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Employment and Working Hour Effects of Minimum Wage Increase: Evidence from China

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Abstract

Using a difference-in-differences model, the present paper provides empirical evidence of minimum wage effects on employment and working hours in China. The results show that male employment is not affected by a minimum wage increase, although men's working hours do increase. In contrast, female employment is more likely to be negatively affected by a minimum wage increase, while their working hours remain unchanged. This may lead to women being in a more disadvantaged position in the workforce, and adopting a monthly minimum wage may induce firms to extend men's working hours. Therefore, to better protect disadvantaged workers, we suggest that minimum wage regulation should focus on the target group of less-educated women, and that a unified minimum hourly wage needs to be set for both full-time and part-time workers. Meanwhile, the importance of human capital accumulation should be addressed in alleviating the negative effects of minimum wage increases.

Key words: difference-in-differences model, employment, minimum wage, working hours

JEL codes: J22, J31, J38

I. Introduction

Minimum wage regulation is widely-used in labor markets around the world to ensure basic living standards are met by workers. However, there is still no consensus on the effects of establishing a minimum wage. Since China issued its first minimum wage regulation in 1993, both the coverage and the absolute level of minimum wage have increased. However, there is still not enough evidence on how minimum wage increases affect disadvantaged workers;

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these workers should be granted more attention and protected through minimum wage policy.

The possible effects of a minimum wage have long been discussed in the field of labor economics. Among these effects, the employment effect has been the main concern, and it is also considered to be the basis for analyzing other minimum wage effects (e.g. spillover effects). According to labor economics theory (Brown, 1999), the minimum wage has a negative impact on employment in a competitive labor market. However, this notion has long been challenged, both theoretically and empirically. Theoretically, if firms have monopsony power and the initial minimum wage is low, a minimum wage increase will actually enhance employment (Cahuc and Zylberberg, 2004). Empirically, as pointed out by Neumark and Wascher (2007), there is still no overall consensus on the employment effect. Some find that the minimum wage has no negative impact on employment (Card and Krueger, 1994; Dickens *et al*., 1999; Machin *et al*., 2003), while others find a negative impact (Neumark and Wascher, 1992; Burkhauser *et al*., 2000).[1] Neumark and Wascher (2008) summarize earlier empirical studies on the employment effect and find that differences in empirical results originate from the different methods and data sources that are applied.

In reaction to a minimum wage increase, the labor market can adjust at both the extensive margin and the intensive margin, which means both employment and working hours may be changed in response to a minimum wage increase. In the long run, firms in pursuit of profit maximization will choose an optimized combination of employment and working hours according to the fixed cost of employment, production technology and labor supply (Stewart and Swaffield, 2008). However, in the short run, adjustment of working hours is easier than adjustment of employment (Hamermesh, 1993). Hence, minimum wage effects may be underestimated if the working hour effect is ignored (Couch and Wittenburg, 2001). Linneman (1982) and Neumark *et al*. (2004) both suggest that it is crucial to study the working hour effect if we want to evaluate the full impact of a minimum wage on low-wage workers.

Since 2010, many provinces in China have raised the minimum wage on a regular basis. On average, provinces increase the minimum wage every 1.2 years.[2] However, there are few serious evaluations of how this regular increase in the minimum wage has affected labor market outcomes, especially the living standards of disadvantaged workers. Moreover, among the few minimum wage studies on China, most focus only on the employment effect (Luo, 2007; Zhang *et al*., 2009; Ding, 2010; Ma *et al*., 2012), and there is still no research on the working hour effect.

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[1]As there are already many reviews of the minimum wage literature, the author will not include a detailed discussion of this topic. Please refer to Neumark and Wascher (2008) for a review.

[2] This value is calculated by the author based on the China Minimum Wage Database.

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The present paper provides empirical evidence of how a minimum wage increase in China affects less-educated workers. The paper is structured as follows. Section II introduces the history and the current state of minimum wage legislation and its application in China. Section III lays out the empirical strategy. Section IV presents the data and provides a descriptive analysis. Section V explores employment and working hour effects in detail. Finally, Section VI concludes and suggests some policy implications.

II. Minimum Wage Regulation in China

China officially recognized the Minimum Wage-Fixing Machinery Convention in 1984.[3] However, from 1984 to 1992, there was no official minimum wage in China. In 1993, the Chinese Government issued its first minimum wage regulation, the Enterprise Minimum Wage Regulation. The regulation stipulates that a minimum wage can only be modified after it has been effective for 1 year. This regulation requires that local governments set the minimum wage according to local average wage, productivity, unemployment rate, economic development and minimum living expenses, and all enterprises should comply with the regulation (Wang and Gunderson, 2011). In 1993, only Shanghai announced a monthly minimum wage. Minimum wage policy was formally established in 1995 when the *Labor Law of the People's Republic of China* was set into force and, as a result, most provinces in China announced their first monthly minimum wages around 1995.

By the end of 2004, temporary labor shortages in some developed areas caught the attention of policy-makers. In the same year, a modified minimum wage regulation was adopted. According to the new regulations, minimum wages should be adjusted at least once every 2 years, and penalties for violation were increased from 20–100 percent of the owed wage to 100–500 percent. Employers should not include subsidies, such as overtime pay, as part of the wage, when calculating the minimum wage. A minimum wage per hour that applies to part-time workers was also stipulated in the updated regulations.

Minimum wage regulation was part of the *Labor Contract Law* which took effect on 1 May 2008. At the end of 2008, the Department of Human Resources and Social Security of China advised local governments against increasing the minimum wage in 2009 in case of possible negative impacts of the international financial crisis. As the influence of the financial crisis waned, there was a new round of minimum wage increases from 2010. In 2010, 30 of 31 provinces increased their minimum wage, with

[3]The Minimum Wage-Fixing Machinery Convention was established in 1928 by the International Labor Organization.

