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The Impact of Minimum Wages on Employment: Evidence from a Lower Middle-Income Country

Cuong Viet Nguyen*

Abstract

In this study, we examine the impact of minimum wages in Vietnam using individual-level data from the 2012-2020 annual Labor Force Surveys. During this period, the average real minimum wage increased by around 4% per year. Overall, we do not find significant effects from minimum wages on employment and monthly wages. However, we find a considerable negative effect on workers' total working hours. Working hours per week are reduced by 0.38% for a 1% increase in the minimum wage. Since total wages remain unchanged, a reduction in working hours results in an increase in hourly income. A 1% increase in the minimum wage leads to a 0.32% increase in hourly wages. Interestingly, for workers earning below minimum wage, we find a positive effect from minimum wages on their monthly income. A 1% increase in the minimum wage increases monthly income of workers earning below minimum wage by 0.83%.

Keywords: Minimum wages; employment; labor productivity; impact evaluation; Vietnam.

JEL classification: J31, J50, O12

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1. Introduction

Although the minimum wage applies in most countries, there is always debate whenever it is adjusted. Increasing the minimum wage is expected to improve the living standard of low-income workers. However, firms can respond to an increase in the minimum wage by cutting back on their labor force to cope with the increase in labor costs. As a result, there can be an unintended disemployment effect on low-wage workers that minimum wages aim to protect (Hamermesh, 1986; Brown, 1999). Understanding whether minimum wages are beneficial or detrimental to workers, especially those on low incomes, is an important question not only for policy makers but also for researchers.

This study presents empirical findings for the impact of minimum wages on employment and the wages of workers in Vietnam using individual-level data from the 2012-2020 annual Vietnam Labor Force Surveys (henceforth referred as to LFSs). Our identification strategy relies on the variation in the minimum wage over districts and time.¹ We merge individual-level data from LFSs with district-level minimum wage data and apply regressions, controlling for year, district and province-year fixed effects. Overall, we do not find that a minimum wage has a significant effect on employment or on the monthly wages of workers. However, we find robust evidence that the minimum wage reduces working hours and increases hourly wages. Specifically, a 1% increase in the minimum wage reduces the number of work hours per week by 0.38%. Since the minimum wage has no effect on total wages, a reduction in working hours implies an increase in hourly income. A 1% increase in the minimum wage results in a 0.32% increase in hourly wages. This suggests that, rather than reducing the number of workers, employers may respond to minimum wage increases

¹ For administrative purposes, Vietnam has 63 provinces covering 713 districts.

by reducing employees' work hours. Higher hourly wages also indicate higher labor productivity as a result of minimum wages. For workers earning below minimum wage, we find that the minimum wage has a positive effect on their monthly income. A 1% increase in the minimum wage increases the monthly income of workers earning below minimum wage by 0.83%.

Our study is expected to make two empirical contributions to the literature on the minimum wage. Firstly, current studies show mixed evidence for the effect of minimum wages on income and employment (see reviews by Belman and Wolfson, 2014; Broecke et al., 2017; Neumark, 2018). Empirical studies in the US indicate that if the minimum wage increases by about 10%, employment decreases by about 1% to 3% (see, for example, Brown et al., 1982; Brown, 1999; Card and Krueger, 1995; Neumark and Wascher, 2007; Clemens and Wither, 2019). However, recent empirical studies suggest that minimum wages have no negative effect on employment (Neumark and Wascher, 2007). If employers can pass on the increase in labor costs due to minimum wages to the price of the final product, or if the minimum wage is relatively low compared with the market wage, the impact of the minimum wage on employment is negligible. There are many empirical studies showing that a minimum wage does not affect employment; typical studies are those of Gudibande and Jacob (2020), Dube (2019), Hohberg and Lay (2015), Dinkelman and Ranchhod (2012), Katz and Krueger (1992), Card and Krueger (1994, 2000), and Rama (2001). Our study shows that moderate increases in the minimum wage do not affect employment or total wages in a lower-middle income country. Moreover, the existence of a minimum wage even helps workers earning less than the minimum and increases their total income.

Secondly, there is a growing body of recent literature that has studied the effect of minimum wages on labor productivity (e.g., Rizov et al., 2016; Riley and Bondibene, 2017; Ku, 2022; Badaoui and Walsh, 2022; Coviello et al., 2022). The minimum wage can increase labor productivity by increasing the effort workers make and boosting investment in capital and technology. Our study shows that the total wages of workers are not affected, while their work time is reduced and as a result, their hourly wage increases significantly. Although we do not have accurate measures of labor productivity, such as employee output per time unit or 'value added' per employee, the increase in workers' hourly wages may indicate an increase in labor productivity. Most studies on the impact of minimum wages on labor productivity focus on high-income countries, such as the US and the UK. Our study is one of the first attempts to provide supportive evidence for the positive effect of minimum wages on labor productivity in a middle-income country.

Vietnam is an interesting case study. Minimum wages are set on a monthly basis for 4 geographical regions in Vietnam. Districts are classified into these four regions, and minimum wages differ across districts according to the four regions. Adjustments are made annually not only to minimum wage levels but also to the list of districts in each minimum-wage region. This allows for variation in the minimum wage across districts over years. During the 2012–2020 period, the average real minimum wage increased by around 4% per year.² Compared to the median as well as to mean wages, minimum wages increased at a higher rate during the 2012-2016 period but at a slower rate in the following period. The ratio of the average minimum wage to the median wage was equal to 49.1% in 2012, increased to

² Our calculation using data on minimum wages in Vietnam. Regional minimum wage levels and the list of districts in each minimum wage region are adjusted and issued in annual government decrees (Government of Vietnam, 2012-2019).

a peak of 64.2% in 2016, then decreased to 58.3% in 2020. As in other countries, raising the minimum wage is always controversial in Vietnam. Opinions that favor minimum wage increases argue that a minimum wage helps low-income earners and their dependents to improve their living standards, raise labor productivity, and reduce turnover. However, some are concerned that increases in the minimum wage may cause firms to reduce their demand for labor. Higher labor costs also make it difficult for companies to improve their competitiveness in the global market, especially in view of Vietnam's closer international integration and the COVID-19 pandemic. Consequently, empirical findings for the impact of the minimum wage on employment using more updated data are very important for policy debate on minimum wage adjustments.

Several studies have evaluated the effect of increases in the minimum wage in Vietnam. For example, Nguyen (2013) and Nguyen (2017b) show that the impact of the 2005 minimum wage increase on workers' labor and firm profits was negligible. Nguyen (2017a) assesses the impact of regional minimum wages in the 2008-2010 period and shows that an actual 10% minimum wage increase reduced the number of company employees by about 1%. More recently, using the 2012 to 2014 Labor Force Surveys, Hansen et al. (2016) find that minimum wages reduce national wage inequality. However, the effect on wage inequality differs between the formal and informal sectors. The minimum wage reduces wage inequality in formal sectors by increasing wages at the lower end of the distribution, but increases wage inequality in informal sectors by increasing wages at the upper end of the distribution. Compared with previous studies on Vietnam, our study uses more recent data sets and looks at the impact of minimum wages on a larger number of employment outcomes.

This paper is structured into six sections. Section 2 introduces the data sets used, Section 3 presents descriptive statistics of employment and minimum wages in Vietnam, Sections 4 and 5 present the estimation method and the empirical results for the impact of minimum wages, respectively, and finally, Section 6 concludes.

2. Data set

This study uses recent data from the Vietnam Labor Force Surveys (henceforth referred to as LFS) from 2012 to 2020. Common regional minimum wages have been applied for domestic and FDI firms since 2012. Using a two-stage stratified cluster design, LFSs have been conducted annually by the General Statistics Office (GSO) of Vietnam. There are 126 strata, comprising urban and rural areas making up the 63 provinces throughout the country.³ The list of enumeration areas is based on the most recent Population and Housing Census (in 2009) or Inter-census Population and Housing Survey (in 2014).

First, the number of enumerated areas in each stratum is selected by the method of probability proportional to size. In the second stage, 15 households are randomly selected from each area enumerated.

LFSs are representative at the national, urban-rural, and provincial levels,⁴ and are also representative for estimates at quarters. The sample size is around 800,000 individuals. LFSs contain basic demographic information (age, gender, and education) for all individuals. People 15 years of age and above are surveyed for detailed information on characteristics of

³ At the highest level of administrative division, Vietnam consists of 58 provinces and 5 central cities or municipalities. A province is divided into districts, and a district is further subdivided into communes or wards. In 2018, there were around 700 districts and 11,000 communes.

⁴ In Vietnam, the Vietnam Household Living Standard Surveys (VHLSSs) also contain data on employment. Compared with VHLSSs, LFSs offer a significantly larger sample size and are representative at the provincial level, not just the regional level as with the VHLSSs. Moreover, the LFSs contain more information on employment and work than VHLSSs. Thus, we use LFSs instead of VHLSSs in this study.

employment, monthly wages, and the number of working hours during the past 7 days. In this study, we focus on a sample of people aged 15 and over (i.e., people of working age in Vietnam).

3. Minimum wages in Vietnam

According to Vietnam's Labor Code, the minimum wage is the lowest wage paid to employees for doing the simplest jobs under normal working conditions, ensuring a minimum standard of living for employees and their families. Following suggestions from the Minimum Wage Setting Convention No. 131, factors that are considered in setting minimum wages include the needs of workers and their families, economic growth, inflation and labor productivity. According to the 2019 Labor Code of Vietnam, "The minimum wage is adjusted based on the minimum standard of living of workers and their families; the correlation between the minimum wage and market wages; the consumer price index and economic growth rate; labor supply and demand relationships; employment and unemployment; labor productivity; the company's ability to pay".⁵ The minimum wage is set on a monthly basis. Since 2022, however, in addition to the monthly minimum wage, hourly minimum wages also are regulated by the government (Article 91 of Vietnam's 2019 Labor Code).

In Vietnam, minimum wages have been adjusted annually since 2008. Before 2008, there was a single minimum wage for workers (see Nguyen, 2013; 2017b). Since January 2008, minimum wages have been set according to four geographical regions. The minimum wage differs by region due to differences in living costs between regions. During 2008-2011,

⁵ The Government sets minimum wages according to the recommendation of a tripartite National Wage Council, whose members represent three parties: (1) the Ministry of Labor, War Invalids and Social Affairs Association, (2) the Vietnam General Confederation of Labor, and (3) employers' associations.

different minimum wages were set for workers in the domestic sector and those in the foreign sector. The minimum wage in the foreign sector was around 40% higher than that in the domestic sector (Nguyen, 2017a). Since 2012, a common regional minimum wage has applied to both domestic and foreign sectors.

Vietnam has 63 provinces covering 713 districts. The minimum wage varies across districts according to the four regions, depending on their economic level.⁶ Provincial People's Committees submit to the government a list of their districts in the four regions. The minimum wage for each region is updated annually. In addition, the list of districts in the four minimum wage regions is also adjusted. Regional minimum wage levels and the list of districts in each minimum wage region are specified in annual government decrees (Government of Vietnam, 2012-2019). For this study, we manually collected data on minimum wages from these decrees for 723 districts, and merged this information with individual-level data in the LFS data. Figure 1 presents the geographic map of districts in the four minimum wage regions in 2012 and 2020. The number of districts in the lowest minimum-wage region decreased over this period, while the number of districts in higher minimum-wage regions increased. In 2020, the highest minimum-wage region covered 11% of districts. The second and third highest minimum-wage regions covered 12% and 21% of districts, respectively. The region with the lowest minimum-wage level accounts for 56% of districts.

[Figure 1 about here]

⁶ Regional minimum-wage levels and the list of districts in each minimum-wage region are adjusted and issued in annual government decrees (Government of Vietnam, 2012-2019).

Figure 2 presents the nominal and real minimum wages in the four regions during 2012-2020. The nominal minimum wage increased at a higher rate than inflation. Thus, real minimum wages increased slightly by around 4% over the 2012–2020 period. However, because of the COVID-19 pandemic, the government decided not to adjust minimum wages for 2020. Therefore, minimum wages in 2020 and 2019 remained the same, equal to 3,070, 3,420, 3,920 and 4,420 thousand VND/month for the four regions.

[Figure 2 about here]

Real wages have increased over time. In this study, our analysis relies on a sample of individuals aged 15 and over. To estimate wages, we use a sample of wage-earning workers aged 15 and above. The mean monthly wage of these workers increased from 4,928 thousand VND in 2012 to 6,885 thousand VND in 2019 (see Figure A.1 in the Appendix). In 2020, the mean wage decreased slightly to 6,791 thousand VND because of the COVID-19 pandemic. However, the average number of working hours per week was relatively stable over time, at around 46.

Panel A of Figure 3 presents the ratios of the average minimum wage to the mean wage and median wage over time. The average minimum wage is computed as the weighted regional minimum wage with a weight equal to the proportion of workers in each region. The ratio of the average minimum wage to the median wage was equal to 49.1% in 2012 and increased to a peak of 64.2% in 2016, then declined to 58.3% in 2020. This inverted U-shape of the ratio of the average minimum wage to the median wage over time is explained by the high growth rate of minimum wages during the 2012-2016 period (Panel B of Figure 3). Figure A.2 in the Appendix presents the ratios of minimum wages to the mean and median

wages for four regions over time. The ratios in the four regions show a similar trend over time, increasing to a peak in 2016 and 2017 then decreasing in recent years.

[Figure 3 about here]

Using data from the 2012-2020 Labor Force Surveys, Figure 4 indicates the proportion of workers earning below the monthly minimum wage. LFSs contain data on the monthly wage of workers and the number of their working hours during the last seven days before the interview date. In Vietnam, around 86% of workers work at least 40 hours a week (Figure A.3 in the Appendix). Therefore, we first estimate the proportion of wage-earning workers who put in at least 40 hours a week and whose monthly wages fall below the regional minimum. This proportion was 7.8% in 2020. According to Vietnam's Labor Code, normal work time may not exceed 48 hours a week. Above 48 hours, additional work must be paid at a higher rate. Around 60% of workers work at least 48 hours a week (Figure A.3 in the Appendix). Figure 4 shows that 6.7% of employees who work at least 48 hours a week received monthly wages below the minimum in 2020. There are a number of part-time workers. To estimate the number of workers earning below the minimum wage as a proportion of the total, we estimate hourly wages and hourly minimum wages. We compute hourly minimum wages by multiplying the monthly minimum wage by 12 and dividing the result by 2,496 working hours a year (52 weeks * 48 working hours/week). In the same way, the monthly wages that workers receive are also converted to hourly wages.⁷ Figure 4 shows that in 2020, 8.6% of workers received hourly wages below the computed hourly minimum.⁸

⁷ Hourly minimum wages = (monthly minimum wages * 12)/(52*48).

Hourly wages = (monthly wages * 12)/(52 * working hours a week).

⁸ Figures A.4 and A.5 show the proportion of workers earning below the minimum for different population subgroups in 2019 and 2020, while Figure A.6 in the Appendix presents geographic variations in wages and the proportion of workers earning below the minimum across districts.

