Minimum Wage and Firm Employment: Evidence from China*

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This version: April 6, 2014

(Preliminary, comments welcome)

Abstract

This paper studies how minimum wage policies affect firm employment in China using a unique county level minimum wage data set matched to disaggregated firm survey data. We investigate both the effect of imposing a minimum wage, and the effect of the policies that tightened enforcement in 2004. We find that the average effect of minimum wage changes is modest and positive, and that there is a detectable effect after enforcement reform. Firms have heterogeneous responses to minimum wage changes which can be accounted for by differences in their wage levels and profit margins: firms with high wages or large profit margin increase employment, while those with low wages or small profit margin downsize. The increase in enforcement of China's minimum wage in 2004 has since amplified this heterogeneity, which implies that labor regulation may reduce the monopsony rent of firms. Our results provide evidence for the theoretical predictions of the positive minimum wage-employment relationship in a monopolistic labor market.

JEL classifications: J24; J31; O14; F10; F14

Keywords: China, employment, minimum wages, heterogeneous effect

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*We thank Olivier Blanchard, Richard Portes and Qiren Zhou for invaluable guidance and generous support. We are indebted to Ministry of Human Resources and Social Security of China, Shi Li, Chunbin Xing (BNU and IZA), Ming Lu (Fudan) and Quheng Deng (CASS), who provided us the data and helpful suggestions. We benefited from Dmitriy Skugarevskiy, Pengtu Ni and Hang Zhang for phenomenal research assistance. We are grateful to Jean-Louis Arcand, Kathleen Beegle, Nicolas Berman, Nick Bloom, Zhao Cheng, Jeffrey Dickinson, Slobodan Djajic, Freeha Fatima, John Giles, Harald Hau, Fan He, Pravin Krishna, Carl Lin, Ghazala Mansuri, Hong Ma, Jaime Marquez, David Locke Newhouse, Ugo Panizza, Jim Riedel, Alexandre Swoboda, Cedric Tille, Heiwai Tang, Hui Tong, Fabian Valencia, Lore Vandewalle, Pengfei Wang, Binzhen Wu, Zhiwei Xu and Du Yang for their helpful comments. We also thank seminar participants at the IHEID, IMF "Job & Growth" working group, World Bank "Labor and Poverty Practice Group", SAIS, Tsinghua University, Fudan University, Ministry of Human Resources and Social Security-BNU "Minimum Wage" workshop, Shanghai Jiaotong University and CEPR. The views in the paper are those of the authors and do not necessarily reflect those of the IMF. Yi Huang is the corresponding author.

1 Introduction

The substantial literature on the effects of the minimum wage arrives at little consensus on the impact on a firm's employment decisions. While Brown (1999) finds that changes in the minimum wage have a negative impact on employment, Card and Krueger (1995) and Dickens et al. (1999) find an insignificant impact. A literature review shows that the evidence impacts of the minimum wage is quite mixed (Neumark and Wascher, 2007).

One of the challenges in measuring the impact of the minimum wage is that the impact may be quite heterogenous across firms and workers. For instance, some recent research for the UK has found that the enforcement of minimum wage policies raises employee wages but also significantly reduces profitability for low-wage firms, especially those in industries with relatively high market power (Draca et al., 2011).

Another challenge comes from the endogenous nature of government policies. The response of firm employment to minimum wages depends on the shape of the labor demand schedule in the range of the minimum. Freeman (2010) argues that the evidence which shows that employment responses are often negligible does not mean that demand curves do not slope downward, or that a high minimum wage cannot reduce employment. Rather, it suggests that governments set minimum wages while considering the risk that minima can cause more harm than good.

In this paper, we provide evidence on the impact of the minimum wage on employment using a novel data set that allows us to confront both of these challenges. In China, the minimum wage policy was initially introduced in 1994 and formally approved shortly thereafter by the National Congress to be part of the labor laws. However, the design and setting of the minimum wage differs across the counties in China. In our paper, we thus start with a detailed examination of minimum wage determinants using data from more than 2,800 counties.[1] This captures changes for every province in China. We show that the setting of the county-level minimum wage is influenced by living costs, secondary industry size, and fixed investment growth (proxy for future growth potential). This first-stage analysis of the likely determinants of the minimum wage allows us to alleviate concerns about endogenous relationship between government policy and firm employment decisions.

After controlling for the characteristics that govern the setting of the minimum wages, we explore the impact of the minimum wage on firm employment decisions. In this part of the paper we take advantage of rich firm-level data from a large representative industry survey covering more than 95 percent of China's manufacturing output and 67 percent of manufacturing

[1] According to China's administrative division, the province is the first level, city is the second level, and county is the third level. In our study, we cover all 31 provinces in China, which includes 337 cities and 2,805 counties across China and includes the years 1994 to 2012.

employment.

We find that the average effects of minimum wage on employment are positive but negligible. The impact on employment, however, does vary across firms, depending on their profit margins and wage levels. After a minimum wage hike, firms with high wages and large profit margins increase employment while those with low wages and small profit margins downsize.

We also exploit an unanticipated minimum wage policy reform in 2004 to test whether the degree of enforcement affects estimated of the impact of the minimum wage on employment. We find that the increased enforcement from 2004 onwards amplified this heterogenous effect, suggesting that the increased enforcement may have reduced the monopsony rent of firms. [2]

Rising labor costs in China are a widely discussed topic among policymakers and economists. In the period from 1998 to 2010, the average growth rate of real wages was 13.8 percent, which exceeds the real GDP growth rate as well as the growth of labor productivity(Li et al., 2012). Among labor market policy tools, minimum wage policy has been considered to be a major force driving increases in wages and reductions of employment. A majority of the recent studies, following Neumark (2001), use the nice provinces urban household survey data to review the effect of minimum wage policy. Wang and Gunderson (2011) show that minimum wage has negative employment effects in slower growing regions, with even greater negative effects in non-state- owned organizations. Fang and Lin (2013) find that minimum wage changes have significant effects on employment in the more prosperous Eastern part of China, resulting in employment reduction for females, young adults, and less-skilled workers.

To the best of our knowledge, this is one of the first studies to show a heterogeneous effect of minimum wage on employment using a county level data set which tracks firms across China using an industry survey. We provide new empirical evidence on the effect the minimum wage policy and reform have on firm employment, and suggest a new framework to study how corporate decisions respond to labor market shocks.

This paper is related to the growing literature which reconsiders the impact on firm employment using local controls across US states and incorporating time varying heterogeneity. Allegretto et al. (2011) and Allegretto et al. (2013) have studied explicitly the lagged effects, wage group dynamics, and shifts in the employment flow using credible research designs. Hirsch et al. (2011) and Schmitt (2013)show no discernible effect on employment by firm's productivity-enhancing activities with the productivity-competition model. Our paper is the first to document heterogeneous effects connected to wage and profit margin differences using a monopsony

[2]Our results provide evidence for the theoretical predictions of labor market theoretical models of competition, (dynamic) monopsony and efficiency wage and labor market search with frictions see(Manning (1995); Rebitzer and Taylor (1995);Bhaskar et al. (2002); Lang and Kahn (1998); Burdett and Mortensen (1998); Acemoglu (2001); Flinn (2006). Meer and West (2013) find that increases in the minimum wage reduce employment growth through effects on job creation.

model.

In our paper, we study how the Chinese government adjusts minimum wage policy to avoid the paradox of costly enforcement, and maintain credible commitment of minimum wage at developing countries (Basu et al., 2010). The minimum wage policy of China provides new opportunities to evaluate the design and enforcement of labour market policy in emerging market countries, an issue which is also explored in (Bell (1997); Harrison and Leamer (1997); Lemos (2004); Lemos (2009)).

In addition, the primary implication of our study is that the effect of minimum wages are positive and small in magnitude during the period of rising minimum wages and increased enforcement in China. Policy makers must weigh the trade-off between the redistribution of welfare, and labour market flexibility(Sobel (1999); Blanchard et al. (2013)).

We discuss the minimum wage policy in the next section. The remainder of our paper is structured as follows. We present theoretical background relating to labor market competition, and minimum wage effects in Section 3; describe the firm level data and minimum wage data as well as the other regional macro variables in Section 4, and present our empirical strategy for the minimum wage determinants and firm employment estimation in Section 5. In Section 6, we provide detailed results, and discuss the general effects and heterogeneous effects by wage group. In section 7, we explore the sensitivity of employment to an enforcement shock and investigate further robustness check. Section 8 concludes.

2 Minimum Wage Policy Background

2.1 Evolution of Minimum Wage Policies

In early 1984, during the early phase of its economic reform, China was approved to join the International Labor Organization (ILO)'s *Minimum Wage-Fixing Machinery Convention* (1928). In July of 1994 the Labor Law formalized the states' requirement to implement a system of guaranteed minimum wages. This law also authorized provincial governments to set their own specific individual minimum wage standards. According to Article 48 of the Labor Law, enterprises are required to comply with local minimum wage regulations. The law was implemented with room for flexibility in provinces and cities, where government officials set their localized minimum wages (Casale and Zhu (2013) and Su and Wang (2014)). Until 2003, nearly all provinces had designed the local minimum wage policies to be adjusted, at most, once per year.

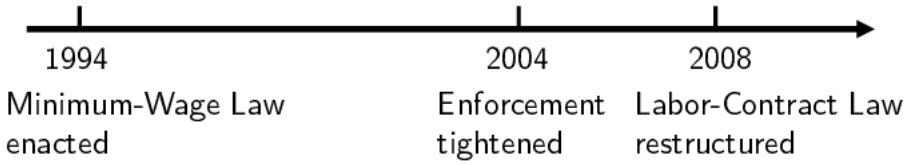
China had advanced in its market reforms when it joined the WTO in 2001. The previous labor law was no longer able to balance the forces of economic development and minimum

wage requirements. In March 2004, the Ministry of Labor[3] issued a new directive which established even more comprehensive minimum standards and threatened tougher punishment for lax enforcement of labor laws. This reform emphasized the following major changes:

- extension of coverage to town-village enterprises and self-employed business;
- creation of new standard for hourly minimum wages;
- increase in the penalty for violators: from 20%-100% to 100%-500% of the wage;
- higher frequency of minimum-wage adjustment: once at least every two years.

Importantly, this new phase of minimum wage reform in 2004 gave rise to the process of the minimum wage adjustment. In the first part of the process, the provincial government drafts the proposal which is then submitted to the central government. The proposal is then discussed with the local labor unions, as well as trade and business associations. Next, the Ministry of Labor reviews the proposal and provides recommendations for revision and other suggestions. If there are no more revision requests within 28 days, the provincial government is then authorized to adjust the minimum wage, and publish it in the local newspaper within 7 days. By the end of 2007, all provinces in China had successfully established the new minimum wage regimes and also implemented the enhanced enforcement measures. Figure 1 summarizes the minimum wage policy of China over time. When the global financial crisis hit China, the Ministry of Human Resources and Social Security provided policy guidelines which allowed for a delay in the new minimum wage adjustment under the new Labor Contract Law (2008).