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the average increase at 23 percent.[4] In each of 2011, 2012 and 2013, 24 provinces increased their minimum wage, and the average increase in each year was above 20 percent.[5] The Chinese Government has also promised to continue this increase in its 12th five-year plan.

Unlike many developed economies, China does not set a national minimum wage, and provincial governments are responsible for minimum wage adjustment in each province. According to the Minimum Wage Regulation of 2004, multiple minimum wages are allowed in the same province. Therefore, to obtain a basic understanding of how the minimum wage standard has been set and increased in China, in the present paper, we use a two-step weighted approach to calculate the national minimum wage in each year. First, we calculate the average minimum wage in each province in each year using the actual enforcement days of each minimum wage as the weight. Second, we calculate the average national minimum wage in each year based on average provincial minimum wages using urban employment of each province as the weight. In Figure 1, we present minimum wage changes in China from 1995 to 2013.[6] It is evident that both nominal and real minimum wages have increased since 1995. However, a comparison of the minimum/average wage ratio (relative minimum wage) between China and OECD countries indicates that the minimum wage in China is still at a relatively low level (see Figure 2). As of 2012, the relative minimum wage in OECD countries was above 35 percent, while in China this ratio was only around 24 percent.[7]

As pointed out by Du and Wang (2008), the average annual wage published by the National Bureau of Statistics of China is based on a labor survey in urban China. However, migrant workers and workers in informal sectors, who generally earn less than the average wage, are not fully represented in the sample. As a result, the official average wage is overestimated, and the relative minimum wage is underestimated. In fact, if we calculate the relative minimum wage using the average wage from a well-represented sample, we find that the minimum wage in China is already at a relatively high level (see Figure 3).[8]

For comparison with the international minimum wage level, we also collect the latest

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[4] This value is calculated by the author based on the China Minimum Wage Database.

[5] This value is calculated by the author based on the China Minimum Wage Database. In 2013, only minimum wage increases in the last three quarters are considered.

[6] Although minimum wage regulation was first introduced in 1993, most provinces issued their first minimum wages in 1995. That is why we do not report a national minimum wage before 1995 in Figure 1.

[7] According to the China Minimum Wage Database, the annual minimum wage in 2012 was 11 438 yuan. According to the *China Statistical Yearbook* 2013, the annual average wage of urban employees in 2012 was 46 769 yuan. As a result, the relative minimum wage is 24 percent for 2012.

[8] For Figure 3, the average wage is calculated from the China Urban Labor Survey, which was conducted by the Institute of Population and Labor Economics, Chinese Academy of Social Sciences, in 2001, 2005 and 2010. For more information regarding this survey, visit http://iple.cass.cn/cate/1103.htm.

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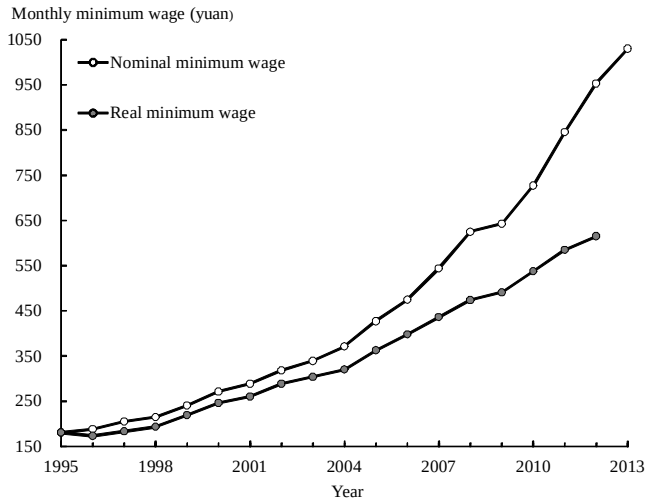
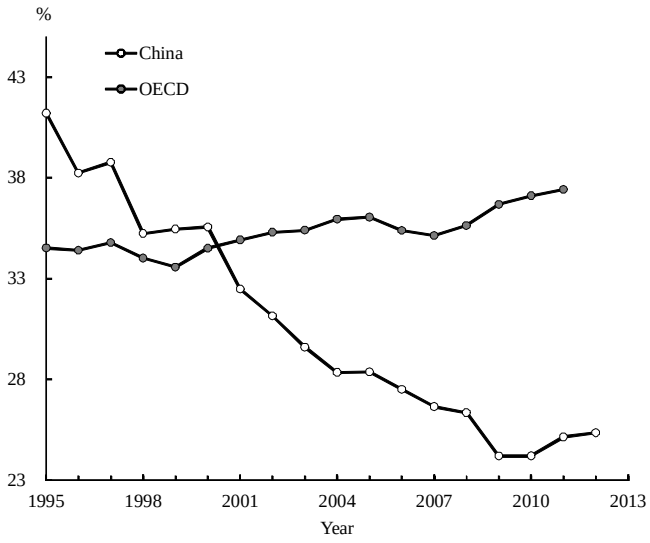
Figure 1. Minimum Wage Increase in China, 1995–2013



Source: China Minimum Wage Database (available from: http://www.chinaminimumwage.org).

Figure 2. Minimum Wage/Average Wage Ratio, 1995–2012



Sources: China Minimum Wage Database (available from: http://www.chinaminimumwage.org) and OECD Statistics Database (available from: http://stats.oecd.org).

