile and higher ones, the minimum wage does not affect the wage. If the minimum wage only has

the censoring effects that wages under the minimum wage are increased exactly to the minimum wage. We have a censoring model as:

$$w_{kdjt}^q - w_{kdjt}^p = w_{kdjt}^{*q} - w_{kdjt}^{*p} \quad \text{if } w_{kdjt}^{*q} \geq MW_{kdjt}$$

$$w_{kdjt}^q - w_{kdjt}^p = MW_{kdjt} - w_{kdjt}^p \quad \text{if } w_{kdjt}^{*q} < MW_{kdjt}$$

MW_{djt} is the minimum wage of group of districts d in province j and time t .

Removing the censoring assumption, $w_{kdjt}^q - w_{kdjt}^p$ is affected the minimum wage and the “latent” income differential, $w_{kdjt}^{*q} - w_{kdjt}^{*p}$.

Let define $MW_{kdjt} - w_{kdjt}^p$ as the “effective minimum wage” and allowing for non-linear effects of the minimum wage. The quadratic term is included to capture dependences of marginal effects the level of the effective minimum wages as followed Lee (1999).

Effects of the minimum wage on the wage distribution can be estimated with:

$$w_{kdjt}^q - w_{kdjt}^p = \beta_{1,q} (MW_{sdjt} - w_{kdjt}^p) + \beta_{2,q} (MW_{sdjt} - w_{kdjt}^p)^2 + \gamma_{k,q} + \delta_{dj,q} + \tau_{t,q} + (\gamma\delta)_{k,j} + (\gamma\tau)_{k,t} + (\delta\tau)_{j,t} + \beta_{x,q} \overline{X_{kdjt}} + \epsilon_{jkt,p} \quad (5)$$

$\overline{X_{kdjt}}$ are averages of the selected individual specific characteristics of sector k of group of district d in province j and time t . $\delta_{dj,q}$ and $\tau_{t,q}$ are groups of district and time factors respectively and terms in parentheses are interactions of these factors.

One of empirical issues is to set p th percentile. Median is studies of the US (Lee, 1999; Autor et al., 2016) use the median. Meanwhile, studies using the same approach often set at higher percentile, for example a study of Leckcivilize (2015) for Thailand, the p is the 60th percentile and Bosch and Manacorda (2010) argue that the threshold should be set at the 70th percentile for the case of Mexico. Therefore, in the current study, we shall conduct some examinations for a valid threshold in the context of Viet Nam.

4.3. Estimation strategies

As noted, the models of employment statuses shall include measures of trends. Initially, trends of groups of districts which have the same level of the minimum wage within provinces is controlled for. However, these trends are possibly too heavy for the models given that we

already employ individual fixed effect models. Therefore, trend of districts with the same levels of minimum wage within geographic regions⁵ of the countries are used when the trends of groups of districts within provinces are impossible.

The model of Lee (1999) discussed above may suffer from a problem of measurement errors. As the observed wages are used to estimate percentiles for both the dependent variable and the effective minimum wage as an independent variable in (3). In addition, if there are shocks that affect both the 60th percentile and differences between specific percentiles and the 60th percentile, the OLS estimation of (3) shall be bias (Autor et al., 2016). Therefore, the two state least square (2SLS) estimation with instrumental variables proposed by Autor et al. (2016) is employed to overcome this. Specifically, the real minimum wage is used an instrumental variable for the effective minimum wage. The square term of the minimum wage and interaction between the minimum wage and average of the median of the wage distribution are used as instruments for the square term of the effective minimum wage.

5. Data and Descriptive Analysis

5.1. Data sources and data construction

In this sub-section, we describe sources of primary data for empirical study, the procedures for calculation of aggregation figures of the model for the total employment effects as well as estimate income percentiles for the model of effects on the wage distribution.

Data used in the current paper is sourced from two survey series: (1) the Vietnam Labor Force Surveys (LFS) and Viet Nam Household Living Standard Surveys, both are conducted by GSO. As panel data can be constructed from the latter survey, it is employed for the investigating the transitions of types of employments. Meanwhile, the large sample sizes of the former survey allows us to aggregate employments for investigating the total employment effects as well as estimate the wage percentiles for groups of districts within provinces for studying effects on the wage distribution.

The LFS is conducted on a monthly basis and the sampling frame is drawn from the 2009 population census. Large sample sizes of more than 500,000 observations for population aged 15 and above per year allow the survey to be representative at the provincial level. Information

⁵ We use 8 geographic regions.

of education, employment status, wages and several demographics factors of individuals are collected. We restrict our sample to 2011-2014 period as we cannot retrieve district identification for identifying grouping districts within provinces for periods before 2011. Meanwhile, the increase in the minimum wage after 2012 has been relatively stable. Put differently, it has been a regular policy. In that context, stakeholders in the economy shall incorporate the predicted changes in the minimum wages in the future to their present decisions or the minimum wage changes to be endogenous. Therefore, if we include a long period, the “endogenous” behaviors of the stakeholders of the economy may make the increases in the minimum wage no longer exogenous. The study of Hansen et al. (2015) restricts the study period from 2011 to 2013 to capture the “shock” increase in the year 2012. We extend one more year of 2014 to be able to include trends in the empirical models.

To estimate the effects on the total employment, we need to calculate the total employment as well as total working-age population of each group of districts within provinces. Individual weights with the total of weights equal the population provided in LFS allow us to calculate these figures.

One may concern about the representative of figures for each group. The LFS surveys represent for rural and urban areas within province separately. The classifications of minimum wage levels are not identical to the urban and rural classification, indeed. Therefore, figures for each group of districts is not fully secure their representativeness. However, the maximum number of groups within a province is three, which is not too low level. Indeed, with 63 provinces, we have 126 representative areas. Meanwhile, we have 140 groups of districts which are modestly higher than the number of representative areas. Of course, the groups of districts are not identical to the urban and rural areas within provinces. Consequently, a number of the groups secure the representativeness and other does not. However, the modest difference between the number of the groups and the number of representative areas implies that the under-representative of some groups of district is not a serious problem.

We restrict our sample to people aged 15 to 65. 15 is the youngest age of laborers defined in the Labor Code of Viet Nam. Meanwhile, 55 and 60 are age for retirements for female and male laborers respectively. However, Oudin et al. (2013) estimate the median ages of stopping working of laborers in Vietnam in 2012 are 64 and 67 for female and male laborers respectively.

Therefore, we select 65 as the restriction for calculating the number of employments for both female and male laborers.

Another term should be defined is working status. By definition of Vietnam, any ones who work for more than 1 hour per week is considered as working. This definition apparently includes part-time jobs. However, our interest is laborers whose working is their main activity, i.e they do not go to school or house-work is not their main activity. To determine this, we base on working times. We only define who works for more than 20 hour per week as having a job, who work for less than 20 hours per week is considered as not having jobs. It is hard to define how many working hours should be applied. One may base on the maximum hours that one can work as part-time jobs, for example, maximum number of hour that one student can work. However, this regulation does not exist in Vietnam. Therefore, we borrow it from other economies, France and Australia in specific, of which the maximum hour that one can work as part-time jobs is 20 hour per week.

Monthly wage and benefits are separately asked for each job. Unfortunately, incomes of self-employed or family workers are not available. Therefore, only compensation of wage earners is included in analysis.

To apply the estimation procedure for investigation of the effects of the minimum wage on the wage distribution as presented in Section 4, we need to select a level of aggregation to estimate the wage percentiles. Location is a base for aggregation as means and variances of the latent wage distribution are allowed to be different across locations. Another criterion is that minimum wage must vary across aggregations. Papers for the United States often select states as the aggregation.

We also start with provinces as the level of aggregation. However, the statutory minimum wages are not homogenous within a province. Therefore, we divide a province into groups of districts based on levels of the minimum wages which are applied for districts. Put differently, districts within a province which have the same statutory minimum wage are grouped into one.

However, groups of districts within provinces for applying the same minimum wage have been only stable since 2012 and it was significantly different from that of the 2011. That, a number of districts classified as the second region for the minimum wage in 2011 has been defined as the

first region since 2012. For example, quarters and a number of districts of Hai Phong city were classified the second minimum wage region in 2011 but they have been considered as the first region since 2012. Consequently, we use the groups of districts since 2012 as the criterion for separation of districts within provinces. This classification secures groups of districts identically overtime. One issue is that the minimum wages in 2011 were different across districts within some groups as they belonged to different minimum wage regions in the year. Therefore, the minimum wage in regressions for the groups of districts which had different minimum wage rates in 2011 is the average of minimum wage rates applied for observations within these groups in 2011.