Figure 1: Minimum Wage Policy Timeline



2.2 Evolution of Minimum Wage Policies

As we have discussed, the adjustment of local minimum wages is a routine policy decision for the provincial and central government. It is thus necessary to investigate quantitatively the legislative process of this adjustment. This helps us control for government considerations that could lead to both changes in minimum wages and local economies, because, in China's reality, a firm's employment decision may still respond to some market conditions beyond those proposed

[3]Ministry of Labor merged Ministry of Human Resources and renamed to Ministry of Human Resources and Social Security in 2008

by economic theory. As stipulated in the law, minimum wage adjustment should follow the equation:

$$MW = f(C, S, A, U, E, a),$$

where C is the average level of consumption, S is social security, A is city average wage, U is the unemployment rate, E is the level of local economy, and other factors etc.

This broad but still vague requirement seems to suggest that minimum wage adjustment is a sophisticated policy change with certain undocumented considerations. These considerations could possibly include economic factors observed only by policy makers. From our discussion of China's minimum-wage policies, local government officials mainly focus their efforts on two areas: economic growth and citizen welfare. In fact, these officials are facing a trade-off between labor demand and supply, conditional on local characteristics. On the one hand, local government has incentive to freeze/slow the rising minimum wage in order to attract firm investment and reduce the cost of labor. On the other hand, local government is forced to compete with other regions to increase the minimum wage in order to attract sufficient labor supply and avoid massive labor outflow.

In effect, the adjustment of minimum wages as a change in, or extension of policy, is more forward-looking than most other economic indicators. Government officials want to uphold the standard of living for low-income workers while, at the same time, improving investment opportunities for local business. Although it is true that they face such a tradeoff, it is not clear how we can translate their attempts to balance these two concerns into a quantitative context. This implies that we have both growth and welfare hypotheses to test empirically. After all, if we can control for these two concerns, other unobservable factors should have little impact on economic conditions that trickle into a firm's hiring decision.

We attempt to summarize these factors in five categories. The first is the trend of local labor income, which should be closely related to living costs in a city, and thus serves as an indicator of policy concerns. We use city average wage per employee to measure the level of city wages. This category corresponds to the welfare hypothesis.

The second is the nominal price level. A rise in consumer prices also leads to a deterioration of worker welfare. We adopt provincial CPI as a proxy. For government officials, consumer prices may be extremely significant and this price index is also directly related to the standard living of low-income workers. For simplicity, we choose the CPI as the price deflator for all the nominal variables.

The third category relates to the prospect of economic growth in the local area. We choose the lagged growth rate of GDP per capita, and fixed asset investment to represent this expecta-

tion. Past prosperity may predict future trajectory and lead to optimistic forecasts. The lagged growth rate serves the purpose of this measurement. Fixed-asset investment is often used by local government as one of the main propellers to boost the economy, and a persistent effect can last for at least one year after an investment boom. If growth concerns dominate, these two variables should show a positive relationship with minimum wage adjustment.

The fourth category incorporates additional criteria which policymakers may take into account. We include output shares of the secondary and the tertiary industries to address how government weighs the importance of the manufacturing sector. The growth rate of foreign direct investment is also used to see whether government officials are concerned with the negative impact of minimum wage hikes on potential investors from abroad.

The fifth factor that we control for is the condition of local labor markets. We use the lagged growth rate of labor and the unemployment rate for this. High growth rates of urban labor in China usually are a consequence of labor migration from rural areas. If a region attracts many migrants, according to the growth hypothesis, local officials should not worry too much about labor constraints. Following the welfare hypothesis, high growth of labor may widen the income gap in a city thus triggering a change in minimum wages lower than expectations. This leads to an ambiguous prediction about the coefficient sign of the growth rate of labor. The unemployment rate is an important welfare measure but we must consider that it is measured in China with significant flaws. Based on the welfare hypothesis, we expect to see negative impact of unemployment on the policy decision of raising minimum wages.

In the following empirical results section, we will discuss the relationships between minimum wage adjustment and factors we are interested in exploring.

3 Data, Measurement and Summary Statistics

Our empirical estimation is focused on the effect of city minimum wage on firm employment in the context of minimum wage reform. For the purpose of estimation, we must match the data set of China's manufacturing firms with local effective minimum wage information as well as regional data on economic conditions. We provide a detailed description of how we construct our sample starting from the raw minimum wage data in an online appendix. Here, we briefly summarize the key variables and sample definitions.

3.1 Minimum Wages

A primary advantage of this study is to introduce unique data which includes minimum wage data at a county disaggregated level, and incorporates all provinces in China. Our minimum

wage data are collected by the Ministry of Human Resources and Social Security[4] using official reports from local county governments. The data span ranges from 1992 to 2012, covering the period of our sample of manufacturing firms. This dataset contains detailed information on all the adjustments of minimum wages at the county level and thus includes, in total, 2,805 county-level districts. A majority of papers incorporate the lagged or present value of minimum wages as variables. Since we have specific date information on the implementation of these minimum wage changes, we are able to calculate the effective minimum wage. Effective minimum wages are calculated using the weighted average of minimum wages during one year. Further details on these calculations are included in the online appendix.

We choose to use monthly minimum wages in our estimation rather than part-time or full-time hourly minimum wages due to the relevance of these wages to the manufacturing sector. Hiring in the manufacturing sector usually involves relatively long and stable employment compared to the service sector. Another reason is that most counties simply set full-time hourly minimum wages based on monthly minimum wages divided by a factor of around 175, which is presumably the typical number of working hours in a month. Hourly minimum wages for full-time workers are thus practically same measures as monthly minimum wages.

Figure 2 shows geographical variation of the effective minimum wage and displays different quartiles over time. The most obvious pattern from the maps in Figure 2 is that the minimum wage is not always lower in inland areas compared with coastal areas, and it varies over the years, especially before and after the reform in 2004. While there may be concerns that the bias arises from economic variation, our analysis is strengthened by exogenous geographical variation in addition to the economic variables.

[4]Ministry of Human Resources and Social Security receives proposals for minimum wage adjustment from province governments, and approves or suggests revisions to the proposal. Within the internal administrative system, we can select the particular minimum wage proposal, final approval information, and the adjustment times

Figure 2: Geographic Variation of Minimum Wage Policy

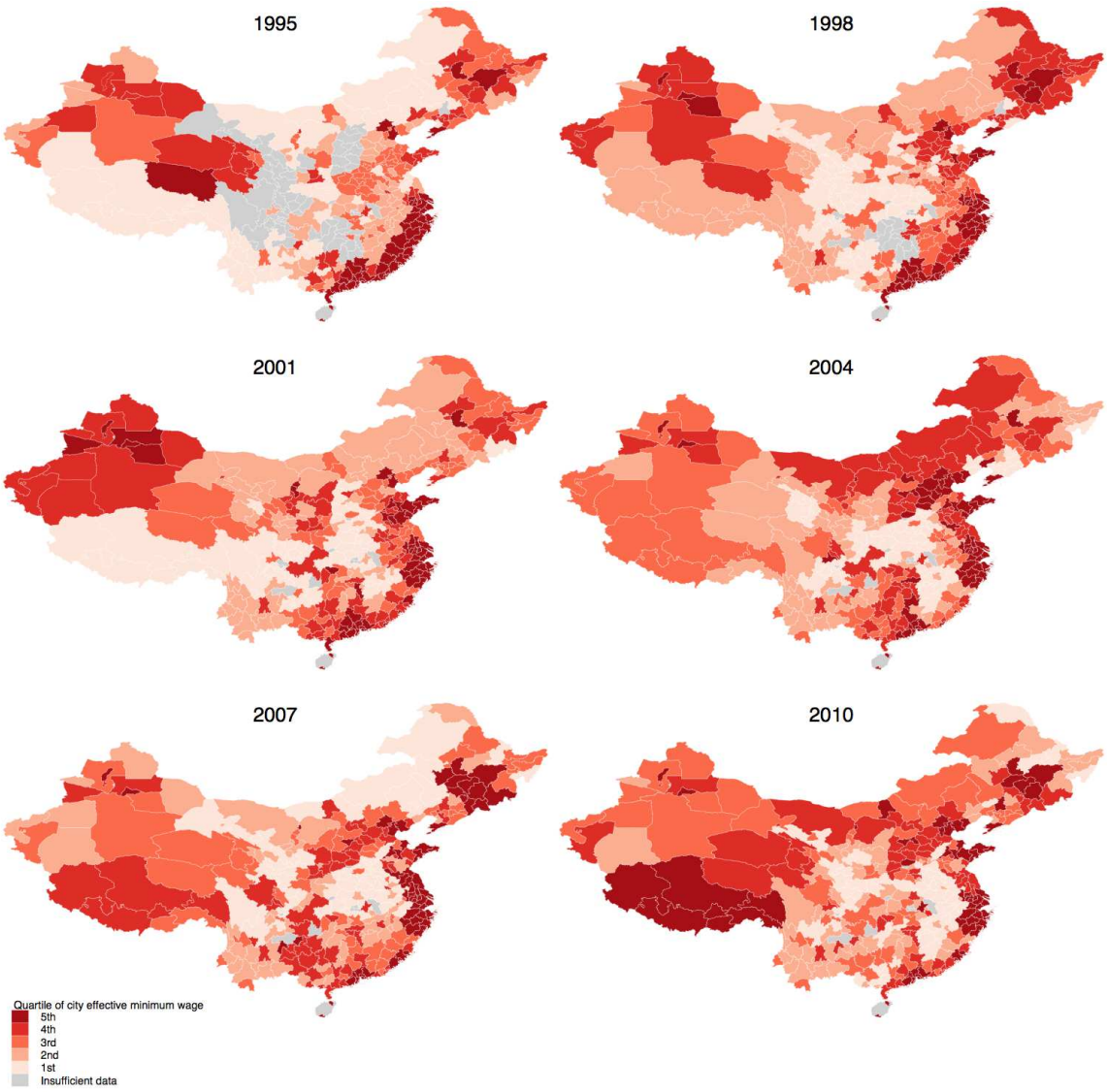


Figure 3: Mean city average wage and effective minimum wage by year

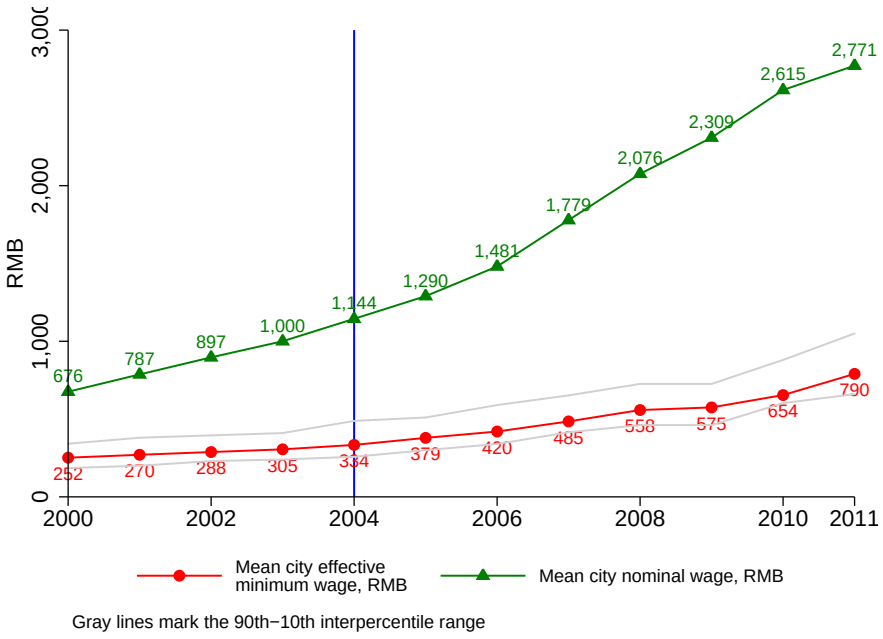


Figure 3 illustrates the comparison between the city average wage and effective minimum wage. On average, the effective minimum wage is roughly 30% of the average wage between 2000 and 2011. After the 2004 reforms the gap gets larger and finally reaches 15% in 2004. Figure 11 describes the variations between effective, minimum wage and the average wage from Chinese cities, ranked by the effective minimum wage level. The difference in time trends represents the heterogeneous behavior of minimum wage policy as well as the city average wage in China.