Note: The minimum wage/average wage ratio is not available for China in 2013, or for the OECD in 2012 and 2013.

minimum wage data for 150 countries and calculate the level of minimum wage relative to per capita GDP. From an international perspective, the relative minimum wage and per capita GDP are negatively correlated (see Table 1): high income countries have a low

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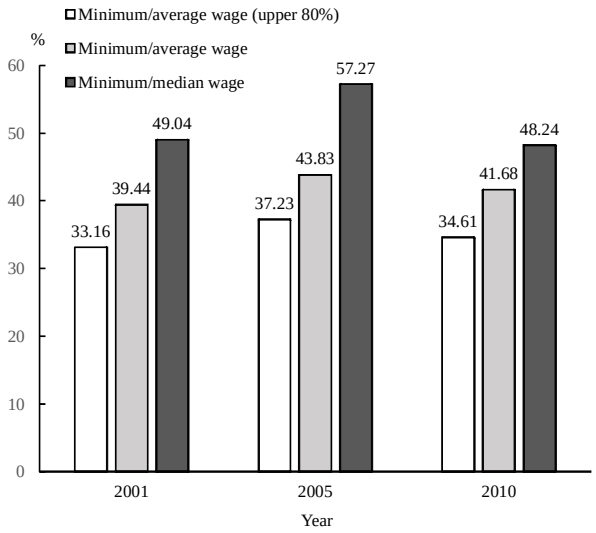
Figure 3. Relative Minimum Wage, 2001, 2005 and 2010



Sources: China Minimum Wage Database (available from: http://www.chinaminimumwage.org) and China Urban Labor Survey (available from: http://iple.cass.cn/cate/1103.htm).

Table 1. Relative Minimum Wage and Per Capita GDP (by the End of 2013)

Income group	Relative minimum wage (%)
Low income countries	104.76
Middle income countries: Lower	64.78
China	38.90
Middle income countries: Upper	39.83
High income countries: Non-OECD	28.19
High income countries: OECD	39.31

Source: Available from: http://en.wikipedia.org/wiki/List_of_minimum_wages_by_country.

Note: Relative minimum wage is calculated using the latest available data for each country. China belongs to the middle income countries (upper).

relative minimum wage, while in low income countries, the necessary costs of basic living (a proxy for minimum wage) account for a large proportion of per capita GDP. If the relationship between the relative minimum wage and per capita GDP is universal, the minimum wage increase in China should not exceed the increase in per capita GDP over the next few years or even over the longer term.

III. Empirical Strategy

In this section, we will lay out the identification strategy applied in the present paper. Following the difference-in-differences (DID) approach in Athey and Imbens (2006), all observations are divided into two groups: an experiment group and a control group. The

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minimum wage can only affect the experiment group, and the control group is used to capture changes in employment and working hours without a minimum wage. The experiment group includes provinces that had at least one minimum wage increase during the specified period, while the control group includes provinces that did not increase their minimum wage during the sample period. Each observation i has a group dummy $G_i \in \{0,1\}$ (1 for the experiment group and 0 for the control group) and a time dummy $T_i \in \{0,1\}$ (1 for after the experiment period and 0 for before the experiment period). For a random sample from the population, G_i and T_i can be considered random variables. Let Y_i denote the outcome variable, which represents employment status and working hours in this study. The observed data for i is (Y_i, G_i, T_i). Using the potential outcome framework proposed by Rubin (1974), we let Y_i^0 denote the outcome of observation i without treatment (i.e. with no minimum wage increase), and let Y_i^1 denote the outcome under treatment. The observed outcome Y_i can be obtained as follows:

$$Y_i = (1 - I_i)Y_i^0 + I_i Y_i^1 = Y_i^0 + (Y_i^1 - Y_i^0)I_i, \tag{1}$$

where $I_i = G_i T_i$ represents the group of individual who are actually affected by the minimium wage increase. Assume Y_i^0 satisfies

$$Y_i^0 = a + bT_i + gG_i + e_i, \tag{2}$$

where b represents the time effect that is invariant of group variable G_i, and g is the group effect which is the invariant of the time variable T_i. The DID estimator can be written as:

$$\begin{aligned} t^{DID} = &\{E[Y_i \mid G_i = 1, T_i = 1] - E[Y_i \mid G_i = 1, T_i = 0]\} \\ &-\{E[Y_i \mid G_i = 0, T_i = 1] - E[Y_i \mid G_i = 0, T_i = 0]\}. \end{aligned} \tag{3}$$

Equation (3) indicates that without a minimum wage increase, changes in employment and working hours between the control and the experiment group should be the same. However, a minimum wage increase induces the experiment group to deviate from this common trend. Therefore, to estimate the treatment effect, we need to subtract the population average differences of the control group from those of the experiment group.

Assume that a minimum wage increase has the same effect on every observation (i.e. $Y_i^1 - Y_i^0 = t$), and also consider other factors that may affect the outcome variable. We can obtain:

$$Y_i = a + bT_i + gG_i + tI_i + dX_i + e_i. \tag{4}$$

Equation (4) is a regression-adjusted DID model (Angrist and Pischke, 2009). In the

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study of the employment effect, X_i includes age, age squared, education, marital status, health, household size and other provincial-level macroeconomic indicators. In the analysis of the working hour effect, X_i includes age, age squared, wage, education and other provincial indicators.

As stated above, the core assumption of the DID approach is that the "same outcome changes without treatment." In practice, it is difficult to test this hypothesis directly. In the next section, we further examine the comparability of the experiment and the control groups.