The three ways described above show a similar trend in the proportion of workers receiving less than the minimum wage during the 2012-2020 period (Figure 4). The proportion of workers earning less than minimum wage increased from 2012 to 2016 and then decreased through to 2019. In 2020, because of the COVID-19 pandemic, the proportion of individuals earning below minimum wage increased.⁹ For purposes of interpretation in this study, we will use the proportion of individuals working at least 40 hours a week and receiving monthly wages below the monthly minimum, since minimum wages are officially defined on a monthly basis in Vietnam.

Compared with other countries in Southeast Asia, Vietnam has a lower proportion of workers earning below minimum wage (Rani et al., 2013; Cowgill and Huynh, 2016). This low proportion can be explained by comparing low minimum wages with market wages. According to Cowgill and Huynh (2016), the minimum-to-median wage ratio in the garment sector is only 55% in Vietnam, whereas the ratio in other Southeast Asian countries is around 80%. In several countries, such as India, Thailand and the Philippines, the minimum-to-median wage ratio in the garment sector is around 100%.

Among those earning below minimum wage, Figure A.8 in the Appendix shows a significant gap between workers with and those without social insurance. In this study, workers are defined as those who have a formal job if they have social insurance. In 2020, we found that 13% of workers without social insurance received monthly wages below the minimum, while this figure for workers with social insurance was only 3%. Compliance with minimum wage regulations in the formal sector is considered strong (e.g., Raj-Reichert and

⁹ In Figure A.7 in the Appendix, we examine the proportion of workers earning below the minimum by quarters in recent years (the sample includes wage earners working at least 40 hours a week). The figure shows a sudden increase in the proportion of workers earning below the minimum in April 2020. This increase was the result of the national lockdown applied in this month due to the COVID-19 pandemic.

Plank, 2019). However, the formal sector remains small in Vietnam. Among wage-earning workers, only 55% had a formal job (i.e., a job with social insurance) in 2020. If we include the self-employed, the proportion of workers with a formal job was only 27% in 2020.

The number of workers earning below the minimum is also presented in the kernel density of the difference between log of wage and log of minimum wages (Figure A.9 in the Appendix). This figure uses the pooled sample of wage-earners from the LFSs from 2012 to 2020. Kernel density graphs are widely used to examine binding minimum wages (e.g., Dinardo et al., 1996; Cunningham, 2007). Minimum wage requirements are more likely to be complied with if there is a spike or truncation right after the minimum wage (i.e., 0 in Figure A.9 in the Appendix). It shows a small degree of truncation for individuals working at least 40 and 48 hours a week (panels A and B of Figure A.9).¹⁰

4. Estimation method

The main objective of this study is to measure the effect of minimum wages on household living standards. We will first examine the effect of regional minimum wages using the following regression:

$$\text{Log}(y_{idpt}) = \alpha + \text{Log}(MW_{dpt})\beta + X_{idpt}\gamma + T_t + P_{pt}\theta + u_{dp} + \varepsilon_{idpt}, (1)$$

where y_{idpt} is the monthly wage of individual i in district d in province p in year t .¹¹ MW_{dpt} is the minimum wage of district p in year t . Since 2008, Vietnam has set four minimum-wage (MW) levels for four regions. A minimum-wage region is defined based on districts. Thus,

¹⁰ The proportion of workers earning less than minimum wage was higher in the 2012-2015 period than in the 2016-2020 period. Figure A.10 in the Appendix estimates the kernel density of the difference between log of wage and log of minimum wage separately for the 2012-2015 period and the 2016-2020 period. The distributions are quite similar in the two periods.

¹¹ At the first-level (primary) administrative division, Vietnam consists of 58 provinces and 5 central-level cities or municipalities. A province is divided into districts, and a district is further subdivided into communes or wards. In 2018, there were around 700 districts and 11,000 communes.

in our data, the minimum wage is determined at the district level. Coefficient β measures the elasticity of the wage with respect to the minimum wage.

It should be noted that we use the variable of the logarithm of real minimum wages rather than the Kaitz index or any ratio of minimum wages to average wages. Since average wages can also be affected by the minimum wage, it is difficult to interpret the effect of minimum wages on firm outcomes. In empirical studies, the log of minimum wages is widely used to measure the effect of the minimum wage on employment and workers' wages (e.g., Allegretto et al., 2013; Dube, 2019).

X_{idpt} is a vector of individual characteristics, such as gender, age and education. The control variables should not be affected by the treatment variables (Heckman et al., 1999; Angrist and Pischke, 2008). Thus, we do not control for endogenous variables, such as occupation and employment industries, since these variables can also be affected by minimum wages. For a robustness check, however, we still try to control for the occupation and industry of workers' main job, and the results are very similar to those from models that do not control for occupation and industry.

T_t is the year fixed effects, which capture the common time effects on individuals. The first year (i.e., 2012 in this study) is omitted and used as the reference year. The main challenge in measuring the effect of minimum wages is endogeneity bias due to omitted variables. For example, the government could move the status of a district from a low to a high minimum-wage region if the district experienced an improvement in living standards in previous years. To mitigate endogeneity bias, we control for district fixed effects (u_{dp}) in the regression.

Controlling for year and district fixed effects is a standard two-way fixed-effects model, which addresses endogeneity bias due to any time-invariant variables at the district level. However, if there are unobserved time-invariant variables that affect both employment and minimum wages, the estimates of minimum wages are still biased. To mitigate this, we follow the approach of Allegretto et al., (2013) and Dube (2019) and control for province-specific year effects (P_{pt}). This means that we control for province dummies within a year as well as province-specific time trends. The inclusion of province-year fixed effects eliminates all the variation between provinces and relies only on variation within provinces to identify the effect of minimum wages, allowing us to control for time-variant heterogeneity in outcomes across provinces.

For dealing with standard errors, the usual approach is to cluster standard errors at the treatment level, i.e., differing minimum wages in the districts. In addition, the data set is comprised of pooled data over time, and the LFSs are designed to be representative at the quarterly level. We adopt the multiway clustering technique of Cameron et al. (2011), which allows us to cluster standard errors at the district level and year-by-quarter.

We use a model specification similar to Equation (1) to measure the effect of minimum wages on different outcomes, including the probability of a worker having a job with a labor contract, the probability of a job with social insurance, the number of working hours during the past seven days, monthly wages, hourly wages and the probability of earning below the minimum wage.

5. Empirical results

5.1. Impact of minimum wages on employment outcomes

Table 1 presents the results of regressions of employment outcomes for people aged 15 and above on district-level minimum wages using the regression specification given in Equation (1). Like Nguyen (2013), we do not find significant effects of minimum wages on unemployment. The unemployment rate is rather low in Vietnam and a relatively large proportion of people work in the informal sector. If there is a hiring disincentive effect from an increase in the minimum wage in the formal sector, the informal sector may absorb the unemployed. In this study, we do not find significant effects from minimum wages on overall employment, the probability of a worker having a wage-earning job or a job with a labor contract, or the probability of having a formal job.

Interestingly, there is a significant negative effect from minimum wages on the number of working hours. A 1% increase in the minimum wage reduces the number of weekly working hours by 0.38%. Possibly, employers do not reduce the number of employees, but instead tend to reduce employees' working hours to respond to the increase in labor costs due to the increase in the minimum wage.

[Table 1 about here]

Table 1 uses the full sample of people (aged 15 and above) including both wage-earning and self-employed workers. In Table 2, we limit the sample to wage earners since this group makes up the majority of workers affected by minimum wages. Using the sample of wage earners, we can also estimate the effect of minimum wages on overall wages. As in Table 1, the minimum wage has no significant effect on the probability of an individual having a job with a labor contract or having a formal job. The estimated effect of minimum

wages on the monthly wage is negative but not statistically significant at conventional levels. The finding that minimum wages have no significant effect on overall employment, having a wage-paying job, or monthly wages suggests that the minimum wage has no effect on employers' labor costs. This finding is consistent with Nguyen (2017a, 2017b), who finds no significant effects from minimum wages on firm labor costs for the period before 2011.

As in Table 1, there is a significant negative effect from minimum wages on the number of working hours shown in Table 2. A 1% increase in the minimum wage reduces the number of weekly working hours by 0.38%. Interestingly, a decrease in working hours leads to an increase in hourly wages. A 1% increase in the minimum wage results in a 0.32% increase in hourly wages. Possibly, employers respond to increases in the minimum wage by reducing employees' working hours instead of reducing the number of workers.

The total wages of workers are not affected, even though their work time is reduced. Although we do not have accurate measures of labor productivity, such as employee output per time unit or 'value-added' per employee, the increase in hourly wage may indicate an increase in labor productivity. This can be viewed as a positive effect of minimum wages. Our finding on the positive effect of minimum wages on labor productivity is consistent with several recent studies (Riley and Bondibene, 2017; Rizov et al., 2016; Ku, 2022; Coviello et al., 2022).

In this study, we do not have data to explore the detailed mechanisms by which minimum wages may increase labor productivity. Previous studies suggest that minimum wages can have this effect by increasing worker effort and capital-labor substitution. Existing employees may be more committed and put in more effort if paid more (Ehrenberg and Smith, 2009; Ku, 2022; Coviello et al., 2022). The minimum wage may spur productivity

gains as a result of businesses substituting capital for labor and adopting more capital-intensive manufacturing technology. Riley and Bondibene (2017) found that firms increased labor productivity in response to rising labor costs in the UK. These increases in labor productivity did not occur as a result of a reduction in the workforce or capital-labor substitution. Instead, they were linked to increases in total factor productivity, which may be explained by organizational changes, improvements in training and management, as a response to rising labor costs caused by setting minimum wages. According to Nguyen (2017a), firms tend to increase total assets in response to increases in the minimum wage. This may be one possible reason for the increase in labor productivity that we find in our study.

[Table 2 about here]

To explore the effect of increases in the minimum wage on the employment of workers earning less than minimum wage, we limit the sample to wage earners whose monthly wage falls below minimum wage, and regress their employment outcomes on minimum wages. The results are reported in Table 3. As a robustness check, we also estimate the effect of minimum wages on workers whose hourly wages fall below imputed hourly minimum wages. These regression results are reported in Table A.1 in the Appendix. Overall, the results are quite similar to those reported in Table 3. For interpretation, we use the results estimated in Table 3. Interestingly, increases in the minimum wage have a positive effect on the probability of a worker having a formal job. It is possible that higher minimum wages attract people to seek work in formal sectors where they can earn higher wages. Minimum wages increase both monthly and hourly wages for low-income earners. As the minimum wage rises by 1%, monthly and hourly wages increase by 0.83% and 0.52%, respectively.

This finding is consistent with recent studies, such as Wong (2019), Pérez (2020), Campos-Vazquez and Esquivel (2021) and Katzkowicz et al. (2021), which find a positive effect from minimum wages on the income of low-wage workers in low- and middle-income countries.

[Table 3 about here]

In Table 4, we estimate the effect of minimum wages on the probability of a worker earning below minimum wage. We define these individuals as those whose monthly wages are lower than the monthly minimum wage and those whose hourly wages are lower than computed hourly minimum wages. For regression of ‘below monthly minimum wages’, we try different samples of workers: all workers, those working at least 40 hours a week, and those working at least 48 hours a week. All regressions give similar significant estimates of minimum wage effects. For example, a 1% increase in the minimum wage increases the probability of earning wages below the minimum by 0.38 percentage points. The positive effect of minimum wages on the probability of a worker receiving less than minimum wage indicates that a number of employers do not comply with the minimum wage requirement.

[Table 4 about here]

Finally, the regressions also reveal several interesting findings on relations between demographic characteristics and employment. For the total sample of workers, men are more likely than women to have a wage-paying job but less likely to have a formal job (Tables 1 and 2). Women are more likely to work in the foreign sector, especially in the garment and textile industries (Nguyen, 2021). Men work a higher number of hours, and earn higher monthly as well as hourly wages. For those of the same age and education, the average monthly wage for men is around 20% higher than for women (column 3 of Table 2). The proportion of men earning less than minimum wage is therefore lower than the proportion of

women. In addition, there is an inverted U-shaped relation between age and wages. As age increases, monthly as well as hourly wages first increase and then decrease after achieving the maximum for middle-aged workers. There is also a strong relationship between education and wages. Workers with higher education earn higher wages than those with less education.

5.2. Robustness analysis

We conduct several robustness analyses to examine the sensitivity of the estimated impact of minimum wages. Firstly, the previous section shows that the estimates are robust for different samples of workers, such as all workers, wage workers, and those working at least 40 or 48 hours a week.

Secondly, as mentioned above, minimum wage regulations are more binding in the formal sector. In Table A.1 in the Appendix, we examine the effect of minimum wages for workers in formal jobs (a job with social insurance). Overall, the findings are similar to those in previous tables. The effect of minimum wages on monthly wage is not statistically significant at the conventional level, though the point estimate has a negative sign. A 1% increase in the minimum wage is associated with a 0.55% reduction in working hours but a 0.65% increase in hourly wages. The association between the minimum wage and the probability of earning below the minimum is still positive but significantly smaller. The small association between minimum wages and the probability of earning below the minimum indicates higher compliance with the minimum wage regulations in the formal sector.

Thirdly, we estimate a standard two-way fixed-effects regression, which controls for district and year fixed effects but does not control for province-year fixed effects. Recent studies often control for province-specific time trends, which allows for these trends in the employment outcomes. However, controlling for province-specific time trends may discount

minimum wages and bias their effect (Wolfers, 2006; Baum-Snow and Lutz, 2011). Table A.3 in the Appendix shows that regressions that do not control for province-year fixed effects yield similar estimates of the impact of minimum wages as regressions that do control for province-specific time trends.

Fourthly, we estimate the minimum wage impact using a sample which excludes the 2020 survey. The COVID-19 pandemic reduced compliance with minimum wage requirements in 2020. The regression results, reported in Table A.4 in the Appendix, are very similar to those based on the sample that includes the 2020 survey.

Fifthly, we include night-time light data as an explanatory variable. One criterion in setting minimum wages and defining minimum wage regions is economic growth. In our model, we already control for province-year fixed effects, which incorporate the economic growth of provinces. However, there are no available data on district GDP. Thus, we use night-time light intensity, which can be regarded as a useful proxy for GDP (e.g., see Henderson et al., 2011; Pinkovskiy and Sala-i-Martin, 2016; Hu and Yao, 2021).¹² Table A.5 in the Appendix shows that regressions controlling for night light give similar estimates of the impact of the minimum wage as the previous regressions.

Sixthly, we try to control for additional employment variables, which are dummies of occupations and industry (classified by 2-digit codes). The results, using the large specification of control variables, are very similar to those from regressions that do not control for night-time light and employment characteristics (Table A.6).

¹² Night light data are a sort of geospatial data in which each data point has geographic information connected with it. A data point for a specific location at a specific time is represented by each pixel in a night light satellite image. The pixel's value represents the intensity of lights at night, as measured in radiance and then converted into a discrete digital number between 0 and 63 (Hu and Yao, 2021).