Table 1: Effective minimum wage in top and bottom 10 cities in 2010

Top 10 cities			Bottow 10 cities		
City	Rank	Effective monthly wage (RMB)	City	Rank	Effective monthly wage (RMB)
Shanghai	1	1080	Guangyuan	277	533
Shenzhen	2	1100	Ya'an	278	569
Suzhou	3	951	Shangrao	279	512
Ningbo	4	1026	Kaifeng	280	542
Hangzhou	5	1065	Bazhong	281	558
Wuxi	6	951	Zhumadian	282	535
Shaoxing	7	948	Guang'an	283	533
Zhuhai	8	897	Nanyang	284	533
Jinhua	9	1038	Yibin	285	542
Jiaxing	10	948	Neijiang	286	533

Table 1 also ranks the top 10 and bottom 10 minimum wages among cities in 2010. The minimum wage is more than twice as large in Hangzhou (highest) than Shangrao (lowest). It should be noted that the distance between two cities is less than 180 miles, and transportation between the two cities is easy; it takes less than 5 hours by train which is roughly similar to the distance between Washington and New York. It is therefore interesting to assess the importance of the economic distance of the two cities as part of our analysis, in addition to physical distance.

Figure A.1 shows the mean of city minimum wage and effective minimum wage from 2000 to 2011. There is an upward trend over time and, on average, the effective minimum wage reaches 442 RMB per month which is smaller than the city minimum wage. This fact has not been carefully taken into account for the duration and timing of the the adjustment. After 2004, the effective minimum wage increases at a faster pace: from RMB 334 per month to RMB 379 per month in 2005.

3.2 City and Provincial Variables

Economic variables at the city and provincial level are collected to control for the determinants of minimum wage policies and the market factors affecting firm employment. The major source of city variables is the *China Statistical Yearbook* (1990-2012). Our city database contains all of the districts at the city level in China, in total 337 cities. Missing values of some economic

variables are interpolated by sophisticatedly designed algorithms (for more details see online appendix). The resulting panel dataset completely covers the sample period of manufacturing firms.

Occasionally regions were divided up and/or combined into other regions. This division restructuring occurred more frequently in the 1990s and less after the year 2000. We collect the corresponding information, and adjust the city code for all the affected firms. Because adjustments to minimum wages should take into account all the regional conditions, no county should have experienced a hike in minimum wages due to the change of its administrative division. This fact is confirmed in the data.

Our provincial database contains all the provinces, in total 31. For example, we collect consumer price index, GDP, employment, and other macroeconomic variables as well as policy variables at the province level. In the case when we do not have detailed data, we choose to use more broadly defined variables. For example, we collect consumer price index at the province level. Indices of output, input, and fixed assets are measured at the industry level.

Figure A.3 shows the mean of log effective minimum wage and the log of city unemployed population by year. This city level evidence indicates how the effective minimum wage evolves. We see that it is less volatile than unemployment in 2000 to 2011. Figure A.4 also illustrates the change of log effective minimum wage and city unemployment, which, theory tells us, has an ambiguous relationship. Conventional wisdom predicts a positive correlation, which is not apparent from our data. If anything, our data show a weak, negative co-movement.

Figure A.7 and Figure A.8 provide cross city evidence between effective minimum wage and unemployment, and we find a weak correlation between city effective minimum wage and city employment both before and after the enforcement change in 2004. Figure A.9 and Figure A.10 indicate that there is no linear relationship in the cross city evidence between the change of effective minimum wage and city unemployment using the full sample.

In summary, there is no clear evidence from the city level data to identify a correlation between effective minimum wage and unemployment. In the next section, we will start to explore the firm level evidence between minimum wage and unemployment.

3.3 Firm data

Our firm data are mainly from the Annual Survey of Industrial Firms (ASIF). In this survey, large-scale industrial firms file detailed reports every year to their local Bureau of Statistics. The National Bureau of Statistics (NBS) then aggregates the data to produce important statistics, such as those in the China Statistical Yearbook. Our dataset spans from 1998 to 2007 and contains exactly the same number of observations used by NBS during all these years.

In principle, the surveyed firms should include all the firms in the sectors of mining, manufacturing, and utility, with annual sales more than twenty million Yuan. The sampling threshold of annual sales was five million Yuan before 2011 and we note that state firms were not subject to this threshold before 2007. Five million Yuan is the effective threshold for our dataset, so we refer to firms with annual sales above five million Yuan as large firms, and other firms as small firms. As a result, the sampling of the ASIF data is biased towards large firms [5]. For small firms, the sampling bias is towards state firms [6]. In general, compared with the economic census of 2004, the survey from the year 2004 includes 20 percent of industrial firms, but covers more than 91% of China's industrial output and 71% of China's industrial employment. After the construction of a panel dataset for all the firms in the manufacturing sector, we have in total 2,043,519 observations in the sample for ten years.

FigureA.5 shows the relationship between the city real effective minimum wage and firm employment. On average, there is a downward slope to firm employment accompanied by a rising minimum wage in the city of the firm. Moreover, we find that the firm employment increases encouragingly after the enforcement shift in 2004.

It is critical that the correlation between the change of the real effective minimum wage and change of the firm employment in Figure A.6. Before the 2004 reform, a weak negative relationship between the change of effective minimum wage and firm employment existed. There is strong, positive co-movement after increased enforcement, which provides a unique result from this firm-level data.

3.4 Summary statistics

We list detailed descriptions of the main variables in AppendixA. Table A.1 presents means of effective minimum wages and other relevant variables including city average wages, city GDP per capita, industry wages per employee, and firm wages per employee in the sample. All the nominal wage rates are normalized to monthly levels and measured in Yuan. During this period of rapid growth, all the variables grew at comparable rates. However, we can also see that the growth rate of wages in the manufacturing sector was slightly lower by comparison to aggregate

[5]The data still contains a small set of non-state small firms. For instance, according to the sample of manufacturing firms, in 2006, small firms account for 1.6% of non-state firms, while they account for 16.7 percent of state firms. In 1998 when state firms just started to restructure mainly through privatization, small firms account for 6.2 percent of non-state firms, while they account for 43.9 percent of state firms. However, the ratio of small firms is much lower than the population ratio. The 2004 economic census shows that small, non-state firms in that year amount to 0.9 million, and thus account for 75.8 percent of non-state firms. At the same time, the fraction of small firms in state firms is 39.3 percent in the census, which shows that small state firms are also undersampled relative to large state firms, although the bias is not as severe as that for small non-state firms. For more details, please see the appendix.

[6]In this paper, firms ownership is categorized as state, collective, private, or foreign if it is well defined in the dataset, otherwise it is attributed to the stakeholder using the share of paid-in capital. Note that we follow the standard definition of a foreign firm in China which only requires more than 25 percent of stock shares to be controlled by foreigners. For details, please see the appendix.

wage rates.

Table A.2 describes the median statistics for main variables at the firm level for every year, the firm age, employment, wage, sales and profit margin. All the medians are calculated with the estimated sample for each year, from 1998 to 2007. Unlike table 3, we consider real city wage at this point. It is noteworthy that the share of firms paying wage below the minimum wage has dropped following the 2004 reform, from 6.95% to 1.75%, within one year. We will discuss the results from firm-level regressions and the issue of the entry and exit in the robustness check section.

Table A.3 shows the median statistics for main variables at the industry level for every year, employment, wage, sales and profit margin. From the two-digit industry codes, we find large variations across the industry. In the case of employment, the tobacco industry has 465 employees compared with 54 workers from the water and recycling industry. Therefore, the level of the labor intensity across the industry should show a different response due to the rise in the minimum wage and heavier enforcement.

We will combine all of the data described above into a city-firm-year data set. It allows us to explore firm and industry characteristics, and, in particular, to discuss the heterogeneous effects of minimum wage changes on firm employment.

4 Theoretical Background

The general assumption we apply to determine firm employment is diminishing value of the marginal product of labor (VMP_L). To reasonably quantify a firm's hiring decision, we can examine VMP_L from two directions. The first is declining product price in response to an output increase;the second is constant or increasing marginal cost. This helps to disentangle the effect of the product market from that of the labor market and simplify our theoretical considerations.

4.1 A Product Market with Monopolistic Competition

At first, by assuming firms face a competitive labor market, we focus on firm operation in the product market and consider the impact of the wage rate on firm employment. If firms are in a product market with monopolistic competition and a factor market with perfect competition, without adjustment costs, a firm's relative size can be determined merely by its specific productivity. Therefore, their employment decisions depend on firm-specific productivity, aggregate demand, and exogenous factor prices, given that a firm determines its own product price. As a standard model with competitive labor markets shows, two key parameters also take effect

in employment decision: the price elasticity of product demand and the income share of each factor. This theoretical framework underpins our variable choice in the estimation.

A formal model is as follows. Assume a firm has a production function given by

$$Y = AK^{\alpha}M^{\beta}L^{1-\alpha-\beta},$$

where Y denotes output, K denotes capital input, M denotes intermediate input, and L is labor input. A is the only firm characteristic that determines firm size and can be viewed as firm-specific productivity. In competitive factor markets, α, β, and $1-\alpha-\beta$ can be explained as the cost share of each factor for a firm, or explained as the elasticities of marginal cost to each factor price. Specifically, we know that marginal cost is given by

$$MC = \frac{1}{A}\left(\frac{w}{1-\alpha-\beta}\right)^{1-\alpha-\beta}\left(\frac{r}{\alpha}\right)^{\alpha}\left(\frac{p_M}{\beta}\right)^{\beta},$$

where w, r, and p_M denote the wage rate, rental price of capital, and the price of intermediate input.

The firm faces a downward sloping curve of product demand. The demand function is given by

$$Y = \bar{Y}\left(\frac{p}{\bar{P}}\right)^{-\sigma} = \bar{Y}\bar{P}^{\sigma}\left(\frac{\sigma}{\sigma-1}MC\right)^{-\sigma},$$

where $\bar{Y}$ denotes aggregate demand, $\bar{P}$ denotes aggregate price, p denotes firm product price, and σ is the parameter for price elasticity of product demand. We apply the optimal condition of firm pricing: $p = \frac{\sigma}{\sigma-1}MC$. $\frac{\sigma}{\sigma-1}$ can be referred to as pricing markup.