IV. Data and Descriptive Analysis

The micro data used in the present paper are from the China General Social Survey (CGSS). The CGSS was co-conducted by the Department of Sociology at Renmin University of China and the Division of Social Science at Hong Kong University of Science and Technology in 2005 and 2006.[9] This survey contains detailed individual information on demographics and employment in 28 of 31 provinces in Chinese mainland (Qinghai, Tibet and Ningxia are not included).[10] The minimum wage data used in the present paper is from the China Minimum Wage Database (CMWD), which was established by the Institute of Population and Labor Economics, Chinese Academy of Social Sciences. The CMWD contains detailed information on minimum wage adjustment for nearly 3000 counties in Chinese mainland from 1993 to 2013.[11]

The present paper focuses on less-educated workers, referring to workers with less than junior high school education. We focus on less-educated workers because a minimum wage increase is expected to have a significant effect on these workers. Less-educated workers generally work in low-wage sectors, and a higher minimum wage will induce firms to use highly-educated workers, or more working hours or more capital to substitute less-educated workers in order to maintain normal production. In the present paper, we only consider workers aged between 20 and 50 years.

In the 2005 questionnaire, the interviewees were asked to state their working status over the past 3 months, including: (i) full-time job; (ii) part-time job; (iii) temporary or unstable job without contract; (iv) retired; (v) no job (unemployed or dismissed); (vi) part-

[9]It should be stated that the 2008 CGSS data have been released. However, unlike the 2005 and 2006 data, for which the respondents were asked about their salary in the past month, only annual income in the last year was requested in the 2008 survey, which makes it impossible to assign correct minimum wage treatment status to each observation.

[10]For more information on this survey, visit http://www.cssod.org.

[11]For more information about CMWD, visit http://www.chinaminimumwage.org.

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time farm work; (vii) full-time farm work; or (viii) never worked before. For those who choose option (i), (ii), (iii), (vi) and (vii), the employment status is defined as 1, while in the other cases the employment status is defined as 0. In the 2006 questionnaire, the interviewees were asked about their current working status. There were three options: (i) currently working; (ii) worked before; or (iii) never worked before. For those who chose option (i), the employment status is defined as 1, while in the other cases the employment status is defined as 0. The interviewees were also asked about their working hours per week in both 2005 and 2006.

The 2005 survey was conducted between September and November in 2005, while the 2006 survey was conducted between September and December in 2006. In our research, observations in provinces that have no minimum wage increase between the 2005 survey start date and the 2006 survey end date are included in the control group, and observations in provinces that have at least one minimum wage increase between the 2005 survey end date and the 2006 survey start date are included in the experiment group. As a result, 5 provinces are in the control group and 23 provinces are in the experiment group.[12] Note that all provinces in the control group are in the central area of China.

In Table 2, we present details of minimum wage adjustment in the experiment group between 2005 and 2006. Beijing, Shanghai and Tianjin, show the highest level of minimum wage in both 2005 and 2006. Because the minimum wage is frequently increased in these 3 cities,[13] the increase between 2005 and 2006 is not very large. Except for Hebei, Shanghai, Guangxi and Shannxi, minimum wage increases in other provinces are all above 10 percent; in some provinces like Jilin, Heilongjiang, Chongqing and Guizhou, the average increase is approximately 40 percent. In 2006, Shanghai had the highest minimum wage level,

Table 2. Minimum Wage Increase between 2005 and 2006

Province	2005 (yuan)	2006 (yuan)	Increase (%)	Province	2005 (yuan)	2006 (yuan)	Increase (%)
Beijing	580	640	10.34	Hunan	412	475	15.38
Tianjin	580	660	13.79	Guangdong	477	604	26.70
Hebei	470	510	8.51	Guangxi	385	418	8.44
Liaoning	400	497	24.17	Hainan	417	497	19.20
Jilin	330	460	39.39	Chongqing	365	500	36.99
Heilongjiang	306	476	55.48	Sichuan	368	485	31.97
Shanghai	690	750	8.70	Guizhou	360	500	38.89
Jiangsu	480	530	10.42	Yunnan	408	480	17.55
Zhejiang	533	645	21.13	Shannxi	445	480	7.87
Anhui	347	443	27.76	Gansu	320	378	17.97
Fujian	450	542	20.37	Xinjiang	370	433	17.12
Shandong	430	490	13.95				

Source: Author's calculation based on the China Minimum Wage Database.

[12]Details of the experiment and control groups are available from the author upon request.

[13]Minimum wages in Beijing, Shanghai and Tianjin are adjusted annually.

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almost twice the minimum wage in Gansu. These differences in the minimum wage level reflect huge differences in economic and social development in different areas of China.

Besides minimum wage regulation, many other individual characteristics, human capital in particular, may affect employment and working hours. In Table 3, we present some descriptive statistics of individual characteristics. It is evident that the male employment rate is much higher than the female employment rate in both experiment and control groups in 2005 and 2006, and this is because of the traditional division of work in Chinese households. In the control group, male working hours are greater than female working hours both before and after a minimum wage increase, while in the experiment group, male working hours are lower than female working hours before a minimum wage increase but are greater than female working hours after the increase, which implies that the minimum wage tends to increase male working hours. Another aspect deserving more attention is that although the *Labor Law of the People's Republic of China* in 1995 has set maximum working hours for all employees, of 44 hours per week, both female and male working hours have exceeded this limit, which may reflect ineffective enforcement of the law and the low bargaining power of less-educated workers. Table 3 also shows that average educational attainment and health conditions are both better for men than for women. As important components of human capital, more education and better health conditions usually increase the possibility of employment, but their impact on working hours is not clear in theory. It is also evident from Table 3 that the proportion of married women is higher than the proportion of married men, and the average household size of women is higher than that of men, which may lower female employment and working hours.