Finally, we conduct a placebo test by running a regression of employment outcome on the one-year lead variable of minimum wages. The regression results are reported in Table A.7 in the Appendix. The minimum wage lead variable is statistically insignificant at the 10% level in all regressions. The point estimates of the lead variable are also very small compared with the point estimates of the minimum wage. This placebo test indicates the exogeneity of the minimum wage in our regression model.

5.3. Heterogeneous effects of the minimum wage on hourly wages

The previous section shows that although increases in the minimum wage have a positive effect on workers' hourly wages, they also increase the probability of earning less than minimum wage. In this section, we examine the heterogeneous effects of minimum wages on the log of hourly wages by running a regression on this variable on the log of minimum wages, using the same specification as Table 1 for different population subgroups. Figures 5 and 6 graph the estimates and the 95% confidence interval of the log of minimum wages in these regressions.

The regression results show that most estimates have a positive sign, indicating a positive effect of minimum wages on hourly wages for most population subgroups. Figure 5 shows a similar effect from minimum wages on female and male workers. By age group, minimum wages have a significant effect on workers younger than 50 years but not on workers over 50. The effect of minimum wages is significant for workers with upper-secondary and post-secondary education. Probably, labor productivity is more likely to increase for the young and for workers with higher education. Moreover, these people tend to work in formal sectors, which show strong minimum wage compliance. By sector, the effect of minimum wages is greatest for the FDI (foreign direct investment) sector, while it

is smallest and least insignificant for the household sector. The household sector includes mainly informal jobs for people with little education. The minimum wage effect was greater in the 2016-2020 period than the 2012-2015 period, though the difference is not statistically significant.

[Figure 5 about here]

By industry, the effect of the minimum wage on hourly wages is highest for those in the professions and sciences, followed by banking, finance and real estate (Figure 6). These industries tend to include younger and more highly educated workers. The estimated effect on labor productivity is very small and not statistically significant for agriculture, fisheries, mining, and individual and household services. Workers tend to have lower education in these industries, which include a large proportion of informal jobs with weak minimum wage compliance.

[Figure 6 about here]

6. Conclusions

This study examines the effect of minimum wages on employment and labor productivity in Vietnam using data from recent labor force surveys. Regression analysis results show that minimum wage increases had no significant effect on overall employment or monthly wages during the 2012-2020 period. However, we find a significant negative effect of minimum wages on the number of work hours. Since total wages remained unchanged while work hours decreased, the average wage per hour tended to increase as a result of increases in the minimum wage. Although the minimum wage does not increase the average wage of all workers, it does increase the average wage of low-income earners. A 1% increase in the

minimum wage results in a 0.83% increase in the monthly wages of workers earning below minimum wage. However, higher minimum wages lead to a higher proportion of workers earning below the minimum. This suggests that to ensure compliance, employers cannot afford to increase the wages of all low-income earners.

The findings from this study suggest several policy implications. Firstly, the minimum wage is an important policy element for increasing the wages of low-income earners. Our findings show that moderate increases in the minimum wage do not have detrimental effects on employment. Secondly, although the proportion of below-minimum wage workers in Vietnam is relatively lower than in other countries, compliance with minimum wage regulations is not very strong in Vietnam. As minimum wages increase, more workers receive less than the minimum. Thus, the government should put in place stronger measures to ensure compliance with minimum wage requirements. Secondly, the proportion of workers earning less than the statutory hourly minimum wage is higher than the proportion of those earning less than minimum monthly wages. This situation indicates the necessity of setting hourly minimum wages in Vietnam, as a means to protect low-income workers who have temporary jobs.

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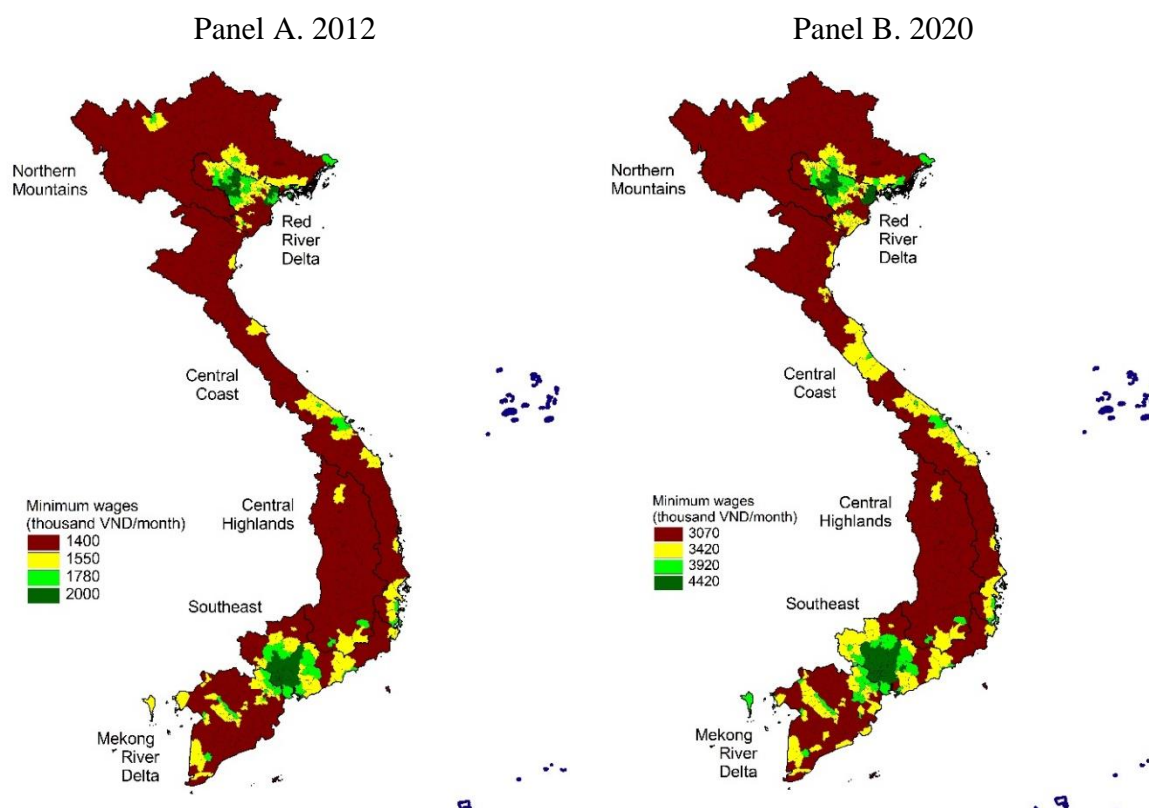
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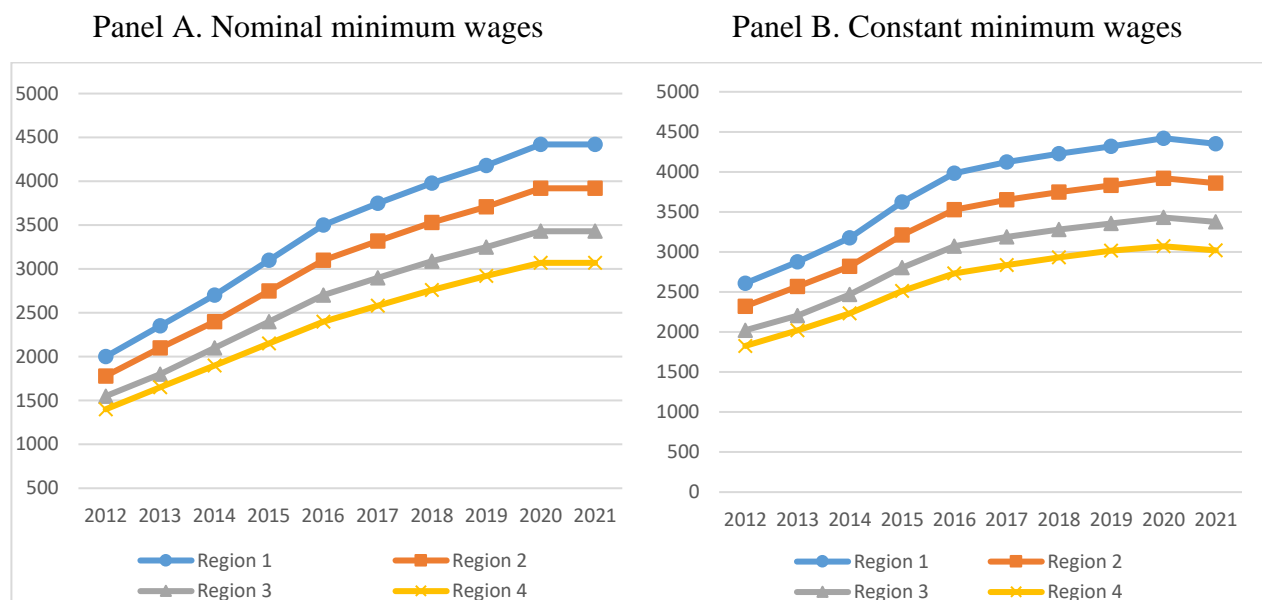
Figures and Tables

Figure 1: Minimum wages by region



Note: This figure presents the geographic map of districts in the four minimum wage regions in 2012 and 2020. The number of districts in the lowest minimum wage region declined over this period, while the number of districts in higher minimum wage regions increased.

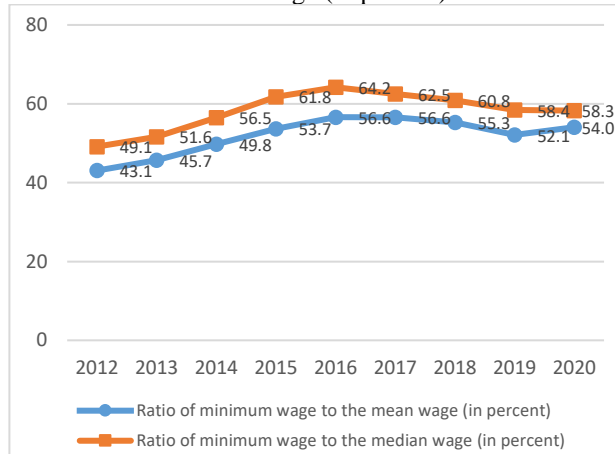
Figure 2. Monthly minimum wages (thousand VND)



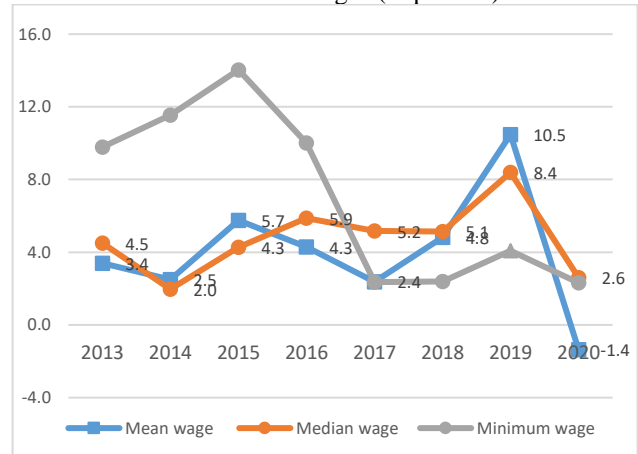
Note: This figure indicates monthly minimum wages (thousand VND/month) for four regions during the 2012-2021 period. Panel A shows nominal minimum wages, while Panel B presents minimum wages in 2020 prices (adjusted by annual CPI). For 2021, the CPI is estimated using the CPI for the first six months.

Figure 3. Mean wages, median wages, and minimum wages

Panel A. Ratio of the minimum wage to mean wage and median wage (in percent)



Panel B. Annual growth rate of mean wage, median wage, and minimum wages (in percent)

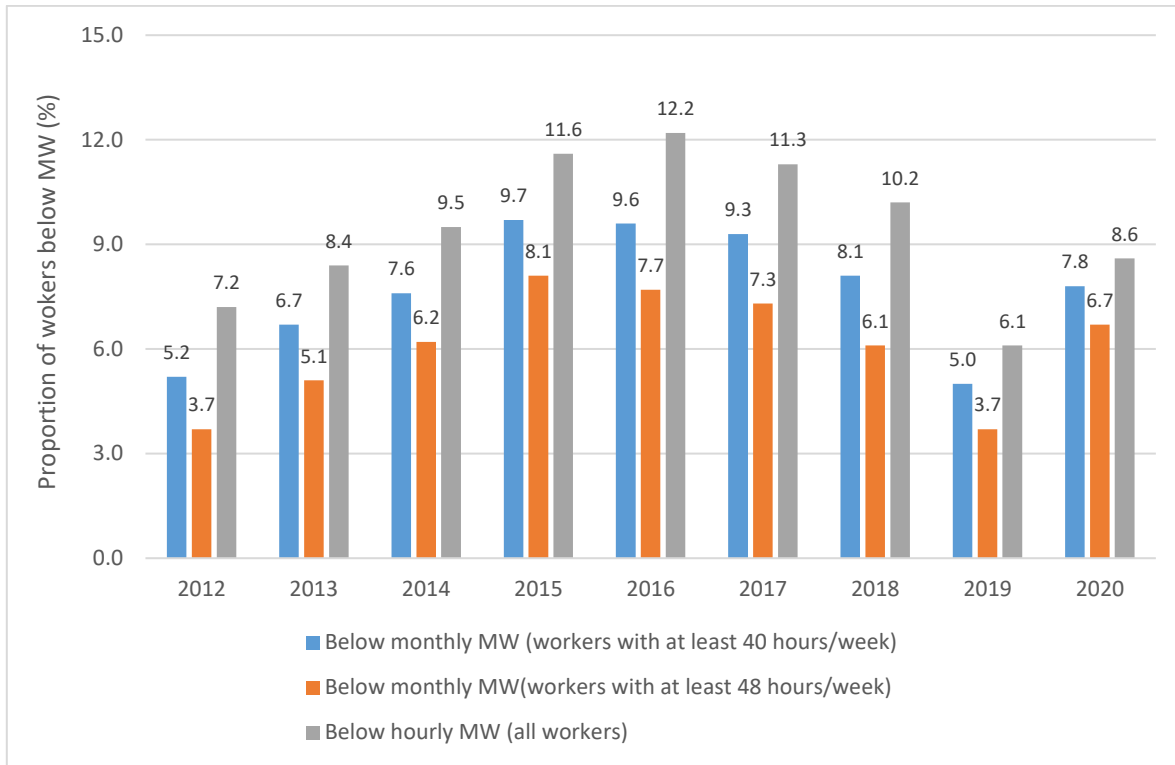


Note: Mean and median wages are computed using the monthly wages (in 2020 prices) of the sample of wage earners working at least 40 hours a week.

This figure is computed using a sample of wage earners aged 15 years and above.

Source: Estimation from LFSs.