To further derive labor demand, we have

$$L = \bar{Y}\left[\frac{1}{A}\left(\frac{w/\bar{P}}{1-\alpha-\beta}\right)^{1-\alpha-\beta}\left(\frac{r/\bar{P}}{\alpha}\right)^{\alpha}\left(\frac{p_M/\bar{P}}{\beta}\right)^{\beta}\right]^{1-\sigma}\frac{1}{w/\bar{P}}\left(1-\alpha-\beta\right)\left(\frac{\sigma}{\sigma-1}\right)^{-\sigma}.$$

This equation shows that fundamental determinants of firm employment are firm characteristics A, and market conditions $\bar{Y}$, $w/\bar{P}$,$r/\bar{P}$, and $p_M/\bar{P}$. A competitive labor market implies that minimum wages are negatively correlated with firm employment. The elasticity of labor demand to the wage rate is $-\left(1+\left(1-\alpha-\beta\right)\left(\sigma-1\right)\right)$. Intuitively, the first term 1 in the sum indicates the structure of constant cost share of labor. The second term $\left(1-\alpha-\beta\right)\left(\sigma-1\right)$ shows that the effect of wage on a firm's average cost depends on labor share $\left(1-\alpha-\beta\right)$ and price elasticity σ.

This simple model can be easily extended to a model with general equilibrium by assuming monopolistically competitive firms producing varieties and a CES (constant-elasticity-of- sub-

stitution) utility function for a representative consumer. The only change we need is to assume heterogeneous productivity A_i across firms, where i indexes the individual firm i.

Firm employment can also be related to other specifications in the sense that marginal cost of labor may be increasing. For example, other than productivity, labor and capital adjustment frictions are important factors for firm employment even on an annual basis. In the empirical analysis, we control for lagged firm employment and physical capital stocks to address this issue.

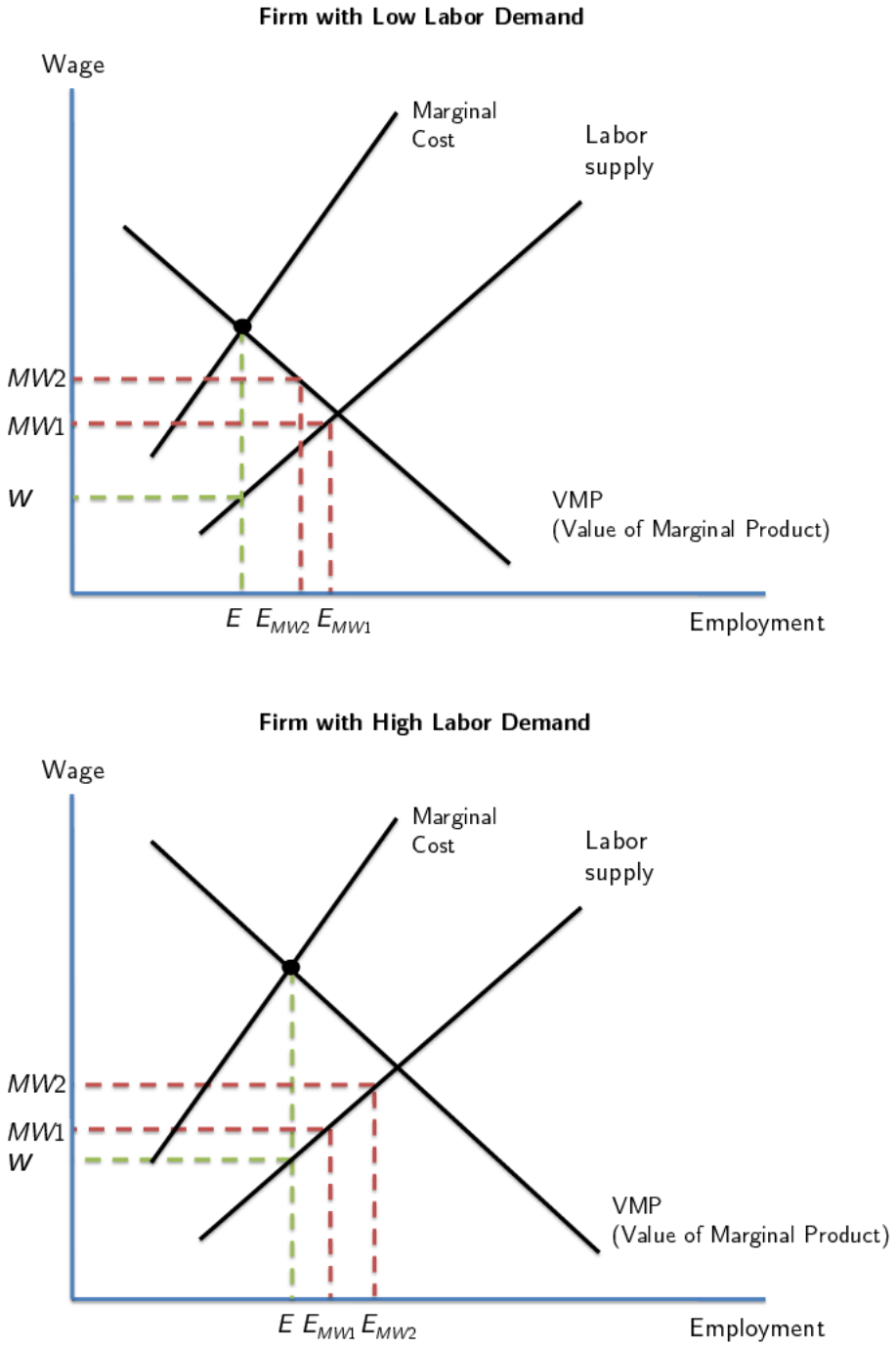
4.2 A Labor Market with the Presence of Monopsony

In the case of increasing marginal cost of labor, the more important problem is to consider labor markets that are not competitive. Stigler (1946) is concerned about a labor market with imperfect competition in which a monopsony may increase employment due to an increase in the minimum wage. Card and Krueger (1995) provide a search model in which the elasticity of labor supply can be reasonably large. This helps to justify the possibility of positive relationship between minimum wages and firm employment for firms with relatively higher labor demand or wages.

A textbook diagram can illustrate the intuition. For example, Figure 5.5 in Ehrenberg and Smith (2010) shows the impact of the minimum wage on a non-discriminating monopsonist. The minimum wage legislation can increase both the employment level of the firm and the wage received by workers. Moreover, there is no unemployment in the labor market. The intuition here is that a firm with excess labor demand by initially setting the wage rate low is willing to raise hirings when wage is pushed up by legislators.

Figure 4 shows hiring decisions for two firms with low and high labor demand, measured by VMP_L. These two firms are both under the impact of a minimum wage. For simplicity, we denote minimum wages their wages under regulation. One can think that this equilibrium is for affected workers in a firm. For the firm with low labor demand, an increase in minimum wages reduces hirings because there is no excess demand exceeding supply for this firm. However, for the firm with high labor demand, an increase in minimum wages raises hirings because excess labor demand still exists and the firm is willing to hire workers up to the level of labor supply. Although a hike in minimum wages raises firm wages without ambiguity, the impact on firm employment is not definite.

Figure 4: Minimum wages and firm employment under monopsonistic conditions



Further investigation shows that the elasticity of labor supply may be of little importance if minimum wages are well above the hypothetical wage rate without minimum-wage regulations. The only requirement is that firms have bargaining power in wage determination and find it optimal to hire at a low level to suppress offered wage.

A straightforward indicator of a firm's labor demand is its average wage. Given the elasticity of labor supply, a firm with higher labor demand should offer a higher average wage. This motivates us to use lagged firm wage to group firms and examine the heterogeneous effect of

minimum wages on different firm groups in the empirical analysis.

Most of the empirical research on minimum wages focuses on employers that hire a significant amount of low-wage workers, for instance, fast-food restaurants in Card and Krueger (1994). Our paper studies the manufacturing sector in China, a sector that pays relatively lower wages compared to China's other sectors.[7] We also argue that it makes more sense to look into these firms to see if there is heterogeneity within this industry in response to minimum wage variations. Other than labor demand, for example, skill composition of employees also affects the effect of minimum wages on firm behavior, which implies that some firms with relatively high wages may show little impact from minimum wage changes.

5 Empirical models

5.1 Identification

Our estimation focuses on the effect of minimum wages on firm employment. Once we control for the possible determinants of minimum wages, other factors at the county or city level can influence firm employment to a negligible degree. This is the advantage of using micro-level datasets to study the effect of macro-level policies.

We also conduct estimations on the effect of minimum wages on a firm's average wage and profit margin. For example, if minimum wages affect a firm's hiring decisions, it is hard not to think that minimum wages should also affect the firm's offered wage rate. Therefore, this analysis can be used to provide supporting evidence for the effect of minimum wages on firm employment. After investigation of the effects on firm employment, wage, and profit margin, we estimate the heterogeneous effects on firm employment by wage and profit margin groupings.

The variation in our empirical study also comes from changes in enforcement in 2004. We adopt the estimation using variations in minimum wage enforcement as a natural experiment to uncover the effects of minimum wage on firm employment. In addition, we also examine the heterogeneous effects by wage and profit margin groupings after the introduction of the enforcement reform.

5.2 Estimation Model

To study the effect of minimum wages on firm employment, we use panel estimation to control for unobserved, time-invariant effects at the firm level. The dependent variable is a firm's average hirings in a year at the logarithmic level. Logarithms of most of the explanatory variables, if they are not ratios, for instance, are also used, so their coefficients should be interpreted

[7] Our data shows that the gap has become larger after the privatization of state firms during 2000s.

as elasticities. Because of the use of lagged dependent variable as one explanatory variable, the consequent bias should be addressed by econometric models developed for dynamic panel estimations. The common method is to use two-period or earlier lagged dependent variables as an instrument for the one-period lagged regressor. Our result shows that the Arellano and Bond (1991) model cannot find reasonable structure of instruments; the over-identification tests are always rejected. We prefer to use a first-difference model with two-stage least squares. The two-year lagged variable of firm employment is used as the only instrument for the one-year lagged variable of firm employment.

The estimation equation is given by

$$Y_{it} = \alpha + X_{it}\beta + \gamma_{it} MW_{ct} + \mu_i + T_t + \varepsilon_{it},$$

where i, c, and t denote firm, city and year. Y_{it} is the dependent variable, the logarithm of firm employment or other variables of interest. X_{it} controls for firm i's characteristics at year t, together with city and industry conditions for firm i. MW_{ct} is the logarithm of effective minimum wages in county c at year t. μ_i is firm i's fixed effect and T_t represents a dummy variables which represents year fixed effects. ε_{it} is the error term, which we assume satisfies the exogeneity condition. In particular, we explore the heterogeneous effect of minimum wages on firm employment. Therefore, the effect γ_{it} is specified to be a linear function of firm, industry, and time variables as follows: α_γ and β_γ are constant parameters and ET_t is a dummy variable indicating whether t is before the year of 2004 or not.

1. $\gamma_{it} = \alpha_\gamma$: constant effect
2. $\gamma_{it} = \alpha_\gamma + ET_t$: with enforcement effect ET_t
3. $\gamma_{it} = \alpha_\gamma + \beta_\gamma X_{it} + ET_t$: different across firm types X_{it}

5.2.1 Relevant Variables in the Estimation

The main independent variable is firm employment and we will also use firm average wages.