As stated in Section III, the core assumption of the DID approach is that without a minimum wage increase, changes in employment and working hours in both control and experiment groups should be the same. In practice, it is difficult to test this hypothesis directly, because we can never observe both potential outcomes for the same observation.

Table 3. Descriptive Statistics of Individual Characteristics, 2005 and 2006

Variable	Control group				Experiment group			
	Female		Male		Female		Male	
	2005	2006	2005	2006	2005	2006	2005	2006
Number of observations	150	179	99	107	798	843	575	602
Employment rate (%)	41.33	51.96	86.87	80.37	52.88	47.81	73.74	79.07
Weekly working hours	53.05	51.77	55.95	52.80	52.69	51.52	52.41	54.93
Monthly wage (yuan)	412.96	676.44	927.06	868.36	587.22	805.69	926.66	1106.07
Age	37.78	39.60	38.06	38.80	37.52	37.67	38.41	38.00
Education (years)	7.42	7.61	7.65	7.94	7.48	7.94	8.03	8.13
Married (%)	92.67	92.74	91.92	87.85	89.60	89.68	83.83	81.89
Health	3.85	3.89	4.19	4.07	4.03	3.85	4.13	4.02
Household size	5.49	4.05	5.19	3.65	5.34	4.51	5.15	4.47

Source: Author's calculation based on the China General Social Survey.

Note: Health is a discrete variable with 1 to 5 representing from very poor to very good, respectively.

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However, we can manually choose an experiment group and a control group that have the same or similar properties before a minimum wage increase. To justify our choice of experiment and control groups in the present paper, we compare some macroeconomics indicators between different groups (see Table 4). It is found that the registered unemployment rate in the control group does not change between 2005 and 2006, while in the experiment group the unemployment rate increased from 3.87 to 3.93. There are also some differences in other macroeconomic indicators between the control and experiment groups in 2005, which indicates that the original choice of experiment and control groups may not be comparable, because the DID approach requires that both groups have similar characteristics. However, as noted in Section III, all 5 provinces in the control group are in the central area and, therefore, it may be better to compare the control group and the experiment group in central areas. Under this scenario, the differences of most indicators are narrowed.

In Table 5, we present the descriptive DID estimates of the minimum wage effect on employment and working hours. A decrease in female employment in the experiment group and an increase of female employment in the control group lead to an estimated 16 percent (14 percent for central area) decrease in female employment. Applying the same logic leads to an estimated 12 percent (16 percent for central area) increase in male employment. Female weekly working hours in both experiment and control groups decreases after a minimum wage increase, but the decrease in the control group is a little larger, and results in an estimated increase of 0.11 (0.78 for central area) working hours for women. For men, a decrease in weekly working hours in the control group and an increase in the experiment group leads to an approximate 5.67-hour (7.13 for central areas) increase in working hours, which equates to working approximately 1 more hour (1.4 hours for central area)

Table 4. Comparability of Experiment and Control Groups, 2005 and 2006

Indicator	Control group		Experiment group		Experiment group (central area)	
	2005	2006	2005	2006	2005	2006
GDP per capita	12 254.40	14 539.40	18 019.30	20 605.96	11 745.25	13 527.50
Average wage	—	16 885.60	—	20 890.57	—	16 824.25
Unemployment rate	3.72	3.72	3.87	3.93	4.30	4.32
Urbanization rate	40.03	41.33	47.90	48.89	44.53	45.57
Industry structure	85.30	86.94	86.44	87.61	83.89	84.78

Source: National Bureau of Statistics of China (available from http://data.stats.gov.cn).

Notes: The average wage is calculated only for urban employees and the 2005 data is not available. The urbanization rate is the proportion of the urban population to the total population. Industry structure is the ratio of non-agriculture GDP to total GDP.

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Table 5. Descriptive Estimates of Minimum Wage Effects Using the DID Method, 2005 and 2006

Group	Female				Male			
	2005	2006	FD	DID	2005	2006	FD	DID
Employment (%)								
Control group	41.33	51.96	10.63	—	86.87	80.37	–6.50	—
Experiment group	52.88	47.81	–5.07	–15.70	73.74	79.07	5.33	11.83
Experiment group (central area)	46.75	43.35	–3.40	–14.03	67.15	76.17	9.02	15.52
Working hours								
Control group	53.05	51.77	–1.28	—	55.95	52.80	–3.15	—
Experiment group	52.69	51.52	–1.17	0.11	52.41	54.93	2.52	5.67
Experiment group (central area)	51.87	51.37	–0.50	0.78	50.56	54.54	3.98	7.13

Source: Author's calculation based on China General Social Survey.

Notes: DID, difference-in differences; FD, first-difference.

per day compared with the situation of no minimum wage increase.

It is evident from Table 3 that differences in individual characteristics may affect both employment and working hours. To obtain more accurate estimates of minimum wage effects, we need to use econometric models to control individual heterogeneity.

V. Minimum Wage Effects on Employment and Working Hours

In the present paper, following the traditional research of labor economics, we split the analysis of women and men in all the regressions. We first consider the employment effect in the basic DID model (model (1) in Table 6). The variable we are interested in is the interaction term of the experiment group dummy and the time dummy in Table 6. There are obvious differences in minimum wage effects between women and men, which validates our choice of splitting the two samples. Moreover, both estimation results are very significant (–0.16 and 0.13; see model (1) in Table 6), and more than 10 percent of the less-educated employed population is affected by a minimum wage increase. This estimation is relatively high compared with the result in earlier studies. For example, Brown *et al*. (1982) point out that a 10-percent increase in minimum wage only reduces teenage employment by 1–3 percent.