One problem stemming when we work at sectors within a group of district in a province (hereafter refers as sectors) as well as further separation of gender and age is small number of observations for percentile estimation. If we restrict to sectors with sufficient numbers of observation only, i.e. over 100 observations, bias problem potentially emerge as excluded sectors is mainly in low development regions which have low proportion of wage workers as well as less density population. However, if we include all samples, wage percentiles of the sectors with small number of observations may be imprecisely estimated, for example. Consequently, we select a sample of sectors with 50 observations or more. The reason for dropping sectors with small number of observations is that outliers of estimated percentiles are easy to be arisen when number of observations is small. Indeed, both number of observations and total wage-workers of small sectors account for less than 1% of total observations or total wage-workers⁶.

Since 2011, LFS is conducted on a monthly basic and rotation strategy. A sample of a quarter represents the national wide. Each household is in the two consecutive quarters and then excluded from the sample. Therefore, each observation is theoretically surveyed twice within a year. However, a number of observations of which identifiers indicate that they were surveyed twice but some information such as age or gender are inconsistent between two survey times. In addition, we only keep one observation per year for those surveyed two time. Therefore, we have to clean the data before analysis. The data cleaning procedure as well as keeping one observation for those surveyed twice is presented in Appendix 1.

⁶ The numbers of wage workers are estimated with weights.

VHLSSs are conducted for every two years and followed the standardized content of the Living Standards Measurement Study (LSMS) of the World Bank. The sampling frame is the 2009 population census. With sample size of 9,400 households and about 37,000 individuals, the VHLSS are representative for the whole countries and its 6 regions with further breakdown into urban/rural areas. The survey provides rich information of demographics of households, education of individuals, and employments of each individual aged 6 and above for 12 months before the survey time. This allows us to define employment statuses for individuals.

VHLSS has been also designed as a rotation survey. Theoretically, we can construct two-wave panels of a half of observations and three-wave panel of one quarter of observations for 2010-2012-2014. Attrition rates of VHLSSs are moderate at about 10% as we estimated from previous rounds surveys. Therefore, data of the surveys are suitable for the empirical model of transition across types of employment both in term of data availability and number of observations. As its rotation mechanism, one-fourth of VHLSS 2010 is theoretically resurveyed in 2014. Consequently, there are two panels that we can construct from VHLSS 2010-2012-2014.

The three-wave-balance panel is the balance panel of 2010-2012-2014, the acquired sample size is 6328 individuals ($3 \times 6328 = 18984$ observations). With 37012 of individuals of VHLSS 2010, the theoretical sample size of three-wave-balance panel is about 9250 individuals (as the VHLSS is rotated with a half of re-surveying in the following round, the theoretical three-wave-balance panel is a fourth of the sample in 2010). So, the attrition rate is about 31.6%.

The three-wave-unbalance panel data is constructed as the combination of two-wave panels of 2010-2012 and 2012-2014, the panel includes 6328 individuals of three-wave-balance panel and observations of individuals of two-wave panels of 2010-2012 and 2012-2014. The sample includes 6328 individuals of three-wave balance panel and 17041 individual of two-wave-panels, the total number of observations is 53066. With my rough calculation, the theoretical number of observations for this three-wave-unbalance panel is about 64417 observations in total and the attrition rate is 17.7%.

We prefer the three-wave-unbalance panel as it is a hybrid between the three- wave-balance panel and the pooled cross-sectional sample and have advantages over the two remaining sample. Comparing with the latter panel, the former one have advantages of (1) the sample is significantly larger; (2) the attrition rate is considerably lower; and (3) the sample is better in

reflecting the whole labor market as the lower attrition rate as well as less restrictive groups of individuals. Meanwhile, fixed effect models are still applicable.

Consequently, the total number of observation of the panel sample is 53066, of which 18,984 is three-wave-panel and 34,082 two-wave panel. However, the panel needs to be cleaned as there are potential errors in panel over years. The identification information may not identify the same persons over years. Our cleaning procedure is relatively simple, persons with inconsistent information of birth years and genders are dropped from the sample. The procedure excludes 2697 observations and we have panel of 50369 observations. With restricting ages, and retaining only panel observations, our final sample include 38,360 observations in total

5.2. Descriptive analysis

Minimum wage and incomes

Table 2 presents proportions of wage workers earning below the minimum wages (binding ratio) across groups in the study period. In general, the binding ratios tremendously increase in the study period. The binding ratio for the whole non-farm wage earners increased by more than 3 times after 5 years, from 3.8% to 13%. This increase is observed for all years but at unevenly speed. The breakthrough increase is in 2012, the binding ratio was doubled. These patterns are consistent with pattern of increase in the real minimum wage.

Table 2. Proportion of laborers receiving wage below the minimum wages (%)

	2011			2012		
	All non-farm wage	Non-farm formal	Non-farm informal	All non-farm wage	Non-farm formal	Non-farm informal
All sample	3.78	1.36	6.94	7.87	3.13	14.15
Gender						
Female	6.82	1.82	17.56	12.52	3.75	31.36
Male	1.94	0.99	2.88	4.97	2.60	7.35
Age						
Adult	3.92	1.33	6.75	8.04	3.09	13.61
Young	3.62	1.40	7.23	7.62	3.17	15.08
	2013			2014		
	All non-farm wage	Non-farm formal	Non-farm informal	All non-farm wage	Non-farm formal	Non-farm informal
All sample	10.55	4.24	18.61	11.60	5.06	20.55

Gender						
Female	16.60	5.14	40.94	16.89	5.83	42.14
Male	6.69	3.43	9.75	8.10	4.35	11.83
Age						
Adult	10.61	3.86	18.05	11.71	4.76	19.82
Young	10.46	4.71	19.62	11.44	5.45	21.97

Source: Authors' calculation with data from LFS 2011, 2012, 2013, and 2014

As expected, the binding ratio is higher for female wage earners, compared with their male counterparts. The differences across gender is widened in the absolute term but narrowed down in the relative term. This result can be partially explained by an extremely low binding ratio of the male wage earners in 2011 that only a small gap between the two genders in the absolute term result in large difference in the relative term. It is interesting that the gap in the binding ratio across the two genders is mainly caused by the difference in the informal sector. The differences in the formal sector between the two genders are consistently less than 2% in all years but the gap is 29% in the informal sector in 2015.

The gap between young and adult wage earners is only slightly different and the patterns of different are somewhat the same in formal and informal sectors. Possibly, higher education of new entrants in the labor markets compromises their lack of experiences.