- Firm employment: L_i. It is reported as the average of a firm's end-of-month employees in a year. We also use the variable of end-of-year employees to diagnose and replace suspected erroneous data on average employees.
- Firm wage: W_i. We compute a firm's total wage bill as the sum of its reported wages, monetary allowances, and unemployment insurance. A firm's wage is equal to the ratio of its total wages to its employment. Because this variable explicitly involves firm employment, and also because it is jointly determined with firm employment, we do not use firm

wages as explanatory variables in general. When we group firms based on their lagged wages, however, lagged wage rates are then included as one explanatory variable.

As a synthesis of our theoretical arguments and the policy framework, we frame our choice of explanatory variables as follows:

- Factor prices: w, r, p_M. These include the price of labor input, measured by minimum wages and industry average wages, the price index of fixed asset investment, and the price index of industry intermediate inputs.

- Aggregate demand: $\bar{Y}$. This includes industry output and city GDP per capita. Industry output is an an indicator of industry aggregate demand measured by total output at the 4-digit industry level.

- Price elasticity: σ. This is indicated by the Herfindahl index for each industry at the 4-digit level.

- Labor income share: $1 - \alpha - \beta$. This is indicated by the share of industry labor income in the value of industry gross output. Because only variation across industry matters, if underestimation of labor share[8] in the data does not correlate with industry distribution, we are safe with this measure.

- Productivity: A_i. We use profitability as the proxy for firm productivity. In addition, ownership is widely believed to be one relatively exogenous indicator of firm productivity. We group firms based on the position of main shareholders into state firms, foreign firms, and private firms. Foreign investors are further divided as from the region of HMT (Hong Kong, Macao, and Taiwan), or from other countries. The export-to-sales ratio is also included based on the theoretically positive relationship between firm exporting status and productivity.

- Lagged firm employment: $L_{i,t-1}$. Adjustment cost and a reasonable amount of idiosyncrasy can be captured by using a lagged dependent variable as one regressor. For the dynamic bias accordingly, we use $L_{i,t-2}$ as the instrument for it.

- Firm size: $S_{i,t-1}$. Aside from $L_{i,t-1}$, lagged annual real sales is used to account for firm size. This variable is useful also because we do not need to be concerned about endogeneity when using interaction terms with it.

[8]Under-reporting of labor share in the ASIF data has been well documented. For example, see **?**.

5.3 Identification Concerns

5.3.1 The Level of Minimum Wages versus the Kaitz Index

The analysis of minimum wages since 1970s usually use the level of minimum wages relative to average wages, multiplied by the fraction of employment covered by the policy Brown (1999). This so-called Kaitz index does not seem important for a single firm because labor flow among covered and uncovered labor markets is not relevant to a firm's decision on labor hirings. We use the logarithmic level of minimum wages as the key regressor. As city average wages are one determinant of minimum wages, we still need to control for this factor in the regression on firm employment. Our economic justification, however, is different from the use of the Kaitz index.

5.3.2 Leads and Lags

Few studies relate employment to lagged minimum wages Brown (1999). However, firm variables at the annual level may not be ideally matched with the duration of minimum wages. For example, an enactment of a new minimum wage in July should be discounted half for the first year. As an advantage, because we have information on the month of adjustment, we construct the effective minimum wage which is essentially an average, weighted by the durations of all prevailing minimum-wage levels in a year. The effective minimum wage is thus preferable to other measures.

5.3.3 Relationship to the DID framework

The empirical research of this paper is closely related to previous research based on the difference-in-difference framework, for example, Draca et al. (2011). The variations we explore include minimum-wage difference across cities, wage difference across firms within a city, and enforcement changes across time, which constitutes of a framework of triple differences. Because the variations we focus on are not completely exogenous, we do not attempt to use explicit dichotomy based on predetermined thresholds. Instead, we examine continuous variations while controlling for other factors, so economic meanings all remain the same.

6 Main Results

This section presents our main reduced-form results about the impacts of minimum wage changes. Our analysis proceeds in four steps. We first show the city evidence on determinants of minimum wage adjustment in order to explore the endogenous nature of government policies. Next, we estimate the average effects of minimum wage on firm employment, as well as

firm wage and profit margin. We then analyze the heterogeneous effects on the firm employment by wage group and profit margin group. Finally, we identify the impacts of the enforcement reform to compare the affects on firm employment before and after the reform.

6.1 Adjustment of Minimum Wages at the Regional Level

We begin by examining the determinants of minimum wage adjustment at city level. The minimum wage data covers 2,374 county-level districts in 346 cities. As a matter of fact, it is highly likely for counties within a city to have same minimum wages. Moreover, while some cities have complete information on minimum wages for all of their counties, other cities may only have single observations. For those cities without county-level minimum wage information, we don't know whether it is because minimum wages are same for all their counties, or because of missing reports. Therefore, to avoid the bias from this information omission, we choose to study the determinants of minimum wages at the city level. In regressions at the firm level, county minimum wages are used to increase the variation of this key variable. In the case that there is no data for a county's minimum wages, we use its city minimum wages as replacement. Table A.5 shows how minimum wages adjust to policy variables[9]. We limit our use of economic indicators to the city level. In the basic estimation with fixed effects, 332 cities can be included. The city sample is unbalanced in the sense that cities started to report minimum wages in different years.

The sample period is from 1994 to 2011. The dependent variable is the logarithm of effective city minimum wages, which is the average of the effective county minimum wages. Column 1 to column 3 contains results for the whole period, while column 4 to column 6 use the sample from 2004 to 2011, the period after the increase in enforcement of minimum wages.

The explanatory variables are grouped into three sets, and all lagged for one year. The first set measures living costs in a city, which includes the logarithmic variables of city average wages and CPI. Column 1 shows that living cost and nominal price levels are positively related to minimum wages, although the coefficient of city average wages is not statistically significant. Column 2 shows that fixed-asset investment and the GDP share of the secondary industry have a positive effect on minimum wages. Considering city growth prospects, the positive coefficient of fixed-asset investment is consistent. The positive coefficient of the size of the secondary industry may indicate the welfare concerns of government officials. Column 3 also includes conditions of local labor markets. Both the coefficients of the growth rate of labor and the unemployment rate are not statistically significant.

The post-tightening period shows a stronger relationship between minimum wages and these

[9]The term of minimum wages in the following refers to effective minimum wages we defined in the above

policy indicators than the pre-tightening period. The coefficients of city wages, CPI, growth rate of GDP per capita, and fixed-asset investment are strongly significant, with the signs unchanged compared to the estimates for the whole period. The signs of growth rates of GDP per capita and growth rates of workers are consistent with the welfare hypothesis, while the signs of fixed-asset investment and unemployment rates are consistent with the growth hypothesis.

By and large, the comparison of within and between shows that within-city variation of minimum wages is explained very well, but cross-city variation is not. This evidence suggests that although the country-wide minimum-wage law stipulates guidance for the adjustment of minimum wages, local government has substantial leeway to accommodate local conditions. Because very few firms changed location in our sample, only within variation of minimum wages is relevant. By controlling for a few main variables at the city level such as city average wages and CPI, we find that most other variables do not add explanatory power to the regression. Unexplained changes in minimum wages therefore can be viewed as exogenous variation for firms.

6.2 Impact of Minimum Wages at the Firm Level

Analogy to Regional Employment Estimation We directly examine the elasticity of firm employment with respect to the minimum wage only with the city and industry controls. Table A.6 shows the effect of minimum wages on firm employment without using explanatory variables at the firm level. The sample period is from 1998 to 2007. This is analogous to an analysis of employment at the regional level and we can thus compare our results to the vast literature based on regional employment. When only minimum wages and the corresponding determinants are controlled for, column 1 shows a fairly small impact of minimum wages on firm employment, with the coefficient being -0.033. This means that a 10 percent hike in minimum wages leads to a 0.33 percent decline in firm employment, approximately within the common range of previous estimates in the Western countries. When industry wages are added in the regression of column 2, we find that the impact of minimum wages is barely changed, and it becomes even smaller at the level of -0.021. This seems to suggest that firm hirings are more responsive to industry-specific labor costs than local labor costs.

Adding other factor prices and incorporating aggregate demand, measured by city GDP per capita and industry output, in the regression of column 3, and adding two parameter variables in column 4, considerably dilute the effect of minimum wages. The coefficient of minimum wages with the full set of explanatory variables becomes -0.017, at a statistically significant level.

Other than the price of intermediate inputs, the coefficients of other new controls in column 4 are consistent with our expectations. A rise in factor prices of fixed assets tends to reduce a

firm's hiring, while a rise in aggregate demand raises firm employment. If a firm operates in an industry which is less concentrated and more labor-intensive, it tends to have high employment.

Table A.6 indicates that firm hiring responds more to aggregate demand and capital cost than labor cost. One explanation is that during this decade full of changes, such as privatization and access to the WTO, the high rate of firm growth depends more on market conditions, demand and investment, than labor cost. The effect of changes in the labor costs may be in part suppressed by the influx of rural migrants.

Introduction of Firm Characteristics Because we are using firm-level data, we need to control for individual characteristics. Table A.7shows the effect of minimum wages on firm employment while considering firm-specific variables. Besides our estimation using 2SLS and first differences in column 1, we also include results from other estimation models. Column 2 shows the result of a pooled OLS regression, and Column 3 shows the result of a panel estimation based using fixed effects. Because we consider adjustment frictions, lagged employment is used as an explanatory variable. This generates a so-called dynamic bias. It is commonly known that the OLS estimate for the lagged employment is positively biased and the fixed-effect estimate is negatively biased. To avoid the potential contamination of this bias on the estimate of minimum wages, we use the variable of two-year lagged employment as an instrument for one-year lagged employment, as in Anderson and Hsiao (1982). Column 1 presents the key results from a first-difference regression with instruments. The coefficient of lagged employment in column 1 is in between the estimates in column 2 and column 3, which is consistent with the predictions of the model. Compared to column 4, which shows the result from a first-difference regression without using instruments, we also see that estimation with instrumentation is more reasonable. The coefficient of lagged employment shown in column 4 is -0.151, which is less convincing. We also use GMM-style instruments in column 5. The results are quite similar to the results in column 4.

The choice of empirical models has an impact on the minimum wage coefficients. The minimum wage coefficients in Table A.7, as we add firm regressors, become much smaller than the results from the fixed-effect regressions compared with Table A.6. The model with 2SLS first difference gives the coefficient of 0.001, which is practically small but statistically insignificant.

This differs considerably in the estimate from our estimation without using firm variable controls, which implies that minimum wage analysis based on regional data may not be reliable. The positive coefficient of the minimum wage effect is still worth further examination, which suggests that, at least for some firms, a hike in minimum wages leads to an increase in hirings in the presence of firm heterogeneity. This motivates us to look into heterogeneous effects of

minimum wage changes on firms in the next subsection.

Other regional variables, as in Table A.6, lose their explanatory power on firm hirings when firm-specific conditions are considered. This implies that the unexplained change in firm employment, after controlling for firm idiosyncrasies, becomes rather noisy which is difficult to capture using regional economic conditions.

For explanatory variables at the firm level, firms with higher profitability hire more. Compared to firms with other ownership types foreign firms tend to hire the most workers while domestic, private firms tend to hire the least, but these differences are not statistically significant. Firms who export more may hire less, which suggests that export status links productivity with other characteristics, such as skill composition of hirings.