Model (2) in Table 6 presents the DID estimates after controlling individual properties. The coefficients of age and age squared indicate that there is an inverse U-shaped relationship between employment and age, which concurs with the theoretical expectation of life cycle models of labor supply. Although more education will increase both male and female employment, its effect on male workers in our study is not significant (close to zero). Better health conditions increase both female and male employment, which meets the expectation of human capital theory. Married women tend to have lower probabilities of being employed, while married men tend to have higher employment possibilities, which

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Table 6. Minimum Wage Effects on Employment, 2005 and 2006

Variable	Female				Male			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Experiment group dummy	0.12***	0.12***	–0.00	0.11**	–0.13***	–0.11***	–0.15**	–0.14***
Time dummy	0.11*	0.16**	0.27***	0.19***	–0.08	–0.09	–0.06	–0.12
Interaction	–0.16***	–0.20***	–0.28***	–0.25***	0.13**	0.11	0.12	0.11
Age	—	0.05***	0.07**	0.04*	—	0.02	0.04	0.03
Age squared	—	–0.08***	–0.10**	–0.07**	—	–0.04*	–0.07*	–0.05*
Education	—	0.01**	0.03***	0.02*	—	0.00	0.00	0.00
Married	—	–0.18***	–0.17**	–0.17***	—	0.17***	0.08	0.09
Health	—	0.02*	0.03	0.02	—	0.06***	0.08***	0.06***
Household size	—	0.01	0.04*	0.03**	—	0.01	0.02	0.02
Unemployment rate	—	–0.03	0.15	–0.04	—	0.04	0.05	0.06*
Urbanization rate	—	–0.00	–0.01	–0.00	—	–0.01**	–0.01	–0.01
Industry structure	—	–0.01**	–0.01	–0.02*	—	0.01***	0.00	0.03***
Log of per capita GDP	—	0.11	–0.12	0.19	—	0.07	0.07	0.05
Pseudo R^2	0.00	0.04	0.09	0.05	0.01	0.10	0.14	0.12
Observations	1970	1343	496	745	1383	924	338	490

Source: Author's calculation based on the China General Social Survey.

Notes: Model (1) is the basic difference-in-differences model; model (2) includes other factors that may affect employment or working hours; model (3) restricts the sample to the central area; model (4) restricts the sample to provinces with minimum wage increase above 20 percent. Variable interaction represents the interaction term of the experiment group dummy and the time dummy. ***, ** and * denote statistical significance at the 1, 5 and 10-percent level, respectively. All estimates are heteroskedasticity robust. All coefficients are marginal effects.

is consistent with the theory of household joint labor supply (Blundell and Macurdy, 1999). However, an increase in non-agriculture contributions to total GDP decreases female employment and increases male employment, which reflects that a large proportion of women are engaged in farming activities and the shrinking of the agricultural sector is reducing their employment. The coefficient of the interaction term for women in model (2) (–0.20) is significantly negative and is much larger than that in model (1) of Table 6, which means after controlling individual properties, the minimum wage still has a negative impact on female employment. However, although the coefficient for men is still positive (0.11), it is no longer statistically significant, which indicates that the increase in male employment is caused by individual properties or macroeconomic changes and is not a result of a minimum wage increase. As the minimum wage in China is already at a high level considering China's economic development, if we choose to continue to increase the minimum wage in the next few years, we need to take some measures to ensure the employment of less-educated women.

China has a vast territory which differs in geographical environment, social and economic development, human capital accumulation and labor markets. As noted previously, all 5 provinces in the control group are in central areas, while the provinces in the experiment group are distributed among western, central and eastern areas. As discussed in Section IV, control and experiment groups in central areas have similar macroeconomic conditions.

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To measure minimum wage effects more accurately, we further restrict the sample to observations in the central area of China (see model (3) in Table 6). In the central area, the relationship between female employment and age still presents an inverse U shape. Better health conditions still increase male employment. In addition, there remains an apparent difference in employment status between married and unmarried women. The interaction term for women is still significantly negative and is much larger than those in models (1) and (2) of Table 6, while the coefficient for men is still not statistically significant. According to Table 2, there are obvious differences in the extent of minimum wage increases among provinces in the experiment group. After we restrict the sample to provinces with higher minimum wage increases (above 20 percent), the results are basically unchanged for both men and women. These estimates further indicate that a minimum wage increase only leads to a decrease in female employment.

Following the same logic, we turn to consider the working hour effect. From the basic DID estimates (see model (1) in Table 7), the minimum wage effect on women's working hours per week is very small (0.11), and is not statistically significant, while its effect on men's working hours is relatively large (5.67). This indicates that, like the employment effect, a minimum wage increase also has different working hour effects for men and women.

In model (2) of Table 7, after controlling individual characteristics, the minimum wage effect on female working hours is still not statistically significant, while that of men is great, which further strengthens our view that the minimum wage only affects male working hours. Comparing with model (1) in Table 7, the coefficient for men is a little larger. Higher wages are associated with longer working hours for men. Older workers tend to work less hours, although these coefficients are not significant (–0.52 and –0.52 in model (2) of Table 7). More education tends to decrease working hours for both men and women, because more-educated people tend to work in firms that are more likely to comply with law requirements on working hours. Models (3) and (4) present similar results to model (2) in Table 7. They indicate that less-educated men generally work in informal labor markets, and after minimum wage increases, they have to work longer hours in order to keep their jobs. Under the current wage system (dominated by a monthly minimum wage), labor inspection agencies of local governments typically do not monitor actual working hours in firms, and less-educated workers are generally not able to bargain with their employers over their working hours. As a result, in response to a minimum wage increase, firms may take advantage of the system by increasing working hours to reduce production costs.