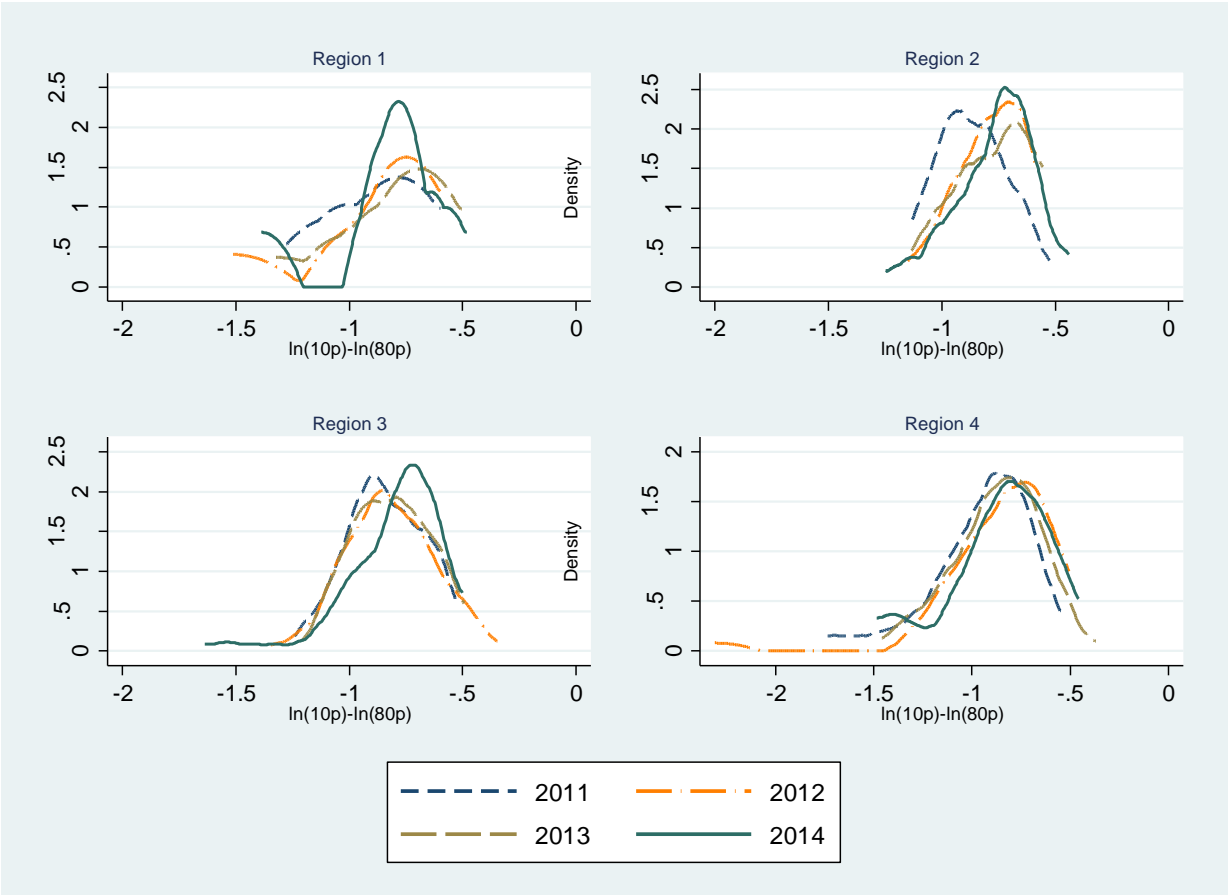
We now turn directly to the gaps between different percentiles. As it is evaluated in detail later, the percentile at which the minimum wage does not affect the "latent" wage is the 80th one. Therefore, we investigate the gaps between different percentiles and this percentile. Beside the changes in the relative percentiles, we also pay attention to the differences across regions to see variances in as one of conditions for estimation (variances in independent variables).

Figure 2a depicts distribution of $\log(p_{10})-\log(p_{80})$ over the study period. As we estimate the distribution for each group of districts with the same minimum wage level within provinces, the number of observations varies across the minimum wage regions. In year 2011, number of observations for the minimum wage regions within provinces are in turn 6, 27, 54, and 47 for the first, second, third and fourth regions . Meanwhile, the corresponding numbers of observations in 2015 are 6, 26, 55 and 46 respectively.

There is two common patterns of changes in gap between $\ln(10p)-\ln(80p)$ in the period. But it should be noted that the small number of observations for the first region and the distribution

of the region is just for reference. Moving to the right of the distribution indicating a narrowing down gap between the two percentiles is observed for the fourth region in 2012, comparing with 2011 but then the gap moved back a little bit for 2013 and 2014. Moving to the right of the distribution in 2012 is also observed for the second region but then the gap has not moved back to the 2011 situation. On the contrary, the distribution of gap is relative stable in the period of 2011-2013 and then moved to the right in 2014 for the third region. In comparisons between 2014 and 2011, there are apparent improvements in the distribution of the gap are observed for the second and third regions. Meanwhile, the improvement for the fourth region is also observed but it is not clear as other regions.

Figure 2a. Distribution of $\log(10p)-\log(80p)$

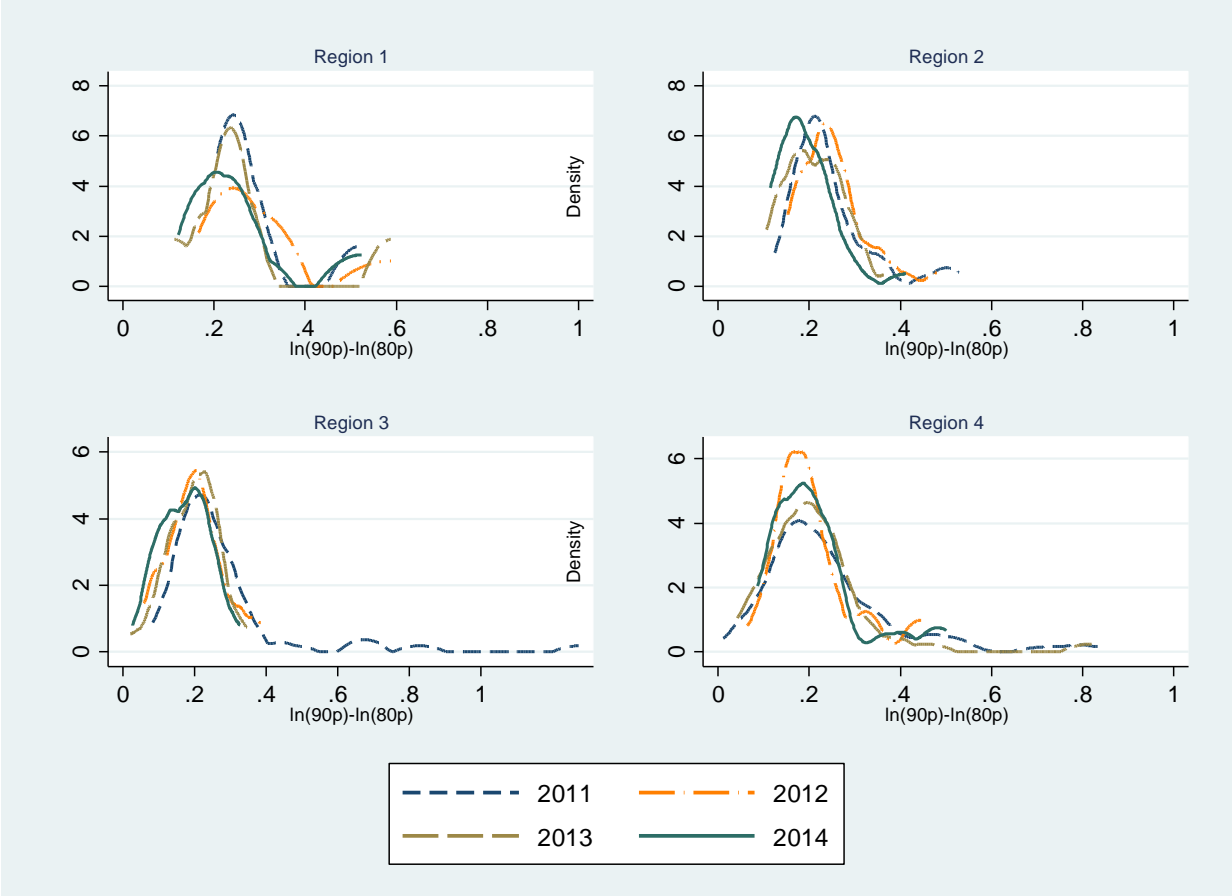


Source: Authors’ estimation with data from LFS 2011-2015

Opposite to patterns of the gap between $\log(10p)-\ln(80p)$ across groups of districts, more changes in the gap between $\log(90p)-\ln(80p)$ is observed for the fourth region and fewer

changes are observed the second and the third regions. Indeed, increase in the gap as the distribution move to the right is only observed for the fourth region. Meanwhile modest reductions in the gap are observed for the second and the third regions. This indicates a compression in the wage distribution. Therefore, distributions of the gap indicate compressions in the wage distribution for the second and the third regions. Meanwhile, the compression is less clear for the fourth region.

Figure 2b. Distribution of $\log(90p)-\log(80p)$



Source: Authors’ estimation with data from LFS 2011-2015

Total employments

Moving to the employment, Table 3 presents proportions of working of population (employment rates) aged 15 to 65 in 4 years from 2011 to 2014. For the whole economy, the rate is considerably declined of more than 2%. However, it should be recalled that one person who is only considered as having a job if he or she worked for 20 hours per week in Table 3.

Furthermore, the decline is gradual over years with the biggest one is the 2011-2012 period. This pattern is oppositely coincident with the increases in the minimum wages that the largest increase was the 2011-2012 period. This decline trend is also observed for all minimum wage regions except the first one, of which the rates increases in 2012 and 2013 and the figure of 2014 is only slightly lower to that of 2011. With these patterns of changes, it is quite ambiguous about the effects of the increases in the minimum wages. Whether the changes in the minimum wage have played a role or the changes have been determined by trends.