In the following, we will apply the model of 2SLS first difference consistently. To disentangle the effects of regional variables, we explore the effect of minimum wages by using different sets of variables which are external to a firm. Table A.8 hows the results. We see this time that the introduction of other regional variables does not substantially change the coefficient on minimum wages. The coefficient on minimum wage changes from -0.007 to 0.001 as from column 1 to column 4, although none of these coefficients is statistically significant. We argue that the result for minimum wages is robust to the use of external controls.

6.3 Heterogeneous Effect of Minimum Wage

Digression to Firm Wages Table A.9 provides estimates of the effect of minimum wages on firm wage with the same structure of explanatory variables as in the employment regressions. The purpose is to verify the possible channel through which firms change wages. After controlling for industry wages and city GDP per capita, minimum wages exhibit smaller effects on firm wages. The coefficient with a full set of controls in column 4 is 0.15, smaller than the one in column 1, 0.35, obtained by excluding all other regional variables. This could suggest that the significant estimate of minimum wage effect on the hiring of all firms may be a result of a strong effect on firm wages.

The theory with monopsony suggests that a hike in minimum wages always leads to an increase in firm wages but may increase labor supply for monopsonistic firms and thus increase their employment while decreasing the employment of firms which have less monopsony power.

The implication is that the impact of minimum wage changes on firm wages is predicted to be positive. Moreover, it is common belief that minimum wages should have more impact on firms with low wages, which is also verified by the data. We find that Table A.9 provides supporting evidence that minimum wages affect firm performance via the channel of wage. As a result, the importance of heterogeneous effects imply a large offset between wage groups ,and

reductions in the average effects.

Digression to Firm Profit Margin We also study the impact of profit margin with respect to minimum wage in Table A.10. The estimated coefficients tend to be positive, though statistically insignificant in column (1), when industry wage is not included as a control. However, the specifications in column (2),(3) and (4), which include industry wage, input prices of capital and labor, city GDP per capita, industry output, market structure and labor share, yield positive and statistically significant effects.

Recall the theoretical predictions that correspond to results in this table; we can now identify the positive impacts to the firm's profit margin due to rising minimum wage. This is unsurprising in light of the model we discussed above, and the result is consistent with efficiency wage, and search friction theories by Hirsch et al. (2011) and Flinn (2006) which tell us that firm's respond to a minimum wage shock by enhancing the profitability. In particular, the importance of profit margin characteristics is crucial for us to identify the heterogeneous effect of minimum wage.

Grouping Based on Firm Wages We divide firms into ten decile groups based on each firm's relative average wage in its city. In one regression we estimate the effect of minimum wages separately for these groups. Table A.11 shows the results. We control for the same set of other variables as above. Consistent with monopsony theory, minimum wages negatively impact employment decisions of low-wage firms but relate positively to employment decisions of high-wage firms. Specifically, approximately 40 percent of firms demonstrate negative effects, while the other 60 percent of firms respond positively by hiring following an increase in minimum wages. Table A.11 reports that the lowest decile has a negative elasticity of employment with respect to minimum wages at -0.038 and decreases to -0.3, then -0.023, -0.017 and -0.012 at lower group 5. As a result, we find the sign changes to positive starting from group 7, though insignificant until positive at a level of 0.028 and 0.058 for wage groups 9 and 10, with high statistical significance.

Figure A.13 also shows how the firm's level of employment changes in response to a hike in minimum wages. Bottom group 1 to group 6 show a negative sign from 1999 to 2007. However, starting from group 7, there is an increasing positive response from wage group 7 to group 10, which is consistent with the findings from Table A.11.

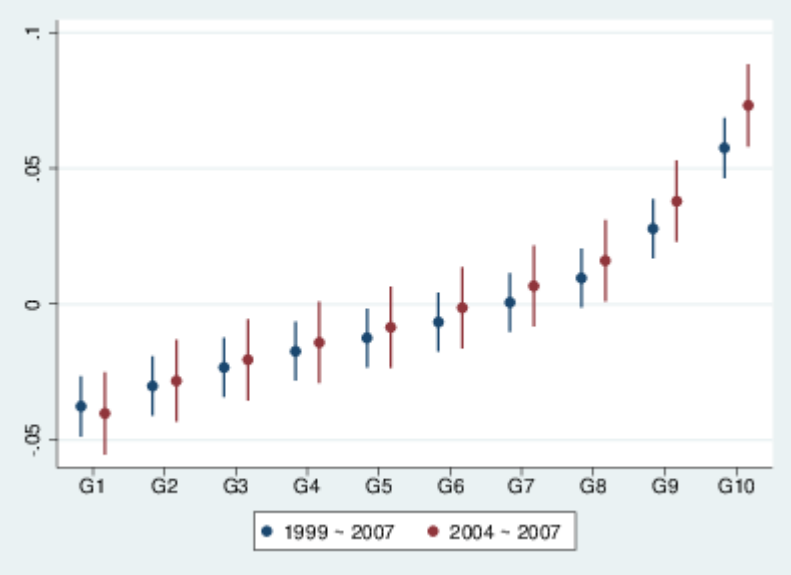
In theory, for these low-wage firms, higher wage costs reduce their labor demand thus reducing firm employment. However, for high-wage firms, higher wage costs raises their labor demand although their profits are dampened by the fact that they previously set low wages. As a consequence, high-wage firms increase hiring in response to an external increase in the

minimum wage.

As we discussed in Section 4, one reason that the average effect of minimum wage might be reduced, is that high wage firms are less bound by the rising minimum wage compared to low wage firm. In addition, high wage firms might increase the average wage to provide an incentive scheme for the incumbent worker, which also signals the market to attract more workers. Moreover, the increase in minimum wage might force low wage firms to reduce their hiring due to the crowding out effect caused by high wage firms. Several recent models attempt to explain the positive effect of increased minimum wages on firm employment such as Bhaskar et al. (2002)and Acemoglu (2001).

Figure 5 shows the heterogeneous effect on firm employment by wage group. As Figure x demonstrates, the rising effects on firm employment of minimum wage, by wage group, from 2001 to 2007. The higher wage group experiences a larger effect on firm hiring decisions compared to the lower wage group. We also find similar patterns of heterogeneous effects by wage group between 2004 to 2007, the period after the enforcement reform.

Figure 5: Effect of minimum wage on firm employment for firms with different wage



Note: x-axis represents decile of firm average wage, y-axis shows the effect of minimum wage on employment from standard 2SLS FD firm-level regression with firm- and -city controls as in Table A.7 estimated on the full data set and on a subset from 2004 separately. Lines are 95% CI.

Full Set of Heterogeneity Table A.12 investigates further this heterogeneous effect of minimum wages by adding interaction terms which multiply minimum wages with firm variables. Column 1 uses one interaction variable: the product of minimum wages and firm wages. The positive effect verifies our findings in Table A.11. When we add a full set of interaction terms, the heterogeneous effect based on firm wages increases from 0.033 to 0.043, a small rise, though statistically significant. Furthermore, the profit margin reacts positively to minimum wage

increases. The regression coefficient shows that a rising minimum wage has a more positive impact, particularly increasing with a firm's profit margin. As a result, the heterogeneous effect of profit margin tends to be larger than firm wage, almost double from 0.043 to 0.086, which indicates the importance firms' adjustments following an increase in the minimum wage.

In addition, we find that state-owned firms, domestic firms and Hong Kong, Macau, and Taiwan firms tend to exhibit differences compared to foreign firms in their hiring responses following an increase in the minimum wage. Firms who operate in a labor-intensive and competitive industry show a tendency to reduce their hirings in response to an increase in the minimum wage. Interestingly, for firms with more exports, their hirings tend to be affected negatively by a minimum wage hike, even after we have controlled labor intensity.

Taken together, our finding of heterogeneous effects shows encouraging results including a significant positive relationship between firm employment and minimum wage hike which is contradictory to conventional wisdom. It is worth mentioning that this is consistent with the model predictions, but different from the empirical evidence from the average effect studies. Allegretto et al. (2013) highlights the credibility of regional and policy discontinuities to control for heterogeneity in the discipline of research design. It is important to note that we focus on the heterogeneous effect with firm characteristics, namely wage and profit margin, which provide more powerful insights rather than the average effect only.

6.4 Enforcement Tightening

The above analysis studies the effect of minimum wages during our sample period from 1999 to 2007. The tightening of minimum wage enforcement may increase the effect of minimum wages on firm wages and firm employment, but previous literature indicates ambiguous results (Draca et al. (2011); Freeman (2010)). Because we can only identify this tightening as a change from the year 2003 to the year of 2004, there are many macro-level changes and, technically speaking, we cannot control for all of them. Hence we particularly focus on the effect of this tightening on the impact of minimum wages, not enforcement itself.

Table A.13 shows the resulting effects of minimum wage increases on firm employment over time. Column 1 divides the whole period into two episodes: pre-enforcement, from 1999 to 2003, and post-enforcement, from 2004 to 2007. In order to test the effect of enforcement tightening, we interact minimum wage and an enforcement dummy (before/ after), which include the full set of firm and city variables. Though now statistically less significant, we find that the positive effect of minimum wages on firm employment mostly comes from the period after the tightening. This suggests the impact of minimum wages increases appear largely in the erosion of a firm's bargaining position with workers, and in the increase of the labor supply. The hike in minimum

wages increases an average firm's profitability, but does not reduce its employment. As a matter of fact, the average effect is even stronger after the increase in minimum wage enforcement.

The next step in our paper is to test whether the enforcement reform has an impact across wage groups. We will also examine whether the increase in enforcement increases the magnitude of the heterogeneous effects on firm hiring. This table focuses on the heterogeneity of different wage groups. Table A.14 executes this estimation. In column 1, we report results from the joint effect between minimum wages, firm wage, and an enforcement dummy (before and after enforcement) regressions, which also controls for the full set of firm and city variables. Firstly, the joint effect before 2004 shows the positive impact on pre reform employment. Secondly, the post-reform evidence on firm employment is also significantly positive and larger than the pre-reform period, increasing from 0.035 to 0.041.

It is very clear that the impact of enforcement on firm employment has increased significantly, which contradicts the findings from other developing countries (Lemos, 2009). When we introduced the monopolistic competition model in the labor market, more credible commitment to labor market policy, where enforcement was previously imperfect, in developing countries (as the theoretical model in Basu et al. (2010) considered) might have positive externalities on firm employment. There are some concerns regarding the casual effect after enforcement reform. We will therefore investigate the impact of the enforcement through a number of robustness checks in the next section.

7 Robustness Checks

There are a number of potential concerns with regard to the causal interpretation of these results. The concerns include a reverse causal relationship between local economic conditions and the minimum wage, endogenous enforcement reform, and interactions with firm employment. In addition, due to the nature of the sample bias within the firm level data (the threshold, and attrition bias), we explore the validity of the estimation results in the following sections. First, we compare the industry survey sample bias with the economic census data. Second, we document the pattern of firm wages which are below minimum wage estimation, and conduct a placebo test by year. Finally, we also test the impact of the minimum wage with time-varying financial constraints in order to explore the inferences of our estimation.