Figure 4: The percentage of workers earning below minimum wage

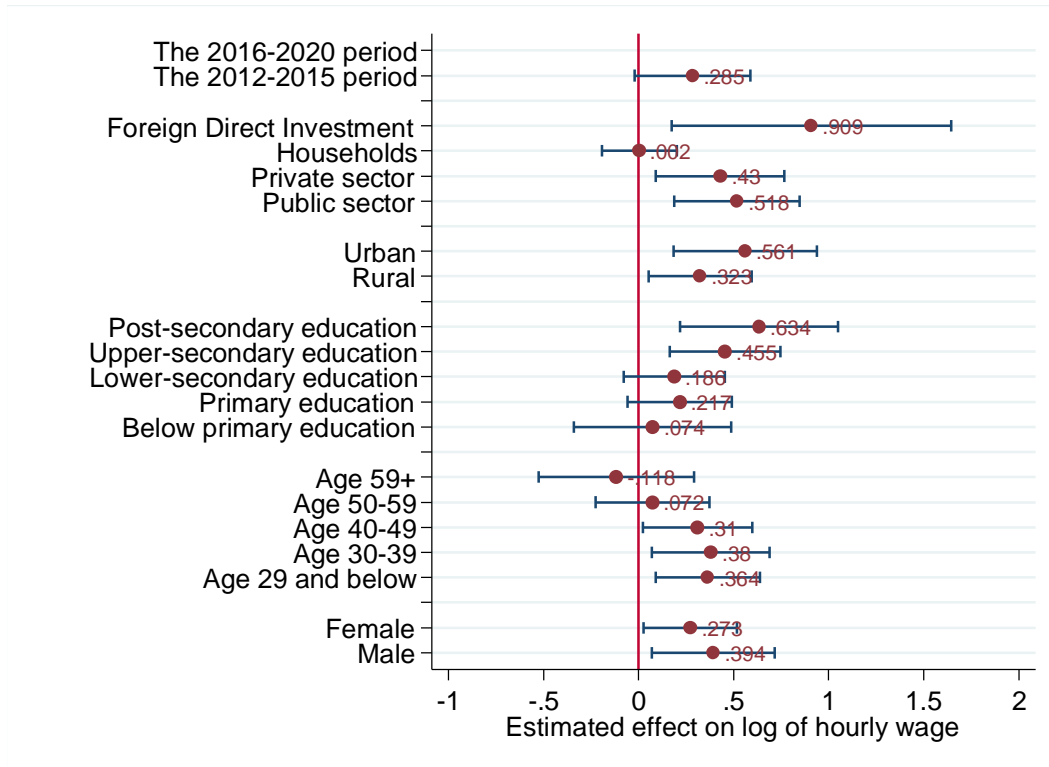


Note: This figure estimates the proportion of workers earning below minimum wage, computed in three ways. The first and second estimate the number of below- minimum wage workers among those working at least 40 hours a week and those working at least 48 hours a week, respectively. The third way estimates the proportion of workers whose average hourly wages fall below the estimated hourly minimum wage.

This figure is computed using a sample of wage earners 15 years and older.

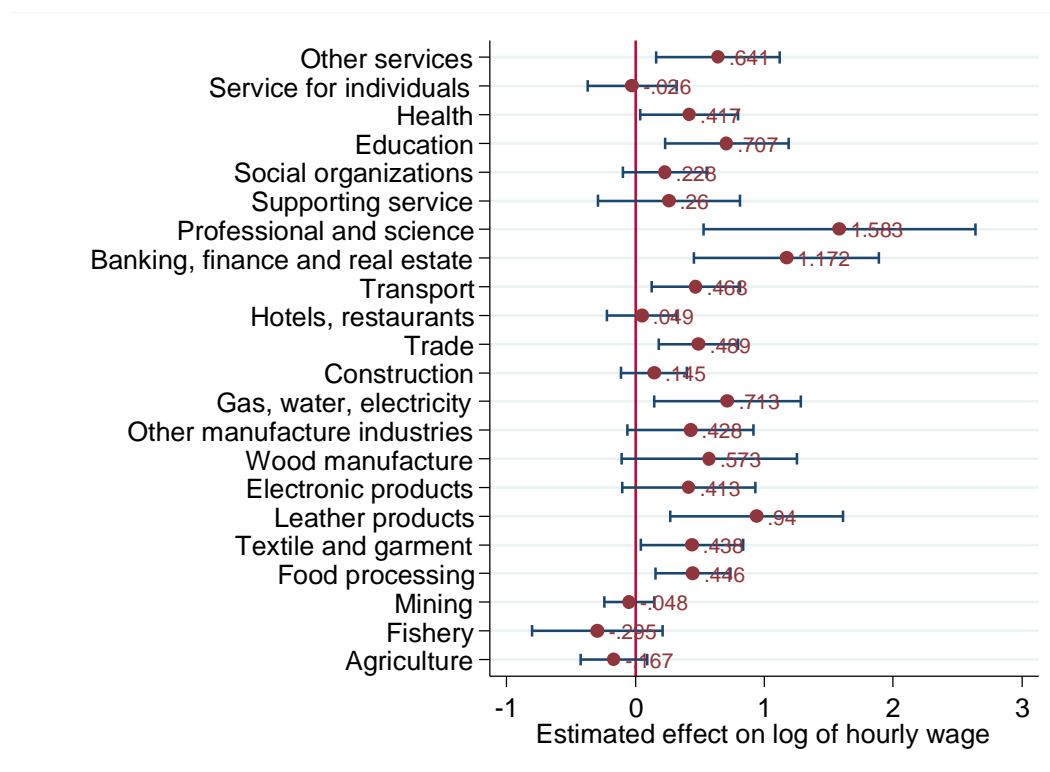
Source: Estimation from LFSs.

Figure 5: Heterogeneous effects for different population subgroups



Note: This figure graphs the estimates and their 95% confidence intervals of the log of minimum wages in regressions of the log of hourly wages for workers in different population sub-groups. The model specification is the same as Table 1.
Source: Estimation from LFSs.

Figure 6: Heterogeneous effects for workers in different industries



Note: This figure graphs the estimates and their 95% confidence intervals of the log of minimum wages in regressions of the log of hourly wages for workers in different industries. The model specification is the same as in Table 1.

Source: Estimation from LFSs.

Table 1. Regressions of employment outcomes on minimum wages

Explanatory variables	Dependent variables				
	Unemployed (yes=1, no=0)	Wage- earning job (yes=1, no=0)	Job with labor contract (yes=1, no=0)	Formal job (yes=1, no=0)	Log of number of working hours in the last 7 days
	(1)	(2)	(3)	(4)	(5)
Log of regional minimum wages	0.0183 (0.0110)	-0.0530 (0.0527)	0.0135 (0.0678)	0.0358 (0.0481)	-0.3839* (0.1982)
Gender (male=1; female=0)	0.0007 (0.0006)	0.0974*** (0.0031)	-0.0203*** (0.0038)	-0.0295*** (0.0035)	0.0641*** (0.0051)
Age	-0.0050*** (0.0003)	-0.0012* (0.0006)	-0.0001 (0.0004)	0.0034*** (0.0005)	0.0459*** (0.0013)
Age squared	0.0000*** (0.0000)	-0.0001*** (0.0000)	-0.0000*** (0.0000)	-0.0001*** (0.0000)	-0.0006*** (0.0000)
Less than primary education	Reference				
Primary education	-0.0008 (0.0010)	-0.0922*** (0.0165)	-0.0730*** (0.0241)	-0.0668*** (0.0240)	0.0241*** (0.0055)
Lower-secondary education	-0.0009 (0.0012)	-0.0953*** (0.0191)	-0.0423 (0.0272)	-0.0401 (0.0273)	0.0302*** (0.0062)
Upper-secondary education	0.0037** (0.0015)	-0.0026 (0.0217)	0.1120*** (0.0303)	0.0991*** (0.0299)	0.0187** (0.0073)
Post-secondary education	0.0183*** (0.0045)	0.2539*** (0.0372)	0.4656*** (0.0468)	0.4673*** (0.0453)	-0.1311*** (0.0262)
Urban areas	0.0073*** (0.0007)	0.0579*** (0.0067)	0.0410*** (0.0081)	0.0370*** (0.0078)	0.0057 (0.0058)
District fixed effects	Yes	Yes	Yes	Yes	Yes
Province-year fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	-0.0195 (0.0865)	0.9971** (0.4236)	0.1701 (0.5446)	-0.1230 (0.3878)	5.7939*** (1.5650)
Observations	4,036,609	4,036,609	4,036,609	4,036,609	4,036,609
R-squared	0.030	0.248	0.333	0.335	0.075

Note: This table reports the regression of employment outcomes of people 15 and above on minimum wages. The sample includes all individuals over 15.

Standard errors in parentheses. Standard errors are clustered at the district and year-quarter levels.

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

Source: Estimation from LFSs.

Table 2. Regressions of employment outcomes of wage earners on minimum wages

Explanatory variables	Dependent variables				
	Job with labor contract (yes=1, no=0)	Formal job (yes=1, no=0)	Log of monthly wage	Log of number of working hours in the last 7 days	Log of hourly wage
	(1)	(2)	(3)	(4)	(5)
Log of regional minimum wages	-0.0664 (0.1412)	-0.0185 (0.0873)	-0.0621 (0.0574)	-0.3805*** (0.1283)	0.3184** (0.1386)
Gender (male=1; female=0)	-0.1253*** (0.0089)	-0.1245*** (0.0084)	0.1786*** (0.0049)	0.0309*** (0.0020)	0.1476*** (0.0046)
Age	0.0075*** (0.0008)	0.0213*** (0.0013)	0.0561*** (0.0013)	0.0050*** (0.0005)	0.0511*** (0.0011)
Age squared	-0.0001*** (0.0000)	-0.0003*** (0.0000)	-0.0007*** (0.0000)	-0.0001*** (0.0000)	-0.0006*** (0.0000)
Less than primary education	Reference				
Primary education	-0.0982** (0.0424)	-0.1031** (0.0448)	-0.0275 (0.0323)	0.0405*** (0.0067)	-0.0680* (0.0377)
Lower-secondary education	0.0195 (0.0460)	-0.0004 (0.0488)	0.0339 (0.0355)	0.0492*** (0.0076)	-0.0153 (0.0418)
Upper-secondary education	0.2486*** (0.0506)	0.2193*** (0.0522)	0.1102*** (0.0382)	0.0184** (0.0086)	0.0918* (0.0455)
Post-secondary education	0.4376*** (0.0539)	0.4640*** (0.0544)	0.4059*** (0.0370)	-0.0701*** (0.0093)	0.4760*** (0.0440)
Urban areas	0.0489*** (0.0102)	0.0504*** (0.0099)	0.0618*** (0.0073)	0.0006 (0.0035)	0.0611*** (0.0074)
District fixed effects	Yes	Yes	Yes	Yes	Yes
Province-year fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	0.9059 (1.1383)	0.1919 (0.7083)	7.7963*** (0.4629)	6.7842*** (1.0269)	-0.4542 (1.1040)
Observations	1,532,251	1,532,251	1,532,251	1,532,251	1,532,251
R-squared	0.369	0.376	0.372	0.110	0.363

Note: This table reports the regression of employment outcomes of wage-earning workers on minimum wages. The sample includes wage earners aged over 15. People who are self-employed or who do not earn wages are excluded. Standard errors in parentheses. Standard errors are clustered at the district and year-quarter levels.

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

Source: Estimation from LFSs.

Table 3. Regressions of employment outcomes of below-minimum wage earners

Explanatory variables	Dependent variables			
	Job with labor contract (yes=1, no=0)	Formal job (yes=1, no=0)	Log of monthly wages	Log of hourly wages
	(1)	(2)	(3)	(4)
Log of regional minimum wages	0.0635 (0.1155)	0.1591** (0.0624)	0.8316*** (0.0913)	0.5178*** (0.1279)
Gender (male=1; female=0)	0.0451*** (0.0065)	0.0056 (0.0039)	0.0278*** (0.0067)	0.0473*** (0.0076)
Age	0.0052*** (0.0011)	0.0110*** (0.0010)	0.0225*** (0.0010)	0.0211*** (0.0010)
Age squared	-0.0000*** (0.0000)	-0.0001*** (0.0000)	-0.0004*** (0.0000)	-0.0003*** (0.0000)
Less than primary education	Reference			
Primary education	0.0110 (0.0185)	-0.0110 (0.0133)	0.0274*** (0.0055)	0.0111* (0.0057)
Lower-secondary education	0.1293*** (0.0229)	0.0483*** (0.0162)	0.0146*** (0.0050)	-0.0134** (0.0065)
Upper-secondary education	0.3840*** (0.0289)	0.2310*** (0.0196)	-0.0271*** (0.0081)	-0.0158 (0.0096)
Post-secondary education	0.6322*** (0.0341)	0.4532*** (0.0274)	-0.0013 (0.0104)	0.0545*** (0.0159)
Urban areas	0.0297*** (0.0085)	0.0149** (0.0062)	0.0219*** (0.0058)	-0.0018 (0.0071)
District fixed effects	Yes	Yes	Yes	Yes
Province-year fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Constant	-0.5465 (0.9248)	-1.4073*** (0.5007)	0.6192 (0.7296)	-1.9823* (1.0214)
Observations	174,603	174,603	174,603	174,603
R-squared	0.283	0.215	0.360	0.262

Note: This table reports the regression on minimum wages of employment outcomes of wage earners (over 15 years of age), whose monthly wage is below minimum wage.

Standard errors in parentheses. Standard errors are clustered at the district and year-quarter levels.

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

Source: Estimation from LFSs.

Table 4. Regressions of the probability of earning below minimum wage

Explanatory variables	Dependent variables			
	Monthly wage below minimum wage (all workers)	Monthly wage below minimum wage (at least 40 hours/week)	Monthly wage below minimum wage (at least 48 hours/week)	Hourly wage below minimum wage (all workers)
	(1)	(2)	(3)	(4)
Log of regional minimum wages	0.3819*** (0.0432)	0.3738*** (0.0380)	0.3787*** (0.0392)	0.3949*** (0.0340)
Gender (male=1; female=0)	-0.0697*** (0.0036)	-0.0532*** (0.0033)	-0.0438*** (0.0032)	-0.0579*** (0.0034)
Age	-0.0262*** (0.0009)	-0.0203*** (0.0009)	-0.0176*** (0.0009)	-0.0238*** (0.0008)
Age squared	0.0004*** (0.0000)	0.0003*** (0.0000)	0.0002*** (0.0000)	0.0003*** (0.0000)
Less than primary education	Reference			
Primary education	-0.0176 (0.0125)	-0.0078 (0.0082)	-0.0091* (0.0048)	-0.0004 (0.0095)
Lower-secondary education	-0.0488*** (0.0132)	-0.0285*** (0.0088)	-0.0257*** (0.0052)	-0.0200* (0.0104)
Upper-secondary education	-0.0647*** (0.0140)	-0.0399*** (0.0094)	-0.0360*** (0.0059)	-0.0429*** (0.0113)
Post-secondary education	-0.1232*** (0.0148)	-0.0778*** (0.0103)	-0.0598*** (0.0073)	-0.1009*** (0.0125)
Urban areas	-0.0257*** (0.0040)	-0.0114*** (0.0025)	0.0046** (0.0017)	-0.0109*** (0.0029)
District fixed effects	Yes	Yes	Yes	Yes
Province-year fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Constant	-2.4276*** (0.3411)	-2.5178*** (0.2999)	-2.6422*** (0.3078)	-2.6088*** (0.2680)
Observations	1,532,251	1,300,267	839,351	1,532,251
R-squared	0.140	0.096	0.090	0.112

Note: This table reports the regression of the probability of earning below the minimum wage of wage earners on minimum wages. The sample includes wage earners 15 and older. People who are self-employed or do not earn wages are excluded.