In term of gender, there is no clear difference in variances over years in the rates of two sub-groups of the whole economy, the proportions decline at almost the same rates, about more than 2%, in the study period. However, the patterns of variances are different between the two genders across the minimum wage regions. The patterns of changes are somewhat the same between the two genders in the second and the third regions. However, they are different in the first and the fourth regions. In the first region, the rate for the female sub-group slightly increases in 2014, compared with that of 2011. Meanwhile, the significant decline has been observed for the male sub-group. The gradual decline trends are observed for both genders for the fourth regions but the rates of decline are different. Compared with 2011, the rates for the female and male sub-groups in the region in 2014 decrease by 3.7% and 2% respectively. This difference in the changes of the rates for the sub-groups implies a possibility of differences in effects of the minimum wages but there is no indication of directions of the differences.

For age sub-groups, declined patterns are observed for both sub-groups but at different rates. In overall, the rates of decline are 2,6% and 3,2% for young and adult sub-groups respectively. The patterns of changes are also relatively consistent between the two sub-groups across the regions except the first one. In 2012, the rate of the young sub-group in the first region increases but it is decreased for the adult sub-groups. Given these differences, we may expect the effects of the increase in the minimum wage are stronger for the adult sub-group.

Table 3. Working rates of population aged 15-65 (%)

	All	Female	Male	Aged 15-29	Aged 30-65
The whole economy					
2011	76.16	71.68	80.75	62.98	83.05
2012	75.13	70.89	79.46	61.16	81.72
2013	74.59	70.00	79.28	60.72	80.80

	2014	74.03	69.54	78.61	60.39	79.85
Region 1						
		All	Female	Male	Aged 15-29	Aged 30-65
2011	69.94	63.92	76.41	57.38	76.89	
2012	70.35	65.05	76.05	58.45	76.26	
2013	70.16	64.88	75.89	57.17	76.13	
2014	69.27	64.18	74.69	56.43	74.96	
Region 2						
		All	Female	Male	Aged 15-29	Aged 30-65
2011	74.10	69.47	78.96	57.81	82.45	
2012	72.56	68.42	76.90	56.32	80.10	
2013	73.46	69.46	77.70	56.75	81.00	
2014	71.99	67.81	76.30	55.47	78.99	
Region 3						
		All	Female	Male	Aged 15-29	Aged 30-65
2011	75.33	70.59	80.12	60.19	82.75	
2012	74.42	70.09	78.82	58.56	81.37	
2013	73.44	68.73	78.24	57.36	80.22	
2014	73.42	69.20	77.69	57.77	79.78	
Region 4						
		All	Female	Male	Aged 15-29	Aged 30-65
2011	79.73	76.19	83.29	67.95	85.96	
2012	78.20	74.55	81.81	64.70	84.63	
2013	77.33	73.07	81.55	64.74	83.05	
2014	76.93	72.58	81.29	64.57	82.24	

Source: Authors' calculation with data from LFS 2011, 2012, 2013 and 2014

Turning to proportion of the wage works in the formal sectors in the total employment, a significant increase is observed for the whole economy, from 15.9% in 2010 to 20.5% in 2014. As on the way of modernization, the increase in the wage work in the formal sectors seems to be a dominant trend in the Viet Nam labor market. However, patterns of increase in sub-periods still support the argument that the increase in the minimum wage potentially and negatively affects employment in the formal sectors. In 2012, when the minimum wage increases drastically, the increase in the proportion of the wage work in the formal sectors is lower to that of 2014 when the minimum wage increase is more moderate. These results also indicate trends play an important role in determining labor allocation in the studying period that we have to control for.

However, the increase is uneven across regions. The lower level of development, the lower increase in the proportions, that the absolute increase in the first region is more than triple to that of the fourth region. Indeed, the increases in the minimum wages after adjusted for regional price index are highest in the first region and lowest in the fourth region. Therefore, if we do not control for trends, there is a potentiality of a suspiciously positive association between the increases in the minimum wages and the increases in the proportions of the wage work in the formal sectors.

One interesting result is that the increases in the proportion of the wage work in the formal sectors are higher for female and young sub-groups. The increases in these sub-sectors are about double to those of their male or adult counterparts. The growth of the low technology-export industries in Vietnam which is favorable to the female laborers can be a reason for the different increases in term of gender. Meanwhile, higher education and physical strength are also preferences of firms in these industries to employ young laborers; this fact is also a potential reason for the higher increase in the proportion of the young sub-group.

Table 4. Proportion of wage work in formal sectors in the total employment (%)

	All	Female	Male	Aged 15-29	Aged 30-65
The whole economy					
2010	15.90	14.15	17.61	23.96	12.15
2012	17.55	16.40	18.66	27.76	13.31
2014	20.51	20.39	20.62	32.08	16.19
Region 1					
	All	Female	Male	Aged 15-29	Aged 30-65
2010	41.39	39.51	43.22	57.75	33.33
2012	44.27	42.57	45.91	63.64	36.25
2014	49.09	49.05	49.12	69.79	41.30
Region 2					
	All	Female	Male	Aged 15-29	Aged 30-65
2010	20.01	17.70	22.36	32.91	15.04
2012	23.06	22.28	23.86	43.36	15.42
2014	26.97	26.06	27.89	45.62	20.42
Region 3					
	All	Female	Male	Aged 15-29	Aged 30-65
2010	15.04	13.56	16.46	26.12	10.43
2012	17.62	16.44	18.79	31.69	12.09
2014	19.67	19.60	19.73	36.95	13.90
Region 4					

	All	Female	Male	Aged 15-29	Aged 30-65
2010	6.66	4.96	8.33	9.99	5.02
2012	7.29	6.20	8.33	11.28	5.55
2014	8.74	8.74	8.74	13.72	6.78

Source: Authors' calculation with data from VHLSS 2010, 2012, and 2014

6. Estimation results

6.1. Employment effects

Total employment

Empirical results of fixed effect models for effects of the minimum wages on the total employments for the whole population and different sub-groups are presented in Table 5. To capture the potential non-linear association between the minimum wages and employments, we also estimate the model with the square term of the log of the minimum wages. The results of two specifications, with and without trends, are presented given that time fixed effects are included in both specifications. Our preferential models are ones with trends of the minimum wage regions within the geographic regions with and without square term of the minimum wage which are given in columns (3) and (4) of Table 5.

Table 5. Effects of the minimum wages on total employments

	(1)	(2)	(3)	(4)
The whole population				
Minimum Wage (log)	-0.112** (0.055)	-0.809 (0.588)	-0.075 (0.064)	0.028 (1.120)
Minimum Wage (log), square		0.051 (0.042)		-0.008 (0.082)
2011			Base	
2012	0.026 (0.022)	0.020 (0.022)	-0.040 (0.033)	-0.039 (0.034)
2013	0.032 (0.028)	0.021 (0.028)	-0.089* (0.048)	-0.088* (0.050)
2014	0.033 (0.032)	0.017 (0.033)	-0.142** (0.065)	-0.140** (0.068)
Trend	No	No	Yes	Yes
Prob > chi2	0.000	0.000	0.000	0.000
Pseudo R2	0.840	0.841	0.919	0.919
Observations	560	560	560	560
Number of groups of districts	140	140	140	140
Minimum Wage (log) + 2* Minimum Wage (log), square*(mean of Minimum Wage (log))			-0.075	-0.080

Wald test statistics of the total effects equal zero		1.65		0.84
Female				
Minimum Wage (log)	-0.157** (0.067)	-2.062*** (0.684)	-0.079 (0.086)	-1.023 (1.483)
Minimum Wage (log), square		0.140*** (0.049)		0.069 (0.109)
			Base	
2011				
2012	0.043 (0.028)	0.024 (0.027)	-0.014 (0.043)	-0.021 (0.045)
2013	0.046 (0.033)	0.017 (0.034)	-0.043 (0.063)	-0.054 (0.066)
2014	0.049 (0.039)	0.005 (0.040)	-0.073 (0.085)	-0.090 (0.089)
Trend	No	No	Yes	Yes
Pseudo R2	0.779	0.783	0.881	0.882
Observations	560	560	560	560
Number of groups of districts	140	140	140	140
Minimum Wage (log) + 2* Minimum Wage (log), square*(mean of Minimum Wage (log))		-0.056		-0.029
Wald test of the total effect equal zero		0.61		0.07
Male				
Minimum Wage (log)	-0.069 (0.053)	0.326 (0.591)	-0.058 (0.063)	0.551 (1.102)
Minimum Wage (log), square		-0.029 (0.043)		-0.045 (0.081)
			Base	
2010	0.005 (0.022)	0.009 (0.022)	-0.070** (0.031)	-0.065** (0.033)
2012	0.008 (0.027)	0.014 (0.028)	-0.138*** (0.046)	-0.130*** (0.048)
2014	0.005 (0.031)	0.014 (0.033)	-0.210*** (0.063)	-0.200*** (0.066)
Trend	No	No	Yes	Yes
Pseudo R2	0.853	0.853	0.924	0.924
Observations	560	560	560	560
Number of groups of districts	140	140	140	140
Minimum Wage (log) + 2* Minimum Wage (log), square*(mean of Minimum Wage (log))		-0.090		-0.090
Wald test of the total effect equal zero		2.31		1.12
Young				
Minimum Wage (log)	-0.123 (0.080)	-1.468* (0.809)	0.022 (0.102)	-3.802** (1.759)