7.1 Survey sampling bias

To our knowledge, previous research using the Annual Survey of Industrial Firms (ASIF) data documents its sampling bias, but chooses either to ignore the bias, or to exclude most of the

small firms, which possibly brings even more bias to the sample. For analysis with a focus on large firms or analysis more relevant to industry growth, this bias might be a side issue. However, when we study the effect of minimum wages, small firms are believed to be more likely to take the hit, which makes it difficult to dodge these issues.

The 2004 Economic Census The Economic Census in 2004 was the first census of all China's economic entities.[10] The industrial firms surveyed in the census were supposed to include all without any omissions.

The 2004 economic census, however, introduced additional sampling bias into the ASIF data. During the period from 1998 to 2007, with only the exception of 2004, ASIF was conducted by the local Bureau of Statistics. But the ASIF of 2004 was replaced with a survey of large-scale industrial firms from the 2004 census. The survey in the census was better organized and followed the threshold of annual sales of 5 million Yuan much more closely. Consequently, the 2004 ASIF contains many fewer small firms, and many more large firms. As we argue, this change of data source raised the in-sample small firm performance in 2004, because small firms with bad performance were mostly excluded if their sales fell under the threshold, which means we are more likely to observe upwardly growing trend for small firms.

Therefore, we are confronted with two sources of sampling bias in the ASIF data. One is relative over-sampling of large firms according to the nature of the ASIF, and the other is further under-sampling of small firms in the 2004 ASIF as a result of the interruption of the census.[11]

Correction of Sampling Bias and Entry and Exist Our remedy takes two steps. First, we replace the 2004 ASIF with the 2004 census data for manufacturing firms. Because the data of the 2004 census essentially contains the population of China's manufacturing firms, we are able to compute the sampling weight for each firm in 2004 that can be matched with their observations in other years.

As a matter of fact, about 80,000 firms or 8 percent of small firms in the 2004 census can find their predecessors or successors, which increases considerably our sample size for small firms. The method we use is propensity score weighting, since the likelihood of a firm being found in other years of the ASIF depends on the firm's characteristics.

We use ownership, province locations, the number of firm employees, and firm sales as indicators of this probability. Firm employment, sales, and ownership are further used to form

[10] Before the first Economic Census, censuses of all industrial firms had been conducted three times in 1950, 1986, and 1995.

[11] The adjustment of excluding state firms below the sales threshold in 2007 brought more inconsistency, although to a more modest extent.

interaction terms. A logit regression is used to generate predicted probability, which we use as propensity score for each matched observation. Regarding the fast growth rate in China during that period, we do not expect firm weights to be constant over time. Fortunately, our focus is exactly around the shift, during the period from 2003 to 2004, when the regulation of minimum wages changed. Thus, our weights represent each firm series, and are based on their presence in 2004.

The replacement with the 2004 census nonetheless introduces another bias to the sample. The reason is that, in other years, ASIF only sampled a limited amount of small firms. We now are faced with under-sampling problems for small firms in other years. We correct this bias in a crude fashion. For small firms with sales less than the threshold, we adjust their weights again based on their frequencies in the 2003 ASIF and the 2004 census. The correction in this step is quantitatively not large compared with the first step. For the analytical use of minimum wages, especially the increase in labor law enforcement in 2004, we construct a sample in which firms are present in the period from 2001 to 2005.[12]

Table A.15 reports the effect of minimum wage with new sample. From column 1 to 5, we employ the different estimation strategies, 2SLS first difference, OLS, fixed effect, first difference and GMM style first difference with historical lag as instrument. The results are very similar with the primary findings. It might not come as a surprise that the rising minimum wage has not reduced firm employment. More importantly, the positive effects on the firm employment remain robust to alternative specifications. However, the statistical significance provides slightly less convincing results, which may be a result of the weighting methods[13].

7.2 Threshold Test of Firm Wage and Minimum Wage

From the previous estimations of the heterogeneous effect and enforcement, there is a concern that the minimum wage only has a negative impact on the low wage firms, especially for firms with the average firm wage below the minimum wage. We investigate the sample of firms whose average wage is below the minimum wage of the city where the firm is located using a population averaged probit estimation. Table A.16 reports the results with year dummies, controlling for the full set of firm explanatory variables.

There is very significant negative correlation from year 2001 to 2003, the coefficient varies from 0.094 to 0.125, and then 0.172. We find an increasing number of firms with wage below the minimum wage before 2004. On the contrary, there are significant negative correlations starting from year 2004 until year 2007. In particular, there is a large negative correlation in 2004, which

[12]Therefore, the sample is an unbalanced panel, but balanced for the years from 2001 to 2005

[13]We also find similar results using propensity scores and no parametric estimations

indicates that fewer firms have a wage below the minimum wage after the enforcement reform in 2004.

Even our probit model might be too simple to test the threshold between firm wage and minimum wage. Even so, our approach evaluates the low wage firm's response to the minimum wage shock over the year. The evidence shows that fewer firms tend to set wages below the minimum wage after enforcement increases in 2004, which illustrates the importance of the reform and its impact.

7.3 Placebo Test of Enforcement Reform

One possible concern is that our results are driven by unobserved variables which simultaneously determine the minimum wage and firm employment, but is unrelated to the enforcement reform and heterogeneous effects. Following the comprehensive study by DellaVigna and Kaplan (2007), we conduct placebo tests to investigate the heterogeneity over time. Table A.13 presents the resulting effects on firm employment, and also the interactions between minimum wage and year dummies. Column 2 shows the effect of minimum wage changes in each year. The change from 2003 to 2004 shows a significant positive change in minimum wage effects. The effect of minimum wage increases in 2004 was strong, measuring 0.041, and afterwards began a slight decline, although the effects are all much larger than the effects before 2004. Therefore, this seems to confirm our result, that the enforcement reform results in a greater impact to firm employment.

Similarly, we also present the heterogeneous effect with a placebo test in Table A.14. In column 2, we look into the heterogeneous effects in each year. Only in 2004, firm wage groups showed a divergence from their positive responses to minimum wage increases. This divergence was rather temporary, and the heterogeneous effect reversed after the enforcement reform. The result is consistent with the evidences of previous tests that minimum wage enforcement reform was very effective, and verifies the positive effects on firm employment.

7.4 Financially Constrained Firms

Financial constraints might play an important role in firm's employment decisions. In order to demonstrate the heterogeneous effect of minimum wage changes, it makes sense to perform a test to take into account possible financial constraints. There are many different approaches to measure financial constraints which have been discussed heavily in the literature (Farre-Mensa and Ljungqvist (2013)). We follow common practice as laid out by (Cai and Liu, 2009; Cull et al., 2009), where access to credit markets/formal finance is used as a proxy of financial constraint. For this proxy we adopt the ratio of interest paid to sales.

Table A.17 reports the heterogeneous effects between different levels of financial constraint, minimum wage, and the joint impact on firm employment. In column 1, we find that the less constrained firms tend to hire fewer employees, which might be due to the higher level of capital intensity of those less constrained firms. In column 2, we interact the minimum wage and financial constraint terms and fail to find any significant relationship. Importantly, we identify the significant and positive correlation for the less constrained firms in column 3. The results show that the less constrained firms tend to experience a larger positive impact on firm employment after the enforcement reform in 2004. The positive effects for the less financially constrained firm might move through the profit channel, which shows that high profit margin firms increase employment after enforcement changes.

Generally, we examine the role of financial constraints in the context of minimum wage impacts on the firm employment, which results in evidence consistent with our analysis in the previous sections.

8 Conclusion

China enacted minimum wage legislation in 1994. It is commonly believed that enforcement of the policy was strenghtened after 2004. After this new law to strengthen the enforcement of minimum wage passed, firms started to feel the pressure of rising labor cost, both from these regulations and from development in the labor market. .

In this paper, we find using various econometric models that the average effects of minimum wages on firm employment during the period from 2000 to 2007 are mostly statistically insignificant from zero, and sometimes positive. This finding coincides with the preponderance of the evidence from the vast literature on the minimum wage effects in western countries.

With the aid of the firm-level data, we are able to investigate the heterogeneous effect on differentiated firms. We find that the negligible effect on average is driven by the distribution of minimum wage effects. Specifically, low-wage firms or less-profitable firms tend to reduce their hiring in response to a minimum wage hike, while high-wage firms or more-profitable firms increase firm hiring. Small average effects disguise the significant effects on different firms. Consistent with the theory of monopsonistic firms and elastic labor supply, a shock that pushes a firm's wages up can induce a rise in firm employment for firms with excess demand when they offer wage rates lower than the level of marking clearing. Whether negative or positive, the significant effects of minimum wages on firm employment show that the regulation of minimum wages is binding in China.

The legislative tightening of minimum wage regulation increased slightly the effect of this

policy, but its reversal in the following years suggests that government might have accommodated departure from the regulations to nurture local firms. Whether this style of regulation is beneficial or distortional is still not clear for the society as a whole. As for firms, we see that government regulations have not served to hinder their development; our evidence shows that the effect of minimum wages on firm profitability has been positive on average.

The effect of minimum wages on firm employment helps shed light on more recent regulations on China's labor market, such as the labor-contract law being enacted in 2008. There have been heated debates on whether these regulations are so excessive as to deteriorate firm performance in China. This paper shows that labor market regulations are certainly binding but their negative effect on firms can be soothed away by government enforcement in practice.

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Supplementary materials

A List of variables

This list describes and explains all the main variables used in estimation.

- County variable (from the Ministry of Human Resources and Social Security of China)
  - County is defined as the administrative division at the third level.
  - MW: effective minimum wage. Effective minimum wages are average monthly minimum wages weighted by their durations within a year. Real effective minimum wages, used in the regression at the firm level, are denominated by the 4-digit industry product price index.
- City variables (from the China Statistical Yearbook)
  - City is defined as the administrative division at the second level.
  - city average wage: city wage per employee. Employees are those who work at the formal sector in the urban area of each city. City average wages are reported in the database. City total wages and a couple of sources for city total employees are used to replace missing values and outliers of city average wages.
  - city GDPPC: city GDP per capita. GDP per capita are reported in the database. GDP and annual population are used to replace missing values and outliers of GDP per capita. Annual population is calculated as the simple average of city population at the beginning and the end of a year.
  - growth rate of GDPPC: growth rate of city GDP per capita.
  - fixed asset investment: the ratio of fixed asset investment to GDP. This variable is winsorized 1% at two sides with replacement.
  - GDP share of 2nd industry: the ratio of output in the secondary industry to GDP.
  - GDP share of 3rd industry: the ratio of output in the tertiary industry to GDP.
  - growth rate of FDI: growth rate of foreign direct investment. FDI is reported in the database. FDI in the urban area is used to replace missing values and outliers of FDI.
  - growth rate of labor: growth rate of urban and rural labor force. A couple of sources for labor force are reported in the database. The one with the fewest missing values and outliers is used and other sources provide supplementary information.
  - unemployment rate: registered unemployment rate. The number of registered unemployed is reported in the database. It is further denominated by urban labor force, which is measured from a couple of sources reported in the database.