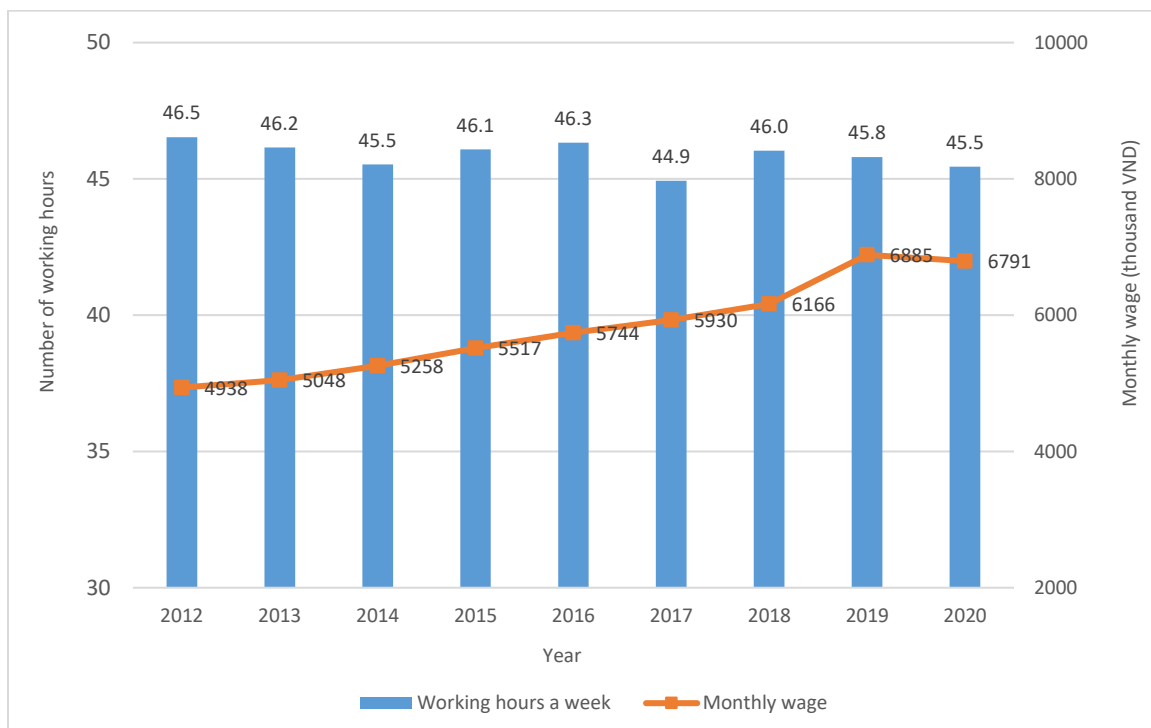
Standard errors in parentheses. Standard errors are clustered at the district and year-quarter levels.

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

Source: Estimation from LFSs.

Appendix

Figure A.1: The number of working hours per week and monthly wages



Note: The number of working hours per week and monthly wages (in 2020 prices) is computed for the sample of all wage earners 15 years of age and over.

Source: Estimation from LFSs.

Figure A.2. Mean, median and minimum wages by regions

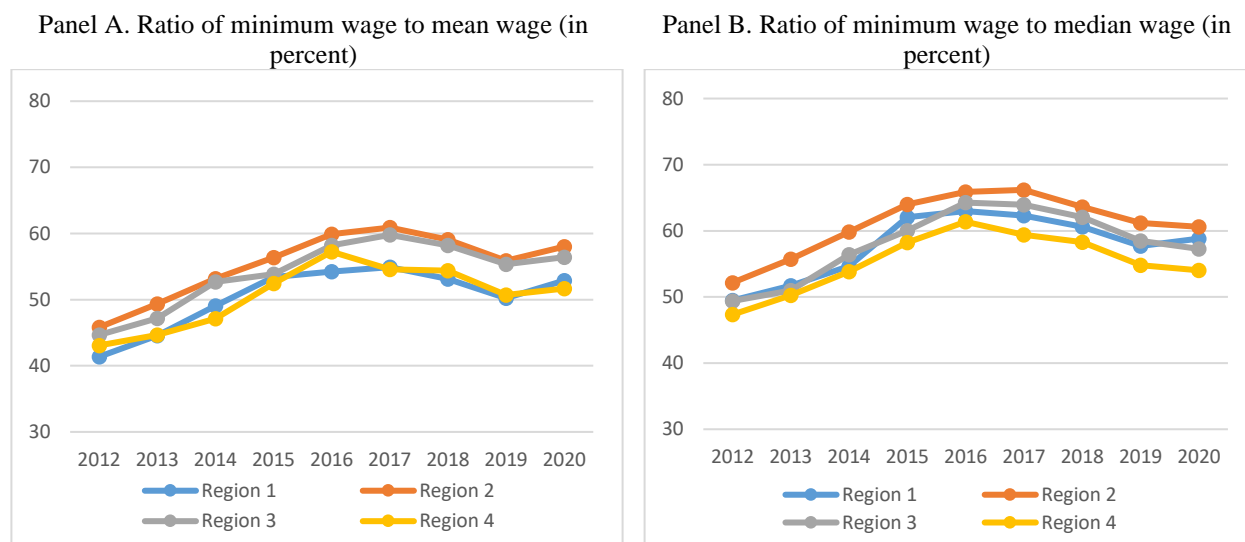
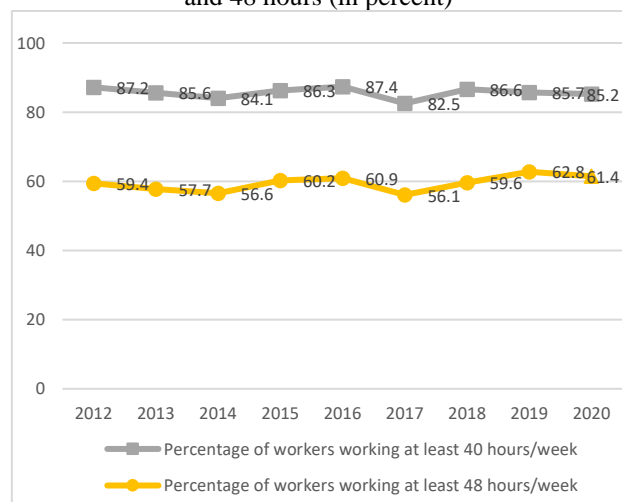
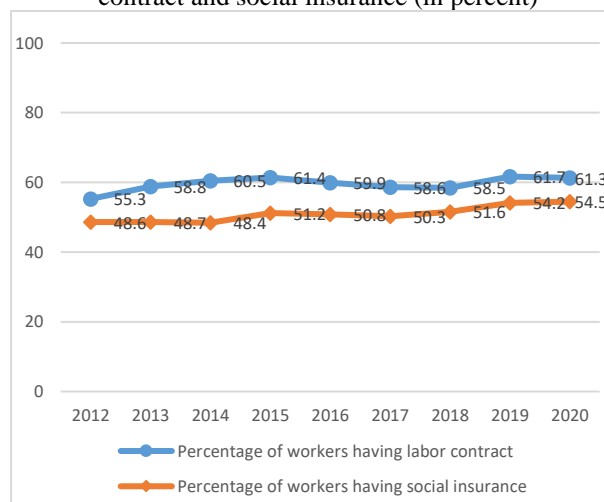


Figure A.3. The proportion of workers by working hours, labor contract, and social insurance status

Panel A. The proportion of workers working at least 40 and 48 hours (in percent)

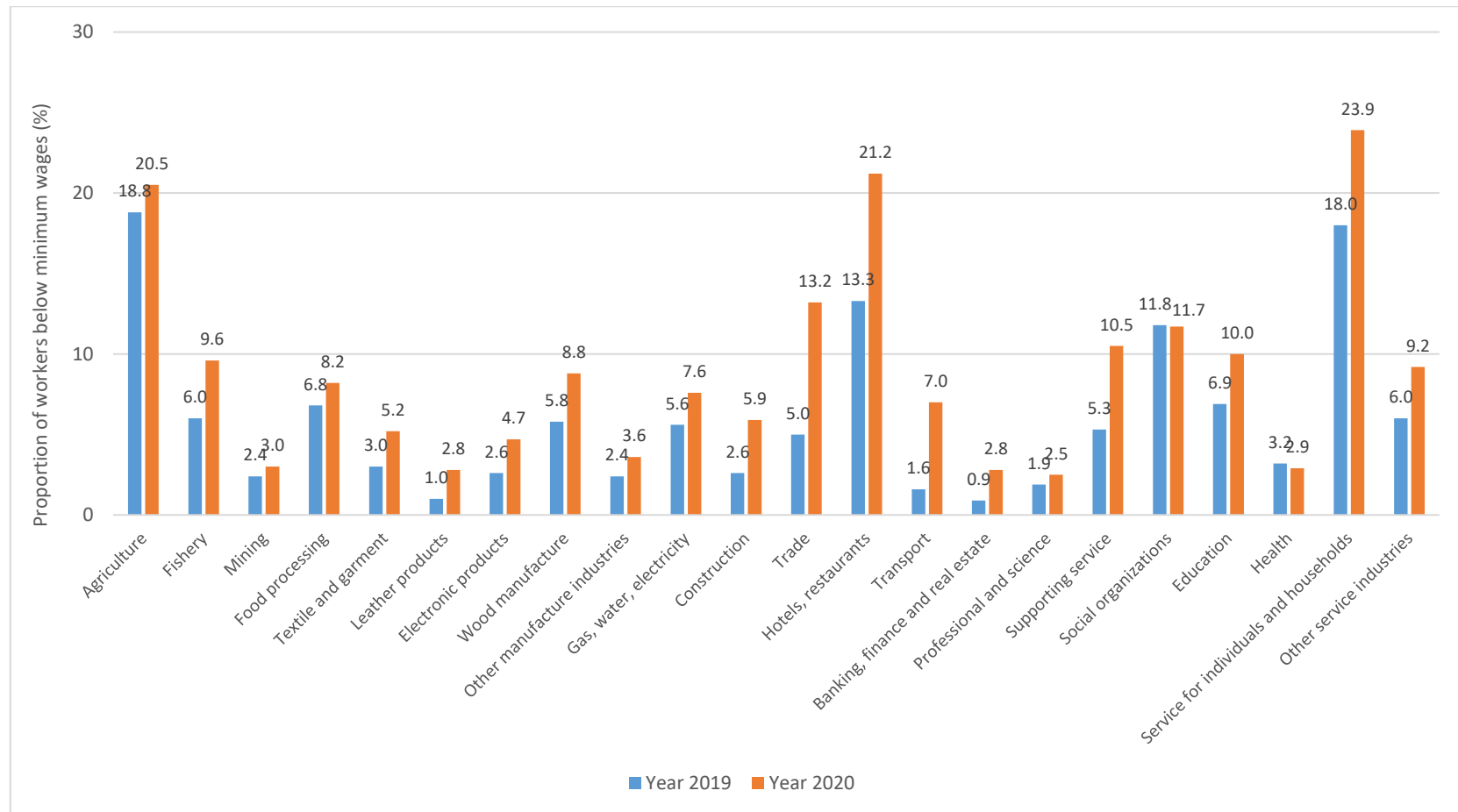


Panel B. The proportion of workers with a labor contract and social insurance (in percent)



Note: The sample includes workers (both wage-earners and self-employed workers) aged 15 and above.
Source: Estimation from LFSs.

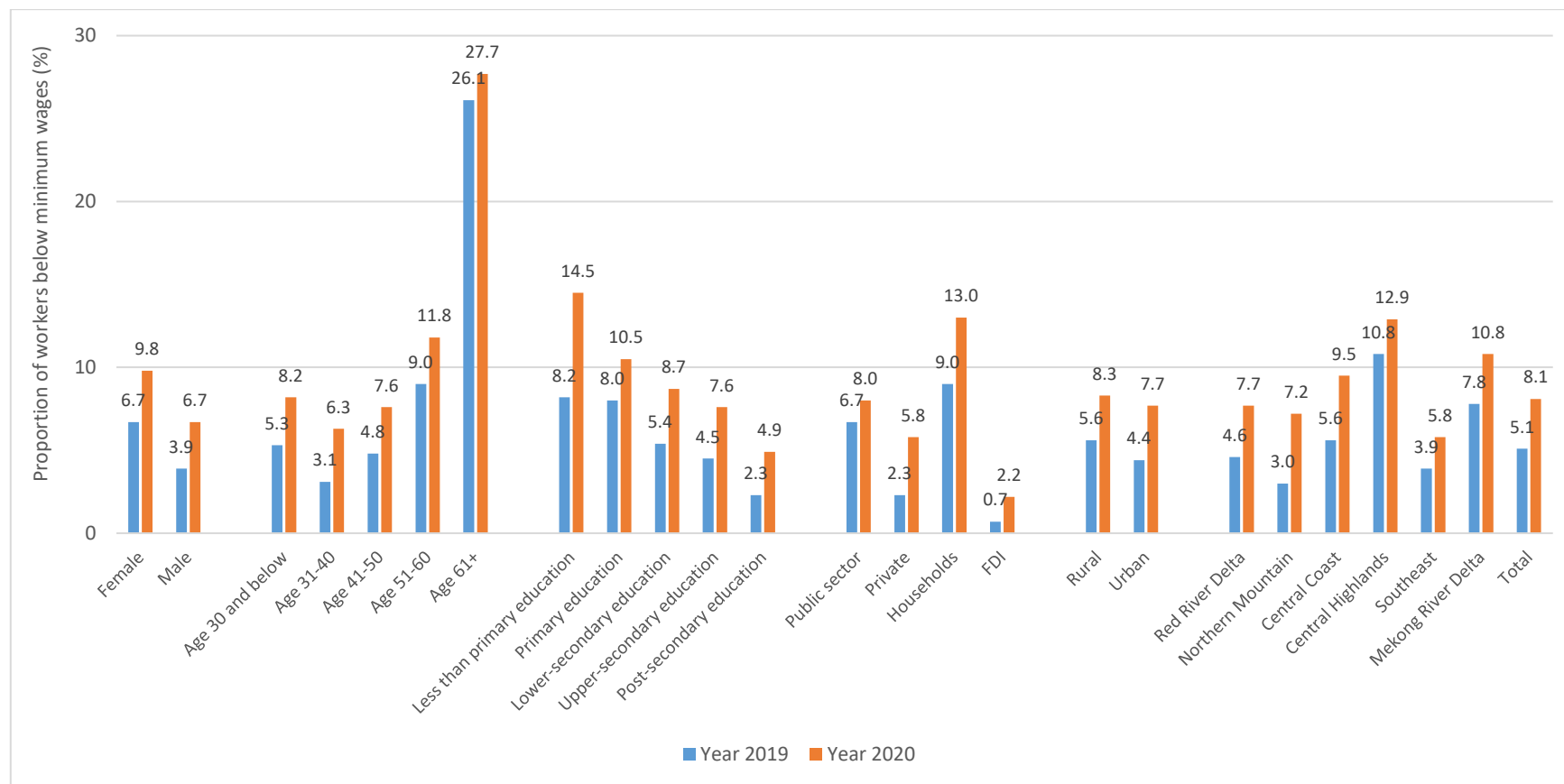
Figure A.4. The proportion of below-minimum-wage workers by industry (in percent)



Note: This table estimates the percentage of workers at below monthly minimum wages in the sample of wage earners (aged 15+) working at least 40 hours a week.