Minimum Wage (log), square		0.098 (0.060)		0.281** (0.129)
2011			Base	
2010	0.023 (0.033)	0.012 (0.035)	-0.076 (0.050)	-0.108** (0.052)
2012	0.024 (0.042)	0.005 (0.045)	-0.134* (0.075)	-0.184** (0.078)
2014	0.038 (0.048)	0.011 (0.054)	-0.173* (0.100)	-0.247** (0.105)
Trend	No	No	Yes	Yes
Pseudo R2	0.872	0.873	0.931	0.933
Observations	560	560	560	560
Number of groups of districts	140	140	140	140
Minimum Wage (log) + 2* Minimum Wage (log), square*(mean of Minimum Wage (log))				
		-0.056		0.215
Wald test of the total effect equal zero		0.40		2.55
Adult				
Minimum Wage (log)	-0.062 (0.054)	-0.695 (0.566)	-0.062 (0.067)	1.203 (1.162)
Minimum Wage (log), square		0.047 (0.041)		-0.093 (0.085)
2011			Base	
2010	0.012 (0.021)	0.006 (0.022)	-0.024 (0.034)	-0.014 (0.035)
2012	0.015 (0.027)	0.005 (0.027)	-0.061 (0.050)	-0.045 (0.052)
2014	0.008 (0.031)	-0.007 (0.032)	-0.106 (0.067)	-0.083 (0.070)
Trend	No	No	Yes	Yes
Prob > chi2	0.000	0.000		
Pseudo R2	0.841	0.841	0.913	0.913
Observations	560	560	560	560
Number of groups of districts	140	140	140	140
Minimum Wage (log) + 2* Minimum Wage (log), square*(mean of Minimum Wage (log))				
		-0.027		-0.131
Wald test of the total effect equal zero		0.21		2.04

Panel fixed effect models; the dependent variable is log of numbers of people having jobs with working exceeding 20 hours per week in each group of districts with the same level of the minimum wage within provinces, of the total population and each category.

Trend: trends of groups of district with the same level of the minimum wage within provinces. 140 groups in total.

*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' estimation with data from LFS, 2011, 2012, 2013, and 2014.

In general, the coefficients of association between the numbers of employment and the minimum wage are negative. However, only the coefficient in the specification without trends and the first order of the minimum wage is significant at 5%. The change into insignificance of the coefficients in the specification with trends indicates the strong effects of trends in the study period. These results imply that the increases in the minimum wages do not have effects on the total employments.

There contexts of Viet Nam's labor market in the period may be underlining reasons for the result of insignificant effects. Firstly, the demographic trend makes the net incremental of the working-age population have significantly decreased in the period. Results of our calculations from LFSs are that the net increase of population aged 15-65 in 2011, compared with that of 2010 is 942 thousand people, but the net increase reduces to 640 thousands, 312 thousands and 308 thousands in the year 2012, 2013, and 2014 respectively. This significant decline in the net incremental of the working age population in a short period would result in increase of working opportunities for all existing people as the economy have been used to operate with an average- increase of almost 1 million of the net increase in the working-age population per year. Therefore, if there is a factor that is negatively affect employments in the economy. The demographic trend would mitigate the impact.

Secondly, the compliance of labor regulations in Viet Nam is quite weak in general. Our estimation from data of the 2014 enterprise census of GSO indicates that there have been about 40% of enterprises in Viet Nam have not contributed social insurance although it has been compulsory for any contracts of more than three months. Therefore, it is suggested that the compliance of the minimum wage is also not strong.

Indeed, a majority number of enterprises under our qualitative survey in Ha Noi and Ho Chi Minh City reported that real compensations of their workers are higher than the minimum wages. The minimum wage is used only for calculating the compensations indicated in contracts which are the base for contributions of the social insurance, health and other wage related insurances. Under the current regulations in Viet Nam, firms have to contribute about 22% of the compensations indicated in contracts for different types of insurances as listed above. Therefore, when the minimum wage increases, the majority number of firms directly faces only 22% of the increase.

Indeed, firms also have the own schedules of increase in compensations which may be coincidence with the increases in the minimum wages. Therefore, about 60% of firms under the qualitative survey report of no effects of the changes in the minimum wage on their operation. The remaining of 40% said the minimum wage have affected but only a modest level.

The second situation mitigates the impacts of the minimum wage in reality. Meanwhile, the first situation neutralizes the negative impacts of the increases in the minimum wages, if any.

Moving to sub-groups, the coefficients of the minimum wage are also negative in three sub-groups of two genders and adult. However, one again, all coefficients in the specifications with trends are statistically insignificant. The results indicate that the minimum wage does not have effects on employments of these sub-groups.

Meanwhile, the coefficients are only significant in the specification including both the first and the second orders of the minimum wages for the young sub-group. As the square term of the minimum wages included in regressions, it is not direct to have the direction of impact when signs of the estimated coefficients of the first and the second terms of the minimum wage are opposite. In this case, we may estimate the total effects at mean of the minimum wage by the formula: Coefficient of the minimum wage +2*(coefficient of the square term)*(mean value of the minimum wage). The positive result as exhibited in Table 5 indicates positive association between the minimum wage and the employment of the young laborers on average. However, the Wald test for the total effects at the mean of the minimum wage is statistically insignificant. Therefore, one arisen question is that at which level of minimum wage, the total effect is statistically significant. This question can be answered by estimation of the minimum wage levels that the statistic of Wald test is higher than the critical value. With 10% level of statistical significance, the total effect would be significant if the minimum wage is less than 521.5 or higher than 1309 thousands per month.

Transition across types of employment

For the Transition within working people, we estimate the fixed effect conditional logit model with and without the trends. The estimation results with of the whole working people and sub-groups are given in Table 6.

The Pseudo R2 of specifications with and without trends is remarkably different for the transition across types of employments. The Pseudo R2 of the specification with the trends is almost more than double to that of the specification without trend for some cases. In addition, the inclusion of trends in the model alters the significance of the whole model for the case of sub-group of adult laborers. Without trends, the whole model is insignificant. This result confirms the importance of trends in Vietnam’s labor market as noted in Section 5.2.

For the whole working population, the estimated coefficients of the minimum wage and its square term are negative but statistically insignificant in the specification with trend although they are statistically significant in one specification without trends. This results exhibit that increases in the minimum wage does not affect the transition across types of employments.

Estimated coefficients for the sub-groups are negative in some cases that mean negative effects on probability of moving to the formal sectors. However, they are also statistically insignificant. Consequently, it is safe to conclude that the minimum wage increase does not affect the allocation across types of employments for these sub-groups. The weak compliance of regulation in Viet Nam formal sectors is a potential reason for the insignificant result in the model of transitions to the sectors.