- Province variables (from the CNKI yearbook database)
  - Province is defined as the administrative division at the first level.
  - CPI: consumer price index.
  - P_k: price index of fixed asset investment.
- Industry variables (constructed from the annual survey of industrial firms or other sources)
  - industry wage: real industry wage per employee. Industry is classified at the 2-digit level following the code of GB/T4754-2002. Real variables, same in the following, are denominated by the 4-digit industry product price index.
  - industry output: real industry output per employee. Industry is classified at the 4-digit level following the code of GB/T4754-2002.
  - HHI: Herfindahl index of firm sales in an industry. Industry is classified at the 4-digit level following the code of GB/T4754-2002.
  - labor share$^{\mathbf{IND}}$: industry labor income share. It is measured by the ratio of total wages to total gross output at the 4-digit industry level following the code of GB/T4754-2002.
  - P_y: price index of industry gross output.
  - P_m: price index of intermediate input. It is collected by BBZ (2011).
- Firm variables (from the annual survey of industrial firms)
  - L employees: annual firm employment. It is reported as the average of a firm's end-of-month employees in a year.
  - S: sales: annual sales revenue from main business.
  - W: firm wage per employee. A firm's wage is calculated as the sum of its wage bill, worker benefits, and unemployment insurance. It is common believed employers underreport actual earnings of employees in their income sheet and thus in the dataset. Since there is no evidence that underreporting varies systematically across industries, no adjustment is conducted in this paper. The average wage per employee is a firm's wage denominated by its annual employment. This variable is winsorized 0.5% from the top and dropped if below one thousand Yuan a year.
  - HMT: dummy variable of foreign firms controlled by citizens from Hong Kong, Macau, and Taiwan (cf. firms controlled by foreigners not including from HMT)
  - SOE: dummy variable of state firms (cf. firms controlled by foreigners not including from HMT)
  - PRV: dummy variable of domestic, private firms (cf. firms controlled by by foreigners not including from HMT)
  - profit margin: the ratio of profit to sales. This variable is winsorized 0.5% at two sides with replacement.
  - export/sales: the ratio of export to sales. This variable is winsorized 0.5% from the top.

B Figures and tables

Figure A.1: Mean city wage and effective wage by year

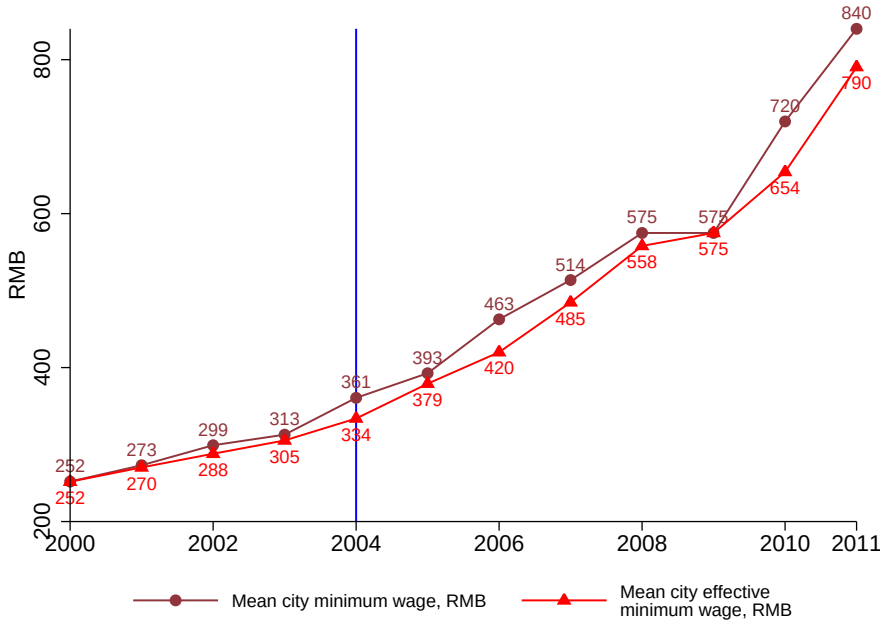
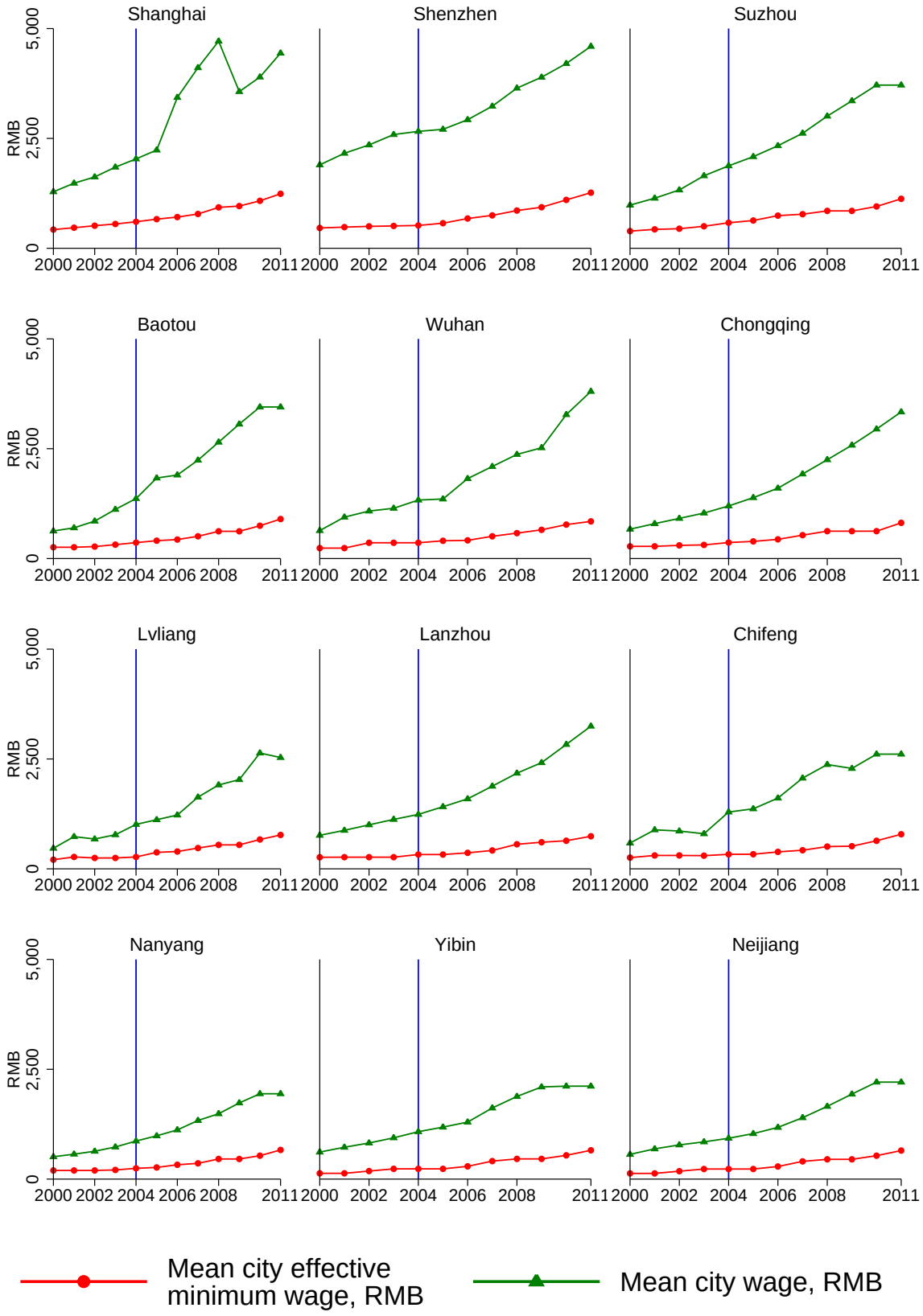


Figure A.2: Mean city average wage and effective minimum wage for selected cities



Note: first row shows the top 3 cities in terms of minimum wage size, second row show the 75th-77th cities in terms of minimum wage, third row — the 151st-153th cities, fourth row — 284–286th cities

Figure A.3: Mean log of city effective minimum wage and mean log of city unemployment by year

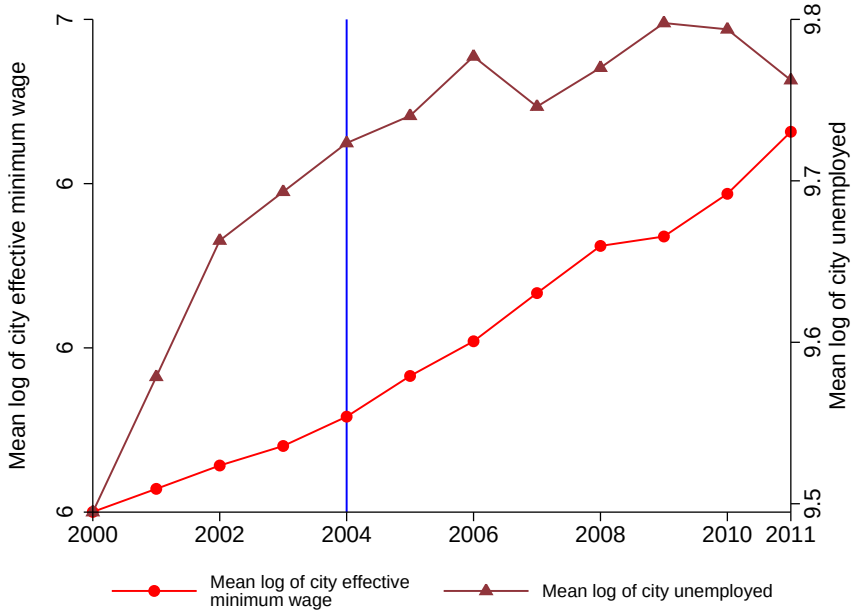


Figure A.4: Change in mean city effective minimum wage and change in mean city unemployment by year

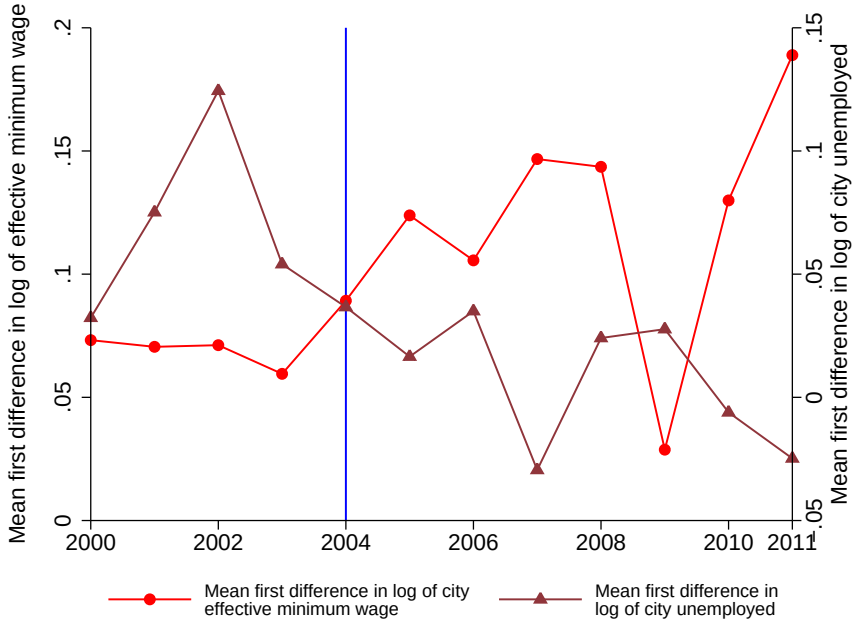