Source: Estimation from LFSs.

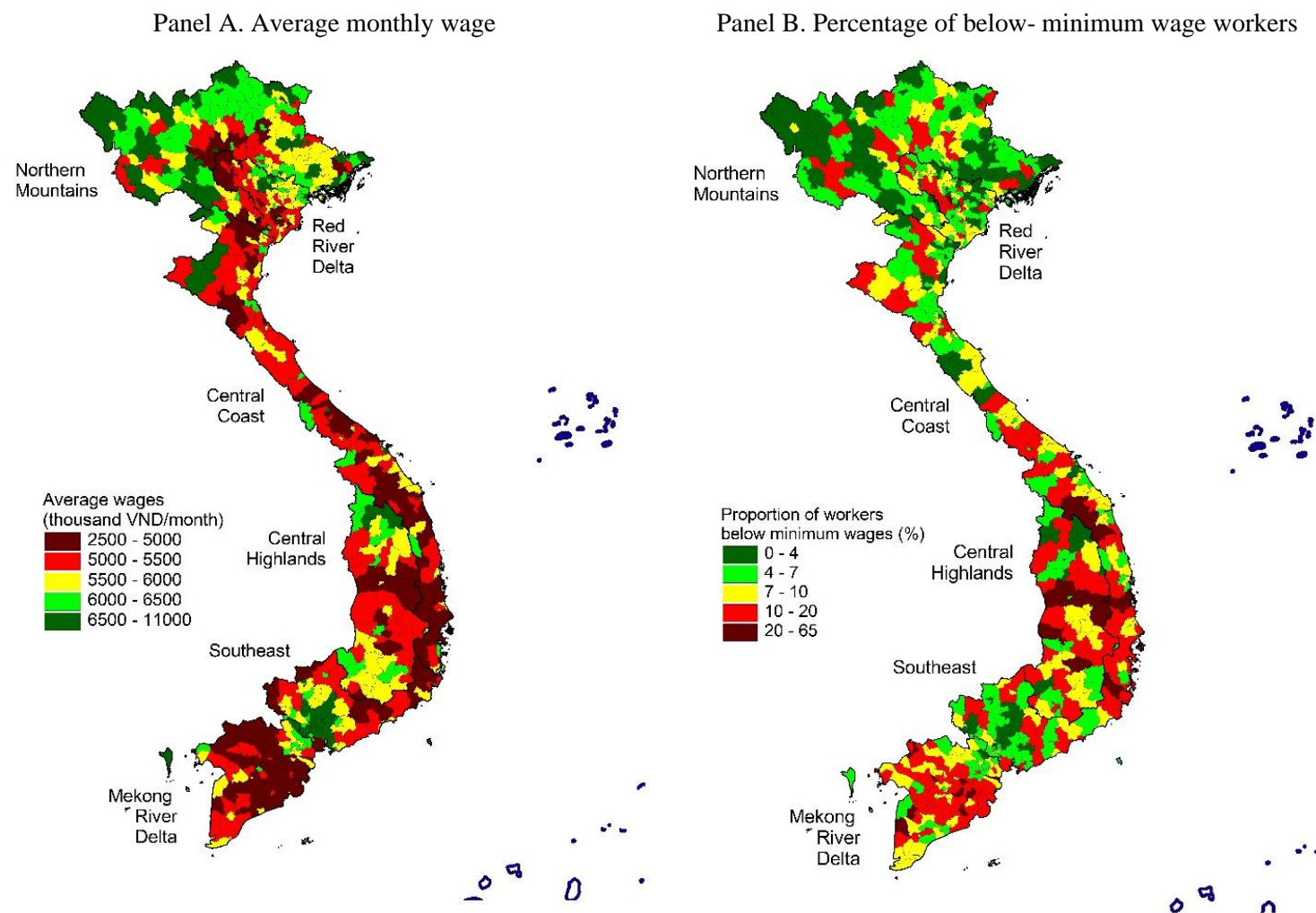
Figure A.5. The proportion of below-minimum-wage workers by population subgroups (in percent)



Note: This table estimates the percentage of workers earning below the monthly minimum wage in the sample of wage earners (aged 15+) working at least 40 hours a week.

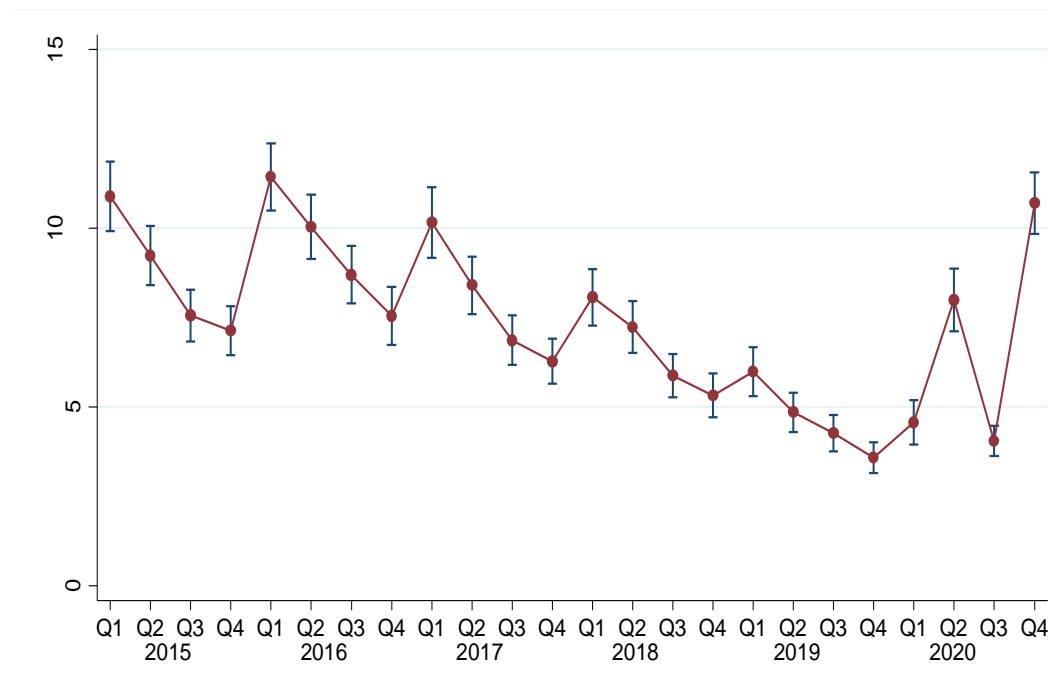
Source: Estimation from LFSs.

Figure A.6. Monthly wage (thousand VND) and the percentage of below-minimum-wage earners in the 2012-2020 period



Note: This figure estimates the average wage and the proportion of workers earning below minimum wage (for individuals 15 years and over and working at least 40 hours a week) using the pooled LFSs from 2012 to 2020.
Source: Estimation from LFSs.

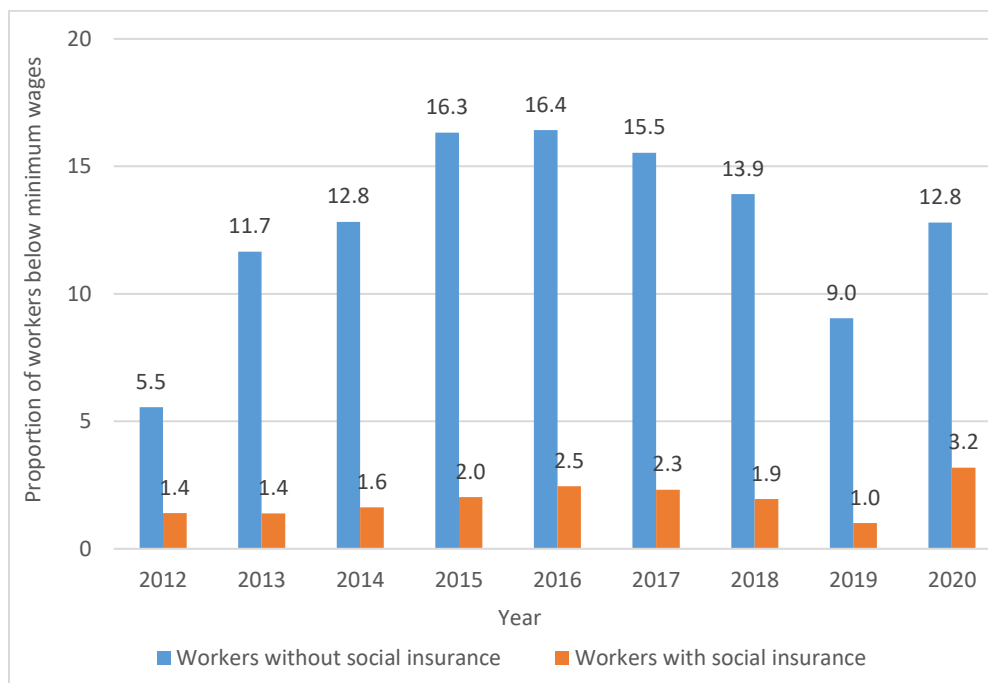
Figure A.7. The proportion of workers earning below minimum wage, by quarters



Note: This figure presents the proportion of workers earning below-minimum wages by quarters in recent years (the sample includes wage earners working at least 40 hours a week). It shows a sudden increase in the proportion of below-minimum-wage earners in April 2020. The national lockdown due to the COVID-19 pandemic was applied in this month.

Source: Estimation from LFSs.

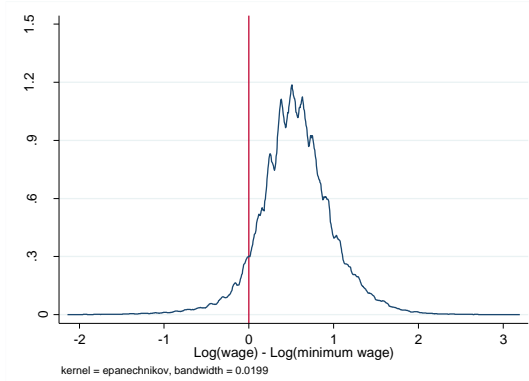
Figure A.8: The percentage of below-minimum-wage earners by social insurance status



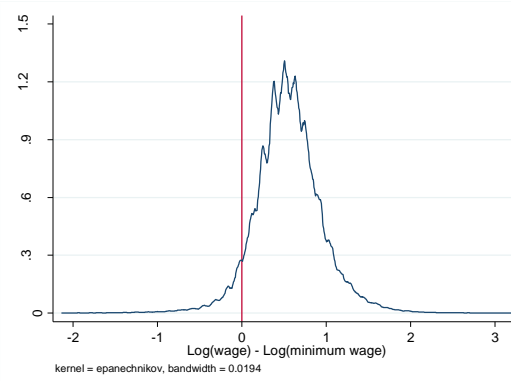
Note: This figure estimates the proportion of workers earning below the minimum wage among individuals with and without social insurance (in percent). The sample includes wage earners (aged 15+) working at least 40 hours a week.
Source: Estimation from LFSs.

Figure A.9. Compliance with minimum wage requirements

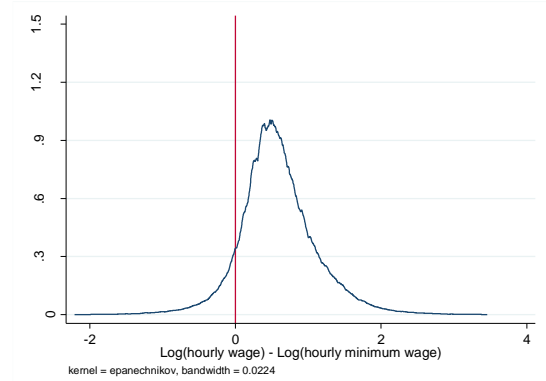
Panel A. Distribution of difference between log of monthly wages and log of minimum wage for employees working at least 40 hours a week



Panel B. Distribution of difference between log of monthly wages and log of minimum wage for employees working at least 48 hours a week



Panel C. Distribution of difference between log of hourly wages and log of hourly minimum wage (all wage workers)

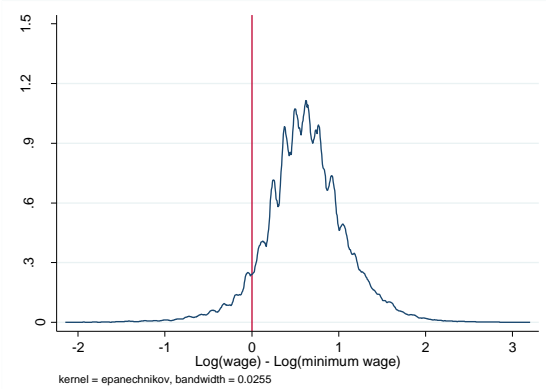


Note: This figure presents the kernel density of difference between the log of wages and the log of minimum wages to examine compliance with minimum wage requirements.

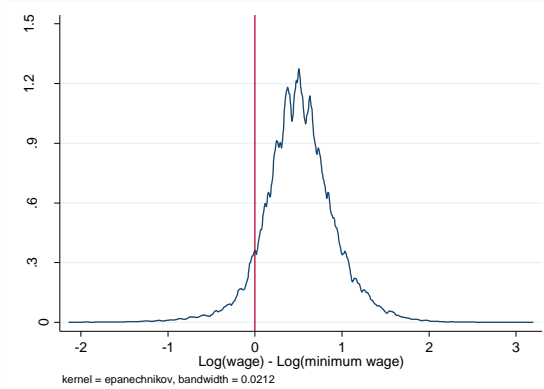
Source: Estimation from LFSs.