From Tables 6 and 7, we find that female employment is more likely to be negatively

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Table 7. Minimum Wage Effects on Working Hours, 2005 and 2006

Variable	Female				Male			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Experiment group dummy	–0.36	–0.48	–1.93	1.75	–3.54*	–2.87	–7.60***	–1.04
Time dummy	–1.28	–5.39**	–6.07**	–7.49***	–3.15	–5.84**	–4.77	–7.21***
Interaction	0.11	2.19	3.92	2.49	5.67**	6.60**	8.33**	6.74**
Monthly wage	—	0.08	0.09	–0.11	—	0.18**	0.03	0.10
Age	—	–0.52	–0.84	–1.00	—	–0.52	–1.19	–0.73
Age squared	—	0.46	0.97	1.26	—	0.32	1.21	0.61
Education	—	–0.56**	–0.20	–0.33	—	–0.85***	–0.26	–0.38
Unemployment rate	—	–0.54	2.74	0.45	—	–0.69	6.75**	0.25
Urbanization rate	—	0.00	–0.23	–0.39**	—	–0.13	–0.29	–0.32*
Industry structure	—	–0.16	0.34	0.15	—	–0.13	0.36	0.11
Log of per capita GDP	—	0.94	–0.87	11.48**	—	4.01	–0.23	8.73*
R^2	0.00	0.04	0.03	0.05	0.01	0.06	0.06	0.05
Observations	1677	1298	471	714	1356	1093	402	580

Source: Author's calculation based on China General Social Survey.

Notes: Monthly wage is in 100 yuan. Model (1) is the basic difference-in-differences model; model (2) includes other factors that may affect employment or working hours; model (3) restricts the sample to the central area; model (4) restricts the sample to provinces with minimum wage increase above 20 percent. Variable interaction represents the interaction term of the experiment group dummy and the time dummy. ***, ** and * denote statistical significance at the 1, 5 and 10-percent level, respectively. All estimates are heteroskedasticity robust.

affected by a minimum wage increase, while their working hours remain unchanged; for male workers, employment is not affected by a minimum wage increase but they have to work longer hours as a result. These differences may reflect different roles of male and female workers in their daily work. This indicates that more male workers are in irreplaceable positions and after a minimum wage increase, firms may not choose to fire lots of male workers so as to maintain normal production; in contrast, they may choose to increase male working hours to deal with the increase in production costs. For female workers, their positions are more likely to be substituted by men and increasing working hours may not be an option. Although, minimum wage increases worsen the labor market conditions of both female and male workers, women are more worse off as they can potentially lose their jobs following a minimum wage increase. Therefore, less-educated women should be considered when improving the enforcement of minimum wage regulation.

We focus on minimum wage effects on less-educated workers in the present paper, For comparison purposes, we also estimate the effects of minimum wages on highly-educated workers to better understand the target group of minimum wage regulation (see Tables 8 and 9 for the employment effect and the working hour effect, respectively). There is an interesting finding that a minimum wage increase only affects less-educated workers. The results in Tables 6–9 also indicate that it is impossible for highly-educated workers to replace less-educated workers, because there are barriers in working conditions and job requirements. We find that employment has been substituted by working hours, and female

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Table 8. Minimum Wage Effects on Employment of Highly-educated Workers, 2005 and 2006

Variable	Female				Male			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Experiment group dummy	0.07	0.05	0.05	0.09	0.07*	0.08**	0.20	0.10**
Time dummy	0.02	–0.05	–0.03	–0.11	0.10**	0.04	0.07	0.00
Interaction	–0.06	0.02	0.02	0.08	–0.18***	–0.10	–0.40	–0.10
Age	—	0.14***	0.13***	0.14***	—	0.06***	0.13	0.05***
Age squared	—	–0.20***	–0.18***	–0.21***	—	–0.09***	–0.18	–0.08***
Education	—	0.05***	0.08***	0.07***	—	0.02***	0.09*	0.03***
Married	—	–0.11***	–0.10	–0.13**	—	0.11***	0.38	0.17***
Health	—	0.05***	0.05*	0.03	—	0.03***	0.18**	0.01
Household size	—	–0.01	–0.01	–0.03*	—	–0.02***	–0.19***	–0.03***
Unemployment rate	—	0.04**	–0.04	0.02	—	0.03**	0.20	0.03
Urbanization rate	—	–0.00*	–0.01*	–0.02***	—	–0.00	–0.02	–0.01*
Industry structure	—	–0.00	0.00	0.02	—	–0.00	0.01	0.01*
Log of per capita GDP	—	0.15**	0.05	0.29**	—	0.08	0.41	0.10
Pseudo R^2	0.00	0.11	0.11	0.12	0.01	0.12	0.07	0.14
Observations	2382	1583	420	636	2183	1512	409	646

Source: Author's calculation based on the China General Social Survey.

Notes: Model (1) is the basic difference-in-differences model; model (2) includes other factors that may affect employment or working hours; model (3) restricts the sample to the central area; model (4) restricts the sample to provinces with minimum wage increase above 20 percent. Variable interaction represents the interaction term of the experiment group dummy and the time dummy. ***, ** and * denote statistical significance at the 1, 5 and 10-percent level, respectively. All estimates are heteroskedasticity robust. All coefficients are marginal effects.