Table 6. The effects of the minimum wage on transition across types of employments

	(1)	(2)	(3)	(4)
The whole population				
Minimum Wage (log)	1.363 (1.014)	-27.748** (13.897)	-0.596 (1.487)	-34.072 (25.022)
Minimum Wage (log), square		2.012** (0.957)		2.428 (1.814)
2010	1.000 (0.780)	0.165 (0.876)	1.063 (1.110)	1.070 (1.105)
2012	0.261 (0.299)	0.167 (0.299)	0.527 (0.426)	0.729 (0.447)
2014			Base	
Trend	No	No	Yes	Yes
Prob > chi2	0.000	0.000	0.000	0.000
Pseudo R2	0.0436	0.0467	0.0698	0.0711
Observations	2055	2055	2055	2055
Minimum Wage (log) + 2* Minimum Wage (log), square*(mean of Minimum Wage (log))		0.369		-0.137
Wald test of the total effect equal zero		0.11		0.01

Female				
Minimum Wage (log)	0.853 (1.689)	-6.937 (24.972)	0.775 (2.812)	-1.096 (44.938)
Minimum Wage (log), square		0.537 (1.704)		0.135 (3.235)
2010	0.165 (1.476)	-0.073 (1.768)	1.813 (2.113)	1.810 (2.116)
2012	-0.117 (0.610)	-0.146 (0.626)	0.779 (0.816)	0.789 (0.853)
2014			Base	
Trend	No	No	Yes	Yes
Prob > chi2	0.000	0.000	0.000	0.000
Pseudo R2	0.1218	0.1220	0.1791	0.1791
Observations	747	747	747	747
Minimum Wage (log) + 2* Minimum Wage (log), square*(mean of Minimum Wage (log))		0.0570		0.795
Wald test of the total effect equal zero		0.08		0.08
Male				
Minimum Wage (log)	1.198 (1.323)	-42.020** (17.427)	-1.716 (1.951)	-47.616 (32.884)
Minimum Wage (log), square		2.985** (1.200)		3.329 (2.390)
2010	0.792 (1.105)	-0.578 (1.275)	-0.035 (1.542)	-0.059 (1.569)
2012	0.237 (0.435)	0.031 (0.464)	0.167 (0.604)	0.425 (0.642)
2014			Base	
Trend	No	No	Yes	Yes
Prob > chi2	0.0667	0.0198	0.0000	0.0000
Pseudo R2	0.0349	0.0413	0.0741	0.0763
Observations	1302	1302	1302	1302
Minimum Wage (log) + 2* Minimum Wage (log), square*(mean of Minimum Wage (log))		-0.302		-1.094
Wald test of the total effect equal zero		0.04		0.28
Young				
Minimum Wage (log)	1.068 (1.637)	-47.405* (24.463)	-2.550 (2.476)	-4.596 (50.895)
Minimum Wage (log), square		3.351** (1.690)		0.149 (3.681)
2010	1.190 (1.438)	-0.256 (1.596)	1.888 (2.332)	1.896 (2.330)
2012	0.461 (0.592)	0.273 (0.582)	1.301 (0.996)	1.318 (1.067)
2014			Base	
Trend	No	No	Yes	Yes

	0.0013	0.0012	0.0000	0.0000
Pseudo R2	0.1148	0.1231	0.2169	0.2170
Observations	701	701	701	701
Minimum Wage (log) + 2* Minimum Wage (log), square*(mean of Minimum Wage (log))		-0.574		-2.520
Wald test of the total effect equal zero		0.10		0.98
Adult				
Minimum Wage (log)	2.691** (1.371)	-22.769 (18.856)	1.223 (1.979)	-48.553 (32.759)
Minimum Wage (log), square		1.763 (1.303)		3.615 (2.383)
2010	1.962* (1.027)	1.295 (1.128)	1.580 (1.437)	1.677 (1.443)
2012	0.540 (0.385)	0.486 (0.386)	0.553 (0.531)	0.882 (0.585)
2014			Base	
Trend	No 0.4298	No 0.4342	Yes 0.0000	Yes 0.0000
Pseudo R2	0.0281	0.0304	0.0602	0.0630
Observations	1193	1193	1193	1193
Minimum Wage (log) + 2* Minimum Wage (log), square*(mean of Minimum Wage (log))		1.872		1.968
Wald test of the total effect equal zero		1.56		0.91

The conditional logit model, the dependent variable is working in formal sectors of SOE, domestic private and FDI enterprises versus other types of employment, it takes 1 if the person working in the formal sectors and 0 otherwise.

Trend: groups of district with the same level of the minimum wage within geographic regions.

*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' estimation with data from VHLSS 2010, 2012, 2014

6.2. Impacts on wage distribution

As the square-term of the effective MW included in the estimation, we have to retrieve the total effects the effective MW by the formula introduced in Section 6.1 that the total effect at mean is given by: coefficient of the first order of the effective MW +2*(coefficient of the second order term)*(mean value of the effective MW). Then, the total effects are tested for being different from zero by the Wald test. If the total estimated effects are positive, the increase in the minimum wage compresses the wage distribution to the threshold percentile and vice versa.

We separate sample into the formal sector of SOE, FDI and private domestic enterprises and non-farm household businesses⁷. Unfortunately, tests for detecting the percentile for that the minimum wage does not affect it and higher percentiles are failed in the informal sector of non-farm household businesses. Therefore, we cannot estimate for the sector.

A key assumption of the model is the percentile from that the minimum wage does not affect the “latent” wage distribution; we name it as the threshold percentile. One implication of this assumption is that the effective MW should not affect the gaps between that percentile and higher ones. For the studies in US, the median wage is often used. Meanwhile, other studies for developing countries employ higher percentiles as discussed above. Therefore, we first evaluate which percentile is valid for the context of Viet Nam.

To find the threshold percentile, we have to select specification of the model among alternatives. The models with trends are our preference as its can capture time-variable-local-effects over time. In addition, the effective minimum wage is potentially endogenous. Therefore, it is tested against the endogeneity to see whether OLS estimation is un-biased. If the effective minimum wage and its square term are endogenous, the estimation with instruments is employed to examine the validity of the threshold percentile.

Starting with the 60th percentile as the threshold, of which the result is reported in Appendix 2.1 along with the result with the threshold of the 70th percentile given in Appendix 2.2. We investigate whether the effective MW affects the gaps between the threshold percentile and higher ones. For 70th and 80th percentiles, the endogenous test indicates that the effective MW and its square term are exogenous in estimation for the gaps between these percentiles and the 60th percentile. Therefore, the OLS results are un-biased and the insignificant effects imply that the condition is satisfied. For the 90th percentile, the test indicates the effective MW and its square are endogenous. However, the test for validity of the instrumental variables implies that the instruments are invalid. Therefore, we cannot conclude whether the 60th percentile meet the condition of the model.

Moving to the 70th percentile, the effective MW and its square are endogenous and the instruments are valid for estimation of both percentiles of 80th and 90th. The estimation results

⁷ In literature, the agricultural sector is not considered as the informal sector. Only informal non-farm activities are regarded as the informal activities. Therefore, we also exclude the agricultural sector from the informal sector.

with the instruments imply that the effective MW has significant effects on the gaps between percentiles of 80th and 90th and the 70th one. Therefore, the threshold of 70th percentile violates the condition.

However, the 80th percentile satisfies the condition. The effective MW and its square term are endogenous and the instruments are valid. The estimation result indicates that effect of the effective MW and its square term on gap between 80th and 90th percentiles is statistically insignificant or the condition is met. Therefore, the 80th is selected as the threshold.

The total effects of the effective MW on the gaps between different percentiles and the 80th percentile as well as statistics of relevant tests are given in Table 7. For the whole population, there are two percentiles of 20th and 30th of which the effective MW and its square term are endogenous but the instruments are invalid. Meanwhile, remaining percentiles of the left to the 80th percentile are not suffered from the endogenous problem. OLS estimation is un-biased for these percentiles as a consequence.

All effects⁸ are statistically significant at 1% level that indicates a strong association between the effective MW and the wage distribution. The positive effects indicate a “compress” effect or the increase in the MW shall narrow downs the gaps between the lower percentiles to the 80th percentile. Furthermore, the decreasing values of the effects for percentiles closing to the 80th percentile imply that the effects are stronger for percentiles which are far from the threshold. This result is similar to that reported in Hansen et al. (2015) that more “compress” effects are found for low percentiles. As the thresholds are different, the median in Hansen et al. and the 80th percentile in the current study, we cannot compare the magnitude of the effects. However, the trends of the effects are similar.

We now turn to effects of the minimum wage on the wage distribution of the sub-groups. The results with the threshold of 80th percentiles of the sub-groups with trends are reported in Table 7. The results of the same specifications without trends are provided in Appendix 3. We firstly evaluate whether the condition of no effects on higher percentiles are satisfied, i.e whether the effects of the effective MW and its square term on the gaps between 80th and 90th

⁸ For the effects of the 20th and 30th percentile, the instruments are invalid but positive associations between the effective minimum wage and the gaps between these percentiles and the 80th percentile are depicted in both OLS and instrument estimations. Therefore, we can tentatively argue that the positive association is also found for these percentiles.

percentile are significant. One again, depending on whether the effective MW and its square term are endogenous, the OLS estimation or the estimation with the instruments are used for evaluation. For sub-groups in terms of age, the OLS estimation is un-biased as the endogenous test implies there is no endogeneity. In addition, the effects on the gap between 80th and 90th percentiles are statistically insignificant. Therefore, 80th percentile satisfies the condition for these sub-groups. The effective MW and its square term are endogenous in estimation of the gap between 80th and 90th percentiles for the female sub-group but the instruments are valid. Furthermore, the effects of the effective MW on the gap in the result of the estimation with instrument are statistically insignificant. This result implies that the 80th percentile also meets the condition for the female sub-group. Meanwhile, the result of the endogenous test indicates that OLS estimation for the gap between 80th and 90th percentiles is un-biased in the male sub-group. However, the OLS estimation result shows that the effective MW significantly associates with the gap. Consequently, the results for the male sub-group are not reliable and we cannot make comments on the results for the sub-group.