Figure A.10. Compliance with minimum wage regulations

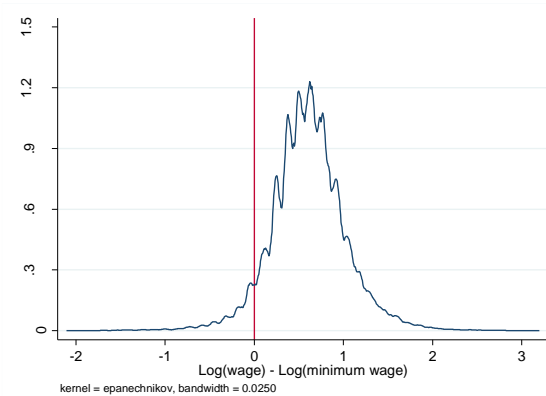
Panel A. Distribution of difference between log of monthly wages and log of minimum wage for employees working at least 40 hours a week: sample 2012-2015



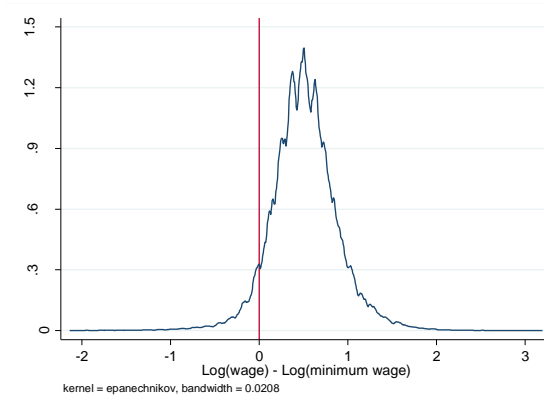
Panel B. Distribution of difference between log of monthly wages and log of minimum wage for employees working at least 40 hours a week: sample 2016-2019



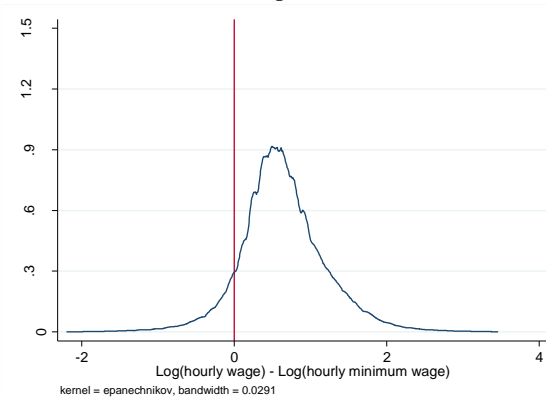
Panel C. Distribution of difference between log of monthly wages and log of minimum wage for employees working at least 48 hours a week: sample 2012-2015



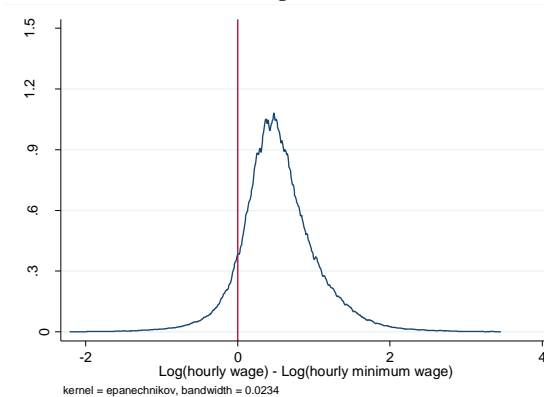
Panel D. Distribution of difference between log of monthly wages and log of minimum wage for employees working at least 48 hours a week: sample 2016-2019



Panel E. Distribution of difference between log of hourly wages and log of hourly MW (all wage workers): sample 2012-2015



Panel F. Distribution of difference between log of hourly wages and log of hourly MW (all wage workers): sample 2016-2019



Note: This figure presents the kernel density of difference between the log of wage and the log of minimum wage to examine compliance with minimum wage rules.

Source: Estimation from LFSs.

Table A.1. Regressions on minimum wages of employment outcomes of workers earning below the hourly minimum wage

Explanatory variables	Dependent variables			
	Job with labor contract (yes=1, no=0)	Formal job (yes=1, no=0)	Log of monthly wage	Log of hourly wage
	(1)	(2)	(3)	(4)
Log of regional minimum wages	-0.0216 (0.1275)	0.1450* (0.0728)	0.1524* (0.0856)	0.8119*** (0.0850)
Gender (male=1; female=0)	0.0742*** (0.0074)	0.0169*** (0.0049)	0.0314*** (0.0039)	0.0086* (0.0047)
Age	0.0071*** (0.0010)	0.0122*** (0.0010)	0.0080*** (0.0008)	0.0151*** (0.0009)
Age squared	-0.0001*** (0.0000)	-0.0002*** (0.0000)	-0.0002*** (0.0000)	-0.0002*** (0.0000)
Less than primary education	Reference			
Primary education	0.0270 (0.0166)	0.0023 (0.0112)	0.0340*** (0.0051)	0.0191*** (0.0046)
Lower-secondary education	0.1381*** (0.0209)	0.0602*** (0.0134)	0.0320*** (0.0054)	0.0197*** (0.0048)
Upper-secondary education	0.3496*** (0.0254)	0.2122*** (0.0154)	-0.0127** (0.0057)	-0.0052 (0.0063)
Post-secondary education	0.5734*** (0.0294)	0.3961*** (0.0231)	-0.0676*** (0.0078)	-0.0207** (0.0099)
Urban areas	0.0114 (0.0078)	-0.0025 (0.0063)	0.0364*** (0.0064)	0.0056 (0.0052)
District fixed effects	Yes	Yes	Yes	Yes
Province-year fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Constant	0.1219 (1.0294)	-1.3078** (0.5883)	2.5035*** (0.6868)	-4.3631*** (0.6852)
Observations	141,854	141,854	141,854	141,854
R-squared	0.244	0.181	0.188	0.411

Note: Standard errors in parentheses. Standard errors are clustered at the district and year-quarter levels.

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

Source: Estimation from LFSSs.

Table A.2. Regressions of employment outcomes on minimum wages of workers in the formal sector

Explanatory variables	Dependent variables						
	Log of monthly wage	Log of number of working hours in the last 7 days	Log of hourly wage	Monthly wage below minimum wage (all workers)	Monthly wage below minimum wage (at least 40 hours/week)	Monthly wage below minimum wage (at least 48 hours)	Having hourly wage below minimum wage (all workers)
	(1)	(2)	(3)	(4)	(5)	(6)	(6)
Log of regional minimum wages	0.1051 (0.0993)	-0.5496*** (0.1576)	0.6547*** (0.2106)	0.1716*** (0.0224)	0.1612*** (0.0223)	0.1457*** (0.0203)	0.1573*** (0.0213)
Gender (male=1; female=0)	0.1194*** (0.0041)	0.0274*** (0.0021)	0.0920*** (0.0044)	-0.0036*** (0.0012)	-0.0043*** (0.0012)	-0.0036*** (0.0012)	0.0005 (0.0009)
Age	0.0330*** (0.0016)	-0.0021*** (0.0005)	0.0351*** (0.0017)	-0.0095*** (0.0007)	-0.0078*** (0.0006)	-0.0055*** (0.0005)	-0.0089*** (0.0007)
Age squared	-0.0003*** (0.0000)	-0.0000 (0.0000)	-0.0003*** (0.0000)	0.0001*** (0.0000)	0.0001*** (0.0000)	0.0001*** (0.0000)	0.0001*** (0.0000)
Less than primary education	Reference						
Primary education	-0.1438*** (0.0309)	0.0791*** (0.0173)	-0.2229*** (0.0471)	0.0108*** (0.0037)	0.0083** (0.0031)	0.0049** (0.0021)	0.0240*** (0.0047)
Lower-secondary education	-0.1103*** (0.0315)	0.0609*** (0.0178)	-0.1712*** (0.0481)	0.0096** (0.0038)	0.0067** (0.0032)	0.0018 (0.0023)	0.0181*** (0.0046)
Upper-secondary education	-0.0705** (0.0319)	0.0171 (0.0185)	-0.0876* (0.0497)	0.0154*** (0.0039)	0.0121*** (0.0032)	0.0025 (0.0023)	0.0127*** (0.0046)
Post-secondary education	0.1513*** (0.0309)	-0.0735*** (0.0176)	0.2248*** (0.0473)	-0.0100** (0.0042)	-0.0080** (0.0035)	-0.0095*** (0.0028)	-0.0147*** (0.0050)
Urban areas	0.0340*** (0.0046)	-0.0129*** (0.0047)	0.0469*** (0.0050)	-0.0089*** (0.0019)	-0.0051*** (0.0017)	0.0034** (0.0013)	-0.0077*** (0.0013)
District fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	7.1365*** (0.8034)	8.3161*** (1.2716)	-2.6459 (1.6947)	-1.1901*** (0.1788)	-1.1375*** (0.1773)	-1.0699*** (0.1614)	-1.0926*** (0.1709)
Observations	744,829	744,829	744,829	744,829	655,520	374,748	744,829
R-squared	0.313	0.147	0.320	0.040	0.034	0.031	0.037

Note: Standard errors in parentheses. Standard errors are clustered at the district and year-quarter levels.

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

Source: Estimation from LFSs.

Table A.3. Regressions of employment outcomes on minimum wages (without province-year fixed effects)

Explanatory variables	Dependent variables								
	Wage job (yes=1, no=0)	Formal job (yes=1, no=0)	Log of number of working hours in the last 7 days	Log of monthly wage	Log of hourly wage	Monthly wage below MW (all workers)	Monthly wage below MW (at least 40 hours)	Monthly wage below MW (at least 48 hours)	Hourly wage below hourly MW (all workers)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log of regional minimum wages	0.0151 (0.1080)	0.0521 (0.0719)	-0.2756*** (0.1010)	0.0404 (0.0573)	0.3160*** (0.1120)	0.3183*** (0.0425)	0.3009*** (0.0362)	0.3024*** (0.0352)	0.3245*** (0.0320)
Gender (male=1; female=0)	-0.1258*** (0.0089)	-0.1253*** (0.0085)	0.0309*** (0.0021)	0.1781*** (0.0049)	0.1472*** (0.0046)	-0.0695*** (0.0036)	-0.0530*** (0.0033)	-0.0436*** (0.0033)	-0.0577*** (0.0034)
Age	0.0076*** (0.0009)	0.0214*** (0.0013)	0.0050*** (0.0005)	0.0562*** (0.0013)	0.0512*** (0.0011)	-0.0263*** (0.0009)	-0.0203*** (0.0009)	-0.0176*** (0.0009)	-0.0239*** (0.0008)
Age squared	-0.0001*** (0.0000)	-0.0003*** (0.0000)	-0.0001*** (0.0000)	-0.0007*** (0.0000)	-0.0006*** (0.0000)	0.0004*** (0.0000)	0.0003*** (0.0000)	0.0002*** (0.0000)	0.0003*** (0.0000)
Less than primary education	Reference								
Primary education	-0.1033** (0.0435)	-0.1078** (0.0457)	0.0423*** (0.0070)	-0.0295 (0.0330)	-0.0718* (0.0388)	-0.0172 (0.0127)	-0.0074 (0.0082)	-0.0088* (0.0048)	0.0004 (0.0097)
Lower-secondary education	0.0140 (0.0472)	-0.0053 (0.0498)	0.0512*** (0.0079)	0.0324 (0.0362)	-0.0187 (0.0428)	-0.0485*** (0.0134)	-0.0282*** (0.0089)	-0.0254*** (0.0052)	-0.0190* (0.0106)
Upper-secondary education	0.2445*** (0.0517)	0.2153*** (0.0532)	0.0201** (0.0088)	0.1081*** (0.0389)	0.0880* (0.0465)	-0.0644*** (0.0142)	-0.0395*** (0.0094)	-0.0357*** (0.0059)	-0.0419*** (0.0114)
Post-secondary education	0.4313*** (0.0558)	0.4577*** (0.0562)	-0.0682*** (0.0097)	0.4016*** (0.0384)	0.4698*** (0.0459)	-0.1217*** (0.0151)	-0.0768*** (0.0103)	-0.0590*** (0.0073)	-0.0989*** (0.0128)
Urban areas	0.0550*** (0.0100)	0.0550*** (0.0100)	-0.0004 (0.0036)	0.0617*** (0.0078)	0.0621*** (0.0079)	-0.0253*** (0.0042)	-0.0106*** (0.0026)	0.0052*** (0.0018)	-0.0103*** (0.0031)
District fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.1398 (0.8402)	-0.7287 (0.5674)	5.8657*** (0.7741)	6.7998*** (0.4446)	-0.5322 (0.8541)	-1.8403*** (0.3200)	-1.8562*** (0.2713)	-1.9493*** (0.2619)	-1.9571*** (0.2394)
Observations	1,532,251	1,532,251	1,532,251	1,532,251	1,532,251	1,532,251	1,300,267	839,351	1,532,251
R-squared	0.358	0.368	0.104	0.367	0.358	0.135	0.092	0.085	0.108

Note: Standard errors in parentheses. Standard errors are clustered at the district and year-quarter levels.

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

Source: Estimation from LFSs.