Table 9. Minimum Wage Effects on Working Hours of Highly-educated Workers, 2005 and 2006

Variable	Female				Male			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Experiment group dummy	–1.25	–0.46	–1.22	1.09	–1.72	–0.87	–2.35	–1.14
Time dummy	0.67	–0.64	0.63	–0.90	0.04	–1.53	–0.43	–2.01
Interaction	–0.92	–0.70	1.31	–2.24	–0.67	–0.01	2.61	–0.49
Monthly wage	—	–0.01	–0.01	0.00	—	–0.00	0.04	0.01
Age	—	–0.64**	–1.09*	–0.91**	—	–0.20	–0.77	–0.63
Age squared	—	0.78**	1.36	1.16*	—	0.21	0.90	0.89
Education	—	–0.87***	–1.51***	–0.94***	—	–0.57***	–0.65**	–0.48**
Unemployment rate	—	0.05	0.27	0.57	—	–0.96**	–2.19	0.29
Urbanization rate	—	–0.04	0.06	–0.08	—	–0.04	0.15	–0.03
Industry structure	—	–0.15	0.19	–0.24	—	0.05	0.57***	0.45
Log of per capita GDP	—	1.57	–6.01	4.41	—	–1.24	–16.68***	–2.42
R^2	0.00	0.04	0.05	0.04	0.00	0.03	0.06	0.02
Observations	2140	1844	488	767	2019	1794	515	762

Source: Author's calculation based on the China General Social Survey.

Notes: Monthly wage is in 100 yuan. Model (1) is the basic difference-in-differences model; model (2) includes other factors that may affect employment or working hours; model (3) restricts the sample to the central area; model (4) restricts the sample to provinces with minimum wage increase above 20 percent. Variable interaction represents the interaction term of the experiment group dummy and the time dummy. ***, ** and * denote statistical significance at the 1, 5 and 10-percent level, respectively. All estimates are heteroskedasticity robust.

employment has been substituted by increased employment and working hours for men. Estimates from Tables 6 to 9 also indicate that human capital accumulation will help workers to escape the negative effects of a minimum wage increase.

In previous estimates, the minimum wage treatment variable is a binary variable which is 1 for treatment status and 0 otherwise. In this case, the extent of a minimum wage

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Table 10. Extents of Minimum Wage Increase and Effects Variation, 2005 and 2006

Range (%)	Female		Male	
	Employment	Working hours	Employment	Working hours
<10	–0.030*	–3.660*	–0.040	0.670*
10–20	–0.050**	–1.720	0.010	2.880**
20–30	–0.050**	–0.290	0.000	3.050**
>30	–0.060***	0.580	–0. 020*	0.760

Source: Author's calculation based on the China General Social Survey.

Notes: The sample used to calculate this table is different from that in Tables 6–9. In this table, observations aged between 20 and 50 years with senior high school education and below are used. ***, ** and * denote statistical significance at the 1, 5 and 10-percent level, respectively. All estimates are marginal effects.

increase between 2005 and 2006 can be used to construct the treatment variable. The results are presented in Table 10. It is found that when a minimum wage increase is below 10 percent, only 3 percent of female employment is affected; when a minimum wage increase is between 10 and 30 percent, the proportion of affected women will reach 5 percent; and when a minimum wage increase is above 30 percent, approximately 6 percent of women are affected. The extent of a negative minimum wage effect is positively correlated with its level of increase. When a minimum wage increase is below 30 percent, it only increases the working hours of men but not employment levels. However, when the increase is above 30 percent, the minimum wage also tends to have a negative effect on male employment. Therefore, when a minimum wage increase exceeds 30 percent, the employment of less-educated men should also be considered.

VI. Conclusions

In the present paper, we have used a DID approach to study the minimum wage effects on employment and working hours of less-educated workers in China. The results show that a minimum wage increase does not lead to male employment changes, but increases their working hours per week. The results also indicate that a minimum wage increase does not have a significant impact on female working hours, but women's employment is negatively affected. This means that for some less-educated women, a wage increase may lead to them losing their jobs and put them in a disadvantaged situation. Therefore, less-educated women should be of central of concern when improving the enforcement of minimum wage regulation.

The findings in the present paper are significantly different from many findings for developed countries. Most of the empirical studies for developed countries find that a

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minimum wage increase may lead to a decrease in working hours. The results in the present paper show that a minimum wage increase may only increase male working hours in China. This is because of the different wage payment and minimum wage policies adopted in China compared with developed countries. For example, an hourly minimum wage is adopted in the USA, while in China although an hourly minimum wage is adopted, it only applies to part-time workers. For most full-time workers, China adopts a monthly minimum wage. Unlike in developed countries, where firms may easily decrease working hours to lower production costs, firms in China may choose to fire some workers or increase working hours to lower costs.

Unlike most other published studies which only focus on the employment effect, the present paper contributes to the research on the working hour effect of minimum wages in China. First, the present paper is the first research to find different minimum wage effects between men and women. Second, the present paper documents two adjustment dimensions in response to minimum wage increases by firms. We also note that the increase of working hours has its limit, because working hours cannot be increased indefinitely. Therefore, with the rapid increase in minimum wages in China, we should pay more attention to its negative impact on men's employment. Third, adopting a monthly minimum wage in China will induce firms to take advantage of the current wage system by increasing working hours when maximum working hour regulations are not well monitored by governments. Therefore, we propose abandoning the monthly minimum wage and setting a unified hourly minimum wage for both full-time and part-time workers.

International evidence indicates that there is an inverse relationship between the relative minimum wage and per capita GDP, and a minimum wage increase should match economic development. As the relative minimum wage in China is already at a high level, Chinese local governments should ensure that minimum wage increases do not exceed increases in per capita GDP.

Comparisons among workers of different educational attainment also indicate that the minimum wage can only affect less-educated workers. Therefore, to alleviate the negative effects of minimum wage increases, the Chinese Government should focus more on disadvantaged workers by way of investing in education, training and medical services, to increase their human capital accumulation, so as to improve their productivity.

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