Table 7. Association between $\log(p) - \log(80p)$ and $\log(\text{minimum wage}) - \log(80p)$ at select percentiles of the wage distribution, specification trends.

	OLS	Instrument variable	Durbin test statistics	Wu–Hausman test statistics	Statistics of test of over-identification
The whole wage earners					
10p	0.7863***	0.4697	2.737	1.058	
20p	0.6749***	1.5027*	8.733**	2.909*	2.760*
30p	0.6875***	1.3397**	7.272**	2.522*	3.933**
40p	0.5812***	1.0312**	3.303	1.078	
50p	0.5294***	0.628**	0.247	0.087	
60p	0.4202***	0.5349**	0.327	0.101	
70p	0.2583***	-0.1418	4.361	1.375	
90p	-0.1054	1.6936	16.899***	4.956***	0.041
Female					
10p	0.8511***	0.8331***	2.084	0.620	
20p	0.6861***	0.6499***	2.231	0.611	
30p	0.6222***	0.6233***	0.018	0.005	
40p	0.6414***	0.5779***	2.397	1.046	
50p	0.5377***	0.5168***	0.961	0.349	
60p	0.4335***	0.3143***	8.163**	1.522	
70p	0.2345***	0.0953	15.036***	2.574*	0.132
90p	0.0082	0.2485	7.791**	2.110	
Male					

10p	0.6783***	-1.1392	5.200*	3.570**	0.172
20p	0.7246***	-0.0609	2.417	0.610	
30p	0.706***	-0.529	8.718**	2.580*	0.503
40p	0.6467***	-0.6743	12.718***	3.962**	0.354
50p	0.5562***	-1.1817	21.528***	7.255***	0.026
60p	0.4193***	-0.7653	12.613***	2.588*	0.001
70p	0.2208***	-0.4729	5.836*	0.872	
90p	-0.3766***	-1.4706	2.721	0.898	
Young					
10p	0.8974***	0.4969**	2.832	0.658	
20p	0.6376***	0.6652***	0.284	0.074	
30p	0.5697***	0.6204***	4.068	0.818	
40p	0.5521***	0.6401***	7.577**	2.469*	15.195***
50p	0.4811***	0.5337***	2.689	0.695	
60p	0.4216***	0.4892***	2.298	0.658	
70p	0.3199***	0.5565***	5.360*	0.886	
90p	-0.073	0.2199	1.783	0.282	
Adult					
10p	0.8162***	0.6882***	0.302	0.106	
20p	0.7588***	0.5089**	2.907	0.683	
30p	0.703***	0.3534	6.502**	1.608	
40p	0.6059***	0.1641	13.727***	5.089***	1.013
50p	0.5541***	-0.2082	33.715***	13.313***	0.268
60p	0.4684***	-0.011	16.372***	7.709***	0.047
70p	0.247***	0.1803	2.413	0.995	
90p	-0.0787	-0.3732	3.941	1.685	
Year fixed effect	Yes	Yes			
Group of district fixed effects	Yes	Yes			
Trends	Yes	Yes			
*** p<0.01, ** p<0.05, * p<0.1					

Source: Authors' estimation with data from LFS 2011-2014

For results of endogeneity test as well as validity of instruments of other percentiles for female, young and adult sub-groups, we have either no endogeneity or valid instruments for endogenous cases, except the 40th percentile for the young sub-group. Therefore, we have unbiased estimation results for almost percentiles of three sub-groups.

Comparing between the results for the young and adult sub-groups, the effective MW have stronger effects for the sub-group of young workers although the positive effects, i.e. the “compress” effects are found in both sub-groups. The effects are only significant for the gaps

between the two lowest percentiles and the 80th percentile for the adult sub-group. Meanwhile, the effects are statistically significant up to 70th percentile for the young sub-group. In addition, the magnitudes of the effects are also larger for the young sub-group. It is understandable that effects are stronger for the sub-group of young workers as their wage is lower compared with their adult counterparts. Therefore, their wage is more likely affected by the minimum wage.

Conclusion

The current paper investigates impacts of the changes in the minimum wage schemes of Vietnam in recent years on the employments and wage distribution of the different groups in term of age and gender. Appropriate techniques of fixed effects with trends and instrumental variables have been employed to apply to data of VHLSSs 2010, 2012, 2014 and LFSs 2011 to 2014.

Trends play important roles in determining both total employments, transitions across types of employments and wage distributions. Estimation results exhibit that inclusions of trends can alter the results considerably both in term of directions of impacts and statistical significance of the estimated coefficients in some cases.

The increase in the minimum wage has no effect on the total employments as well as transitions across types of employments for the whole population as well as its sub-groups. Negative direction of impacts is detected but they are all statistically insignificant. Decrease in net incremental of working-age-population of the economy and the weak compliance in the labor market are two factors which partially mitigate the negative impacts of the increases in the minimum wages on the total employments as well as transitions for the formal sectors of laborers. The results on the total employments are somewhat different to those reported in previous works for Vietnam. However, our alternative specifications detect that the differences in the results are attributed to the inclusion of trends in the panel fixed effects models in the current study.

In term of impacts on wage distribution, various tests of endogeneity as well as assumption of the approach are conducted to secure reliability of results. The 80th percentile instead of lower ones as often used in other studies is the valid percentile which satisfies the key assumption of

the used model. This percentile is also valid for female, young and adult sub-groups. However, it is not valid for the male sub-group. Therefore, we do not estimate the impact for the sub-group.

The results imply that the minimum wages have the effects on the whole sample of wage earners in the formal sectors as well as sub-groups. The increases in the minimum wages result in more compression of the wage distribution. Put differently, the increase in the minimum wage reduces the gaps between lower percentiles to the 80th percentile. Furthermore, the reductions in the gap decrease for percentiles which are closer to the threshold percentile. Broader effects are found for the young sub-group, compared with the adult counterparts. The minimum wages have both impacts on higher percentiles, instead of low percentile for the adult sub-group, and the larger magnitudes in the young sub-group.

Reference

- Autor, D. H., Manning, A, and Smith, C. L. (2016), "The Contribution of the Minimum Wage to US Wage Inequality over Three Decades: A Reassessment", *American Economic Journal: Applied Economics*, Vol. 8(1), pp. 58–99.
- Betcherman, G. (2015), "Labor Market Regulations: What do we know about their Impacts in Developing Countries?", *The World Bank Research Observer*, Vol.30(1).
- Brown, C. (1999), "Minimum wages, employment, and the distribution of income", in Ashenfelter, O. and Card, D. (Eds), *Handbook of Labor Economics*. North-Holland Publisher, Amsterdam, Holland.
- Bosch, M and Manacorda, M., (2010), "Minimum Wages and Earnings Inequality in Urban Mexico", *American Economic Journal: Applied Economics*, Vol. 2(4), pp. 128-49.
- Card, D., and Krueger, A. B., (1994) "Minimum wages and employment: A case study of the fast-food industry in New Jersey and Pennsylvania." *American Economic Review*, Vol. 84(5), pp: 772–793.
- Del Carpio, X. and Pabon, L., (2014), "*Minimum wage policy : lessons with a focus on the ASEAN region*". Washington, DC ; World Bank Group.
- Hansen, H, Rand, J. and Torm (2015). "The Impact of Minimum Wage Adjustments on Vietnamese Workers' Hourly Wages". International Labor Office, forthcoming.
- Hohberg, M. and Lay, J. (2015), "The impact of minimum wages on informal and formal labor market outcomes: evidence from Indonesia", *IZA Journal of Labor & Development*, Vol 4(14).
- Leckcivillize, A. (2015), "Does the minimum wage reduce wage inequality? Evidence from Thailand", *IZA Journal of Labor & Development*, Vol. 4 (21)
- Lee, D. S. (1999), "Wage inequality in the United States during the 1980s: Rising dispersion or falling minimum wage?", *The Quarterly Journal of Economics*, Vol. 114 (3), pp. 977-1023.
- Lemos, S. (2007), "Minimum Wage Effects across the Private and Public Sectors in Brazil", *Journal of Development Studies*, Vol. 43(4), pp: 700-720.
- Maloney, W. F., and Mendez, J. N. (2004), "Measuring the Impact of Minimum Wages: Evidence from Latin America.", In J. Heckman and C. Pagés (eds.), *Law and Employment: Lessons from Latin America and the Caribbean*. Chicago: University of Chicago Press.
- Montenegro, C., and Pages, C. (2004), "Who Benefits from Labor Market Regulations? Chile 1960-1998," In J. Heckman and C. Pagés (eds.), *Law and Employment: Lessons from Latin America and the Caribbean*. Chicago: University of Chicago Press.
- Neumark, D. and Wascher, W. (2007), "Minimum wages and Employment", *IZA Discussion Paper*. No. 2570. Institute for the Study of Labor (IZA). Bonn.