Table A.4. Regressions of employment outcomes on minimum wages (excluding 2020)

Explanatory variables	Dependent variables								
	Wage-paying job (yes=1, no=0)	Formal job (yes=1, no=0)	Log of number of working hours in the last 7 days	Log of monthly wage	Log of hourly wage	Monthly wage below MW (all workers)	Monthly wage below MW (at least 40 hours)	Monthly wage below MW (at least 48 hours)	Hourly wage below hourly MW (all workers)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log of regional minimum wages	-0.0701 (0.1479)	-0.0199 (0.0910)	-0.4033*** (0.1313)	-0.0474 (0.0562)	0.3559** (0.1401)	0.3868*** (0.0437)	0.3838*** (0.0384)	0.3911*** (0.0400)	0.4020*** (0.0345)
Gender (male=1; female=0)	-0.1245*** (0.0091)	-0.1237*** (0.0086)	0.0310*** (0.0021)	0.1790*** (0.0049)	0.1480*** (0.0047)	-0.0702*** (0.0036)	-0.0536*** (0.0034)	-0.0442*** (0.0033)	-0.0585*** (0.0034)
Age	0.0074*** (0.0009)	0.0212*** (0.0014)	0.0050*** (0.0005)	0.0565*** (0.0013)	0.0516*** (0.0011)	-0.0264*** (0.0009)	-0.0205*** (0.0009)	-0.0178*** (0.0009)	-0.0241*** (0.0008)
Age squared	-0.0001*** (0.0000)	-0.0003*** (0.0000)	-0.0001*** (0.0000)	-0.0007*** (0.0000)	-0.0006*** (0.0000)	0.0004*** (0.0000)	0.0003*** (0.0000)	0.0002*** (0.0000)	0.0003*** (0.0000)
Less than primary education	Reference								
Primary education	-0.1024** (0.0429)	-0.1070** (0.0454)	0.0411*** (0.0068)	-0.0305 (0.0327)	-0.0716* (0.0382)	-0.0167 (0.0127)	-0.0074 (0.0083)	-0.0088* (0.0049)	0.0003 (0.0096)
Lower-secondary education	0.0150 (0.0466)	-0.0047 (0.0495)	0.0494*** (0.0077)	0.0312 (0.0359)	-0.0182 (0.0424)	-0.0480*** (0.0134)	-0.0283*** (0.0089)	-0.0257*** (0.0053)	-0.0196* (0.0105)
Upper-secondary education	0.2442*** (0.0513)	0.2150*** (0.0529)	0.0180** (0.0087)	0.1077*** (0.0387)	0.0897* (0.0462)	-0.0641*** (0.0142)	-0.0397*** (0.0096)	-0.0360*** (0.0060)	-0.0428*** (0.0115)
Post-secondary education	0.4315*** (0.0549)	0.4587*** (0.0554)	-0.0713*** (0.0095)	0.4072*** (0.0374)	0.4785*** (0.0444)	-0.1229*** (0.0150)	-0.0780*** (0.0104)	-0.0601*** (0.0075)	-0.1015*** (0.0127)
Urban areas	0.0496*** (0.0104)	0.0512*** (0.0101)	0.0006 (0.0037)	0.0630*** (0.0075)	0.0625*** (0.0076)	-0.0266*** (0.0041)	-0.0120*** (0.0026)	0.0042** (0.0017)	-0.0114*** (0.0030)
District fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.9398 (1.1915)	0.2065 (0.7372)	6.9655*** (1.0496)	7.6666*** (0.4526)	-0.7653 (1.1144)	-2.4612*** (0.3443)	-2.5924*** (0.3026)	-2.7355*** (0.3132)	-2.6586*** (0.2717)
Observations	1,345,210	1,345,210	1,345,210	1,345,210	1,345,210	1,345,210	1,142,240	731,791	1,345,210
R-squared	0.368	0.376	0.112	0.373	0.365	0.142	0.098	0.092	0.115

Note: Standard errors in parentheses. Standard errors are clustered at the district and year-quarter levels.

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

Source: Estimation from LFSs.

Table A.5. Regressions of employment outcomes on minimum wages, controlling for night-time light

Explanatory variables	Dependent variables								
	Wage-paying job (yes=1, no=0)	Formal job (yes=1, no=0)	Log of number of working hours in the last 7 days	Log of monthly wage	Log of hourly wage	Monthly wage below MW (all workers)	Monthly wage below MW (at least 40 hours)	Monthly wage below MW (at least 48 hours)	Hourly wage below hourly MW (all workers)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log of regional minimum wages	-0.0962 (0.1504)	-0.0468 (0.0918)	-0.4188*** (0.1302)	-0.0680 (0.0565)	0.3507** (0.1415)	0.4049*** (0.0414)	0.3917*** (0.0375)	0.3948*** (0.0395)	0.4107*** (0.0339)
Gender (male=1; female=0)	-0.1244*** (0.0091)	-0.1236*** (0.0086)	0.0310*** (0.0021)	0.1790*** (0.0049)	0.1480*** (0.0047)	-0.0702*** (0.0036)	-0.0536*** (0.0034)	-0.0442*** (0.0033)	-0.0585*** (0.0034)
Age	0.0074*** (0.0009)	0.0212*** (0.0014)	0.0050*** (0.0005)	0.0565*** (0.0013)	0.0516*** (0.0011)	-0.0264*** (0.0009)	-0.0205*** (0.0009)	-0.0178*** (0.0009)	-0.0241*** (0.0008)
Age squared	-0.0001*** (0.0000)	-0.0003*** (0.0000)	-0.0001*** (0.0000)	-0.0007*** (0.0000)	-0.0006*** (0.0000)	0.0004*** (0.0000)	0.0003*** (0.0000)	0.0002*** (0.0000)	0.0003*** (0.0000)
Less than primary education	Reference								
Primary education	-0.1023** (0.0428)	-0.1070** (0.0453)	0.0412*** (0.0069)	-0.0304 (0.0326)	-0.0716* (0.0382)	-0.0168 (0.0126)	-0.0074 (0.0083)	-0.0088* (0.0048)	0.0002 (0.0096)
Lower-secondary education	0.0150 (0.0464)	-0.0047 (0.0493)	0.0494*** (0.0078)	0.0312 (0.0358)	-0.0182 (0.0423)	-0.0480*** (0.0133)	-0.0283*** (0.0089)	-0.0257*** (0.0053)	-0.0196* (0.0105)
Upper-secondary education	0.2441*** (0.0512)	0.2149*** (0.0528)	0.0179* (0.0088)	0.1076*** (0.0386)	0.0897* (0.0462)	-0.0640*** (0.0141)	-0.0397*** (0.0095)	-0.0360*** (0.0060)	-0.0428*** (0.0114)
Post-secondary education	0.4318*** (0.0547)	0.4590*** (0.0552)	-0.0712*** (0.0096)	0.4074*** (0.0372)	0.4786*** (0.0443)	-0.1231*** (0.0149)	-0.0781*** (0.0104)	-0.0601*** (0.0074)	-0.1015*** (0.0126)
Urban areas	0.0503*** (0.0103)	0.0520*** (0.0100)	0.0010 (0.0037)	0.0636*** (0.0075)	0.0626*** (0.0076)	-0.0271*** (0.0041)	-0.0123*** (0.0026)	0.0041** (0.0018)	-0.0116*** (0.0030)
Log of night-time light intensity	-0.0289*** (0.0084)	-0.0297*** (0.0071)	-0.0172*** (0.0061)	-0.0229** (0.0090)	-0.0057 (0.0077)	0.0200*** (0.0061)	0.0089** (0.0040)	0.0053 (0.0036)	0.0096** (0.0041)
District fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.2266 (1.2201)	0.5013 (0.7509)	7.1359*** (1.0398)	7.8937*** (0.4572)	-0.7086 (1.1311)	-2.6599*** (0.3234)	-2.6797*** (0.2934)	-2.7807*** (0.3079)	-2.7538*** (0.2666)
Observations	1,345,210	1,345,210	1,345,210	1,345,210	1,345,210	1,345,210	1,142,240	731,791	1,345,210
R-squared	0.369	0.376	0.112	0.373	0.365	0.143	0.098	0.092	0.115

Note: Standard errors in parentheses. Standard errors are clustered at the district and year-quarter levels.

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

Source: Estimation from LFSs.

Table A.6. Regressions of employment outcomes, controlling for night-time light, occupation and industry of employment

Explanatory variables	Dependent variables								
	Wage-paying job (yes=1, no=0)	Formal job (yes=1, no=0)	Log of number of working hours in the last 7 days	Log of monthly wage	Log of hourly wage	Monthly wage below MW (all workers)	Monthly wage below MW (at least 40 hours)	Monthly wage below MW (at least 48 hours)	Hourly wage below hourly MW (all workers)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log of regional minimum wages	-0.1253 (0.1482)	-0.0620 (0.0888)	-0.4259*** (0.1276)	-0.0575 (0.0581)	0.3683** (0.1422)	0.3919*** (0.0370)	0.3786*** (0.0343)	0.3739*** (0.0365)	0.3968*** (0.0316)
Gender (male=1; female=0)	-0.0034* (0.0019)	-0.0094*** (0.0018)	0.0259*** (0.0012)	0.1641*** (0.0039)	0.1381*** (0.0034)	-0.0681*** (0.0035)	-0.0517*** (0.0032)	-0.0431*** (0.0033)	-0.0527*** (0.0031)
Age	0.0090*** (0.0006)	0.0203*** (0.0011)	0.0061*** (0.0004)	0.0475*** (0.0010)	0.0413*** (0.0009)	-0.0221*** (0.0008)	-0.0177*** (0.0008)	-0.0151*** (0.0008)	-0.0195*** (0.0007)
Age squared	-0.0001*** (0.0000)	-0.0003*** (0.0000)	-0.0001*** (0.0000)	-0.0006*** (0.0000)	-0.0005*** (0.0000)	0.0003*** (0.0000)	0.0002*** (0.0000)	0.0002*** (0.0000)	0.0003*** (0.0000)
Less than primary education	Reference								
Primary education	-0.0359*** (0.0112)	-0.0410*** (0.0124)	0.0167*** (0.0029)	0.0123 (0.0135)	-0.0044 (0.0125)	-0.0146* (0.0073)	-0.0079 (0.0054)	-0.0104*** (0.0036)	-0.0048 (0.0056)
Lower-secondary education	0.0044 (0.0145)	-0.0023 (0.0157)	0.0211*** (0.0029)	0.0485*** (0.0161)	0.0273* (0.0151)	-0.0336*** (0.0083)	-0.0231*** (0.0062)	-0.0241*** (0.0041)	-0.0201*** (0.0066)
Upper-secondary education	0.0845*** (0.0191)	0.0860*** (0.0200)	0.0145*** (0.0036)	0.1067*** (0.0207)	0.0923*** (0.0197)	-0.0557*** (0.0104)	-0.0409*** (0.0078)	-0.0374*** (0.0051)	-0.0484*** (0.0086)
Post-secondary education	0.0899** (0.0332)	0.1075*** (0.0357)	0.0090 (0.0076)	0.2022*** (0.0334)	0.1932*** (0.0325)	-0.0726*** (0.0183)	-0.0536*** (0.0129)	-0.0438*** (0.0084)	-0.0630*** (0.0156)
Urban areas	0.0021 (0.0051)	0.0139*** (0.0050)	-0.0046 (0.0031)	0.0311*** (0.0042)	0.0357*** (0.0044)	-0.0148*** (0.0026)	-0.0086*** (0.0020)	0.0042** (0.0016)	-0.0098*** (0.0021)
Log of night-time light intensity	-0.0158** (0.0071)	-0.0183*** (0.0056)	-0.0140*** (0.0048)	-0.0109* (0.0057)	0.0031 (0.0060)	0.0141*** (0.0041)	0.0063** (0.0030)	0.0037 (0.0031)	0.0065** (0.0031)
Occupation and industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.4313 (1.1972)	0.6356 (0.7188)	7.1389*** (1.0218)	7.9533*** (0.4699)	-0.6519 (1.1387)	-2.6132*** (0.2905)	-2.6091*** (0.2693)	-2.6449*** (0.2850)	-2.7077*** (0.2494)
Observations	1,345,210	1,345,210	1,345,210	1,345,210	1,345,210	1,345,210	1,142,240	731,791	1,345,210
R-squared	0.589	0.564	0.174	0.477	0.447	0.224	0.153	0.135	0.172

Note: Standard errors in parentheses. Standard errors are clustered at the district and year-quarter levels.

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

Source: Estimation from LFSs.

Table A.7. Regressions of employment outcomes on minimum wages and the one-year lead variable of minimum wages

Explanatory variables	Dependent variables								
	Wage-paying job (yes=1, no=0)	Formal job (yes=1, no=0)	Log of number of working hours in the last 7 days	Log of monthly wage	Log of hourly wage	Monthly wage below MW (all workers)	Monthly wage below MW (at least 40 hours)	Monthly wage below MW (at least 48 hours)	Hourly wage below hourly MW (all workers)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log of regional minimum wages	-0.0046 (0.0943)	0.0124 (0.0647)	-0.2771** (0.1319)	0.0467 (0.0510)	0.3238** (0.1393)	0.3408*** (0.0380)	0.3012*** (0.0352)	0.2953*** (0.0356)	0.3187*** (0.0301)
One-year lead of log of regional minimum wages	0.0066 (0.0761)	0.0490 (0.0581)	-0.0449 (0.1243)	-0.0130 (0.0580)	0.0320 (0.1116)	-0.0166 (0.0489)	0.0237 (0.0412)	0.0494 (0.0447)	0.0342 (0.0354)
Gender (male=1; female=0)	-0.1253*** (0.0090)	-0.1248*** (0.0086)	0.0308*** (0.0021)	0.1791*** (0.0049)	0.1482*** (0.0047)	-0.0700*** (0.0037)	-0.0533*** (0.0034)	-0.0442*** (0.0033)	-0.0586*** (0.0035)
Age	0.0076*** (0.0009)	0.0216*** (0.0013)	0.0051*** (0.0005)	0.0571*** (0.0013)	0.0520*** (0.0011)	-0.0267*** (0.0009)	-0.0206*** (0.0009)	-0.0179*** (0.0009)	-0.0243*** (0.0009)
Age squared	-0.0001*** (0.0000)	-0.0003*** (0.0000)	-0.0001*** (0.0000)	-0.0007*** (0.0000)	-0.0006*** (0.0000)	0.0004*** (0.0000)	0.0003*** (0.0000)	0.0002*** (0.0000)	0.0003*** (0.0000)
Less than primary education	Reference								
Primary education	-0.1094** (0.0444)	-0.1133** (0.0467)	0.0438*** (0.0072)	-0.0333 (0.0336)	-0.0771* (0.0396)	-0.0161 (0.0129)	-0.0068 (0.0084)	-0.0082 (0.0049)	0.0016 (0.0099)
Lower-secondary education	0.0089 (0.0480)	-0.0106 (0.0508)	0.0519*** (0.0082)	0.0271 (0.0366)	-0.0248 (0.0435)	-0.0468*** (0.0135)	-0.0272*** (0.0089)	-0.0248*** (0.0053)	-0.0178 (0.0107)
Upper-secondary education	0.2399*** (0.0525)	0.2102*** (0.0542)	0.0203** (0.0091)	0.1021** (0.0394)	0.0818* (0.0473)	-0.0627*** (0.0143)	-0.0387*** (0.0095)	-0.0351*** (0.0060)	-0.0410*** (0.0116)
Post-secondary education	0.4249*** (0.0565)	0.4517*** (0.0571)	-0.0686*** (0.0100)	0.3984*** (0.0387)	0.4670*** (0.0463)	-0.1199*** (0.0153)	-0.0762*** (0.0104)	-0.0589*** (0.0075)	-0.0984*** (0.0130)
Urban areas	0.0541*** (0.0102)	0.0543*** (0.0104)	0.0002 (0.0038)	0.0618*** (0.0081)	0.0616*** (0.0081)	-0.0255*** (0.0044)	-0.0108*** (0.0027)	0.0050*** (0.0018)	-0.0103*** (0.0032)
District fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.0447 (1.1313)	-0.8122 (0.7761)	6.2237*** (0.8165)	6.8428*** (0.6286)	-0.8473 (0.8851)	-1.8779*** (0.4728)	-2.0404*** (0.4058)	-2.2775*** (0.4169)	-2.1728*** (0.3707)
Observations	1,313,371	1,313,371	1,313,371	1,313,371	1,313,371	1,313,371	1,116,554	718,129	1,313,371
R-squared	0.356	0.366	0.106	0.368	0.359	0.138	0.094	0.088	0.111

Note: Standard errors in parentheses. Standard errors are clustered at the district and year-quarter levels.

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

Source: Estimation from LFSs.