Neumark, D, Salas, J. M. I. and Wascher W., (2014), “Revisiting the Minimum Wage—Employment Debate: Throwing Out the Baby with the Bathwater?”, *Industrial Relations & Labor Review*, Vol. 67(3), pp: 608-648.

Nguyen, N. A, Nguyen, T. T., Nguyen, T. H., Trinh, T. T. N and Nguyen, V. T., (2015), “Labour market transitions of young women and men in Viet Nam”, *Work4Youth Publication Series No. 27*, International Labour Office, Geneva.

Nguyen, C. V. (2010). “The impact of Minimum wage increase on employment, wages and expenditures of low-wage workers in Vietnam”, *MPRA Working Paper*.

Nguyen, C. V. (2014). “Do Minimum Wages Affect Firms’ Labor and Capital? Evidence from Vietnam”, *IPAG Working Paper series*, Nol. 2014-179.

Oudin X., Pasquier-Doumer, L., Roubaud, F., Pham Minh Thai and Vu Hoang Dat (2013), “Adjustment of the Labor Market in Time of Economic Fluctuations and Structural Changes”, Chapter 6 in Vietnam Economic Annual Report 2013 “*On the Bumpy Road to Future*” edited by Nguyen Duc Thanh. Hanoi National University Publisher, 2013.

World Bank Viet Nam, (2015), “Điểm lại tình hình phát triển kinh tế Việt Nam: Chuyên mục về Thị trường Lao động – Xây dựng các Quy định vàT hể chế Thị trường Lao động Hiện đại tại Việt Nam (Viet Nam taking stock: Special issue for Labor Market- constructing modern regulations and institutions for labor market in Viet Nam”. Available at: [http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2015/07/16/090224b0830000b1/1_0/Rendered/PDF/Diem0lai000cap0en0kinh0te0Viet0Nam0.pdf].

Appendix 1: Data cleaning

As only wage is available in LFS, only wage earners are kept. Then we follow the data cleaning procedure of Hansen et al. (2015) with some modification.

Consistencies in typical personal characteristics are firstly checked. Observations are surveyed twice (identifying via household and personal ID) of which differences in age or education across two times of surveys are larger than 1 are dropped. Duplication observations which are inconsistent in term of birth year, gender and ethnicity are also dropped.

In the last step, duplication observations in term of birth year, gender, ethnicity and working sectors (and age or education differences by only one as the maximum) are retained one by means of the two observations.

Appendix 2.1. Association between $\log(p) - \log(60p)$ and $\log(\text{minimum wage}) - \log(60p)$, specification with trends.

	OLS	Instrument variable	Durbin test statistics	Wu–Hausman test statistics	Statistics of test of overidentification
The whole wage earners					
10p	0.4661***	0.5794***	3.898	1.655	
20p	0.3802***	0.6615***	10.840***	5.549***	0.061
30p	0.3801***	0.5752***	9.175**	5.171***	0.498
40p	0.2298***	0.4097***	13.436***	7.966***	3.572*
50p	0.1889***	0.2772***	4.573	1.368	
70p	-0.0517	-0.0708	1.234	0.462	
80p	-0.0739	0.0642	2.466	0.929	
90p	-0.0414	0.4644**	11.554***	2.946*	4.859**

*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' estimation with data from LFS 2011, 2012, 2013 and 2014

Appendix 2.2. Association between $\log(p) - \log(70p)$ and $\log(\text{minimum wage}) - \log(70p)$, specification with trends.

	OLS	Instrument variable	Durbin test statistics	Wu–Hausman test statistics	Statistics of test of overidentification
The whole wage earners					
10p	0.5759***	0.6849***	3.254	1.417	

20p	0.5224***	1.0469***	14.481***	5.099***	1.371
30p	0.5185***	0.9184***	12.284***	4.759***	2.165
40p	0.392***	0.7616***	11.762***	4.226**	4.502**
50p	0.353***	0.572***	5.7556*	2.080	
60p	0.2119***	0.399***	6.386**	1.508	
80p	-0.0268	0.2739*	10.472***	4.033**	0.523
90p	-0.0458	1.016**	23.856***	7.418***	0.547

*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' estimation with data from LFS 2011, 2012, 2013 and 2014

Appendix 3. Association between log(p) – log(80p) and log(minimum wage) – log(80p) at select percentiles of the wage distribution, specification without trends.

	OLS	Instrument variable	Durbin test statistics	Wu–Hausman test statistics	Statistics of test of overidentification
The whole wage earners					
10p	0.5616***	0.2496	3.273	0.969	
20p	0.5748***	0.2988	3.044	0.829	
30p	0.5985***	0.3332*	3.336	1.643	
40p	0.5217***	0.213	4.954*	2.266	4.300**
50p	0.4837***	0.1243	9.931***	6.357***	2.614
60p	0.398***	0.2101	4.580	2.672*	7.499***
70p	0.2548***	0.0527	6.197**	3.924**	3.730*
90p	-0.0714	0.3895	7.924**	4.159**	0.000
Female					
10p	0.6236***	-0.1718	3.866	2.211	
20p	0.5154***	-0.2771	7.860**	4.580**	0.003
30p	0.4787***	-0.2801	8.779**	5.760***	0.014
40p	0.4946***	-0.1479	8.577**	4.866***	0.102
50p	0.4226***	-0.0863	6.408**	3.125**	0.223
60p	0.346***	-0.1487	7.472**	3.799**	0.212
70p	0.1731***	-0.1919	4.806*	2.418*	0.089
90p	0.0402	0.5784	2.289	0.796	
Male					
10p	0.7003***	0.7733***	0.844	0.322	
20p	0.7119***	0.8118***	1.772	0.771	
30p	0.6654***	0.6687***	1.858	1.848	
40p	0.5951***	0.4989***	2.914	3.000*	7.234***
50p	0.5467***	0.3712***	6.104**	6.929***	7.574***
60p	0.4142***	0.3254***	4.493	5.922***	4.681**
70p	0.2394***	0.2006***	2.775	1.525	
90p	-0.3344***	-0.2811*	0.270	0.118	

Young					
10p	0.5772***	0.3389	1.543	0.746	
20p	0.5165***	0.1275	4.955*	1.677	8.110***
30p	0.4725***	0.1501	4.864*	1.736	5.209**
40p	0.4521***	0.1967	4.529	2.274	
50p	0.3829***	0.1	6.982**	4.347**	4.482**
60p	0.3413***	0.0858	6.588**	4.622**	3.010*
70p	0.2589***	0.1757	1.035	0.753	
90p	-0.1613	0.1516	1.403	0.417	
Adult					
10p	0.6882***	0.7084***	0.231	0.152	
20p	0.6489***	0.5459***	1.356	0.489	
30p	0.6147***	0.4661***	3.274	1.239	
40p	0.5457***	0.3681***	4.528	3.059**	6.772***
50p	0.4948***	0.2647**	9.227***	5.058***	4.692**
60p	0.4102***	0.3217***	2.816	3.856**	10.565***
70p	0.239***	0.2449***	1.929	2.052	
90p	-0.1195**	-0.3276**	4.368	3.896**	0.138
Year fixed effect	Yes	Yes			
Group of district fixed effects	Yes	Yes			
Trends	No	No			

*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' estimation with data from LFS 2011, 2012, 2013 and 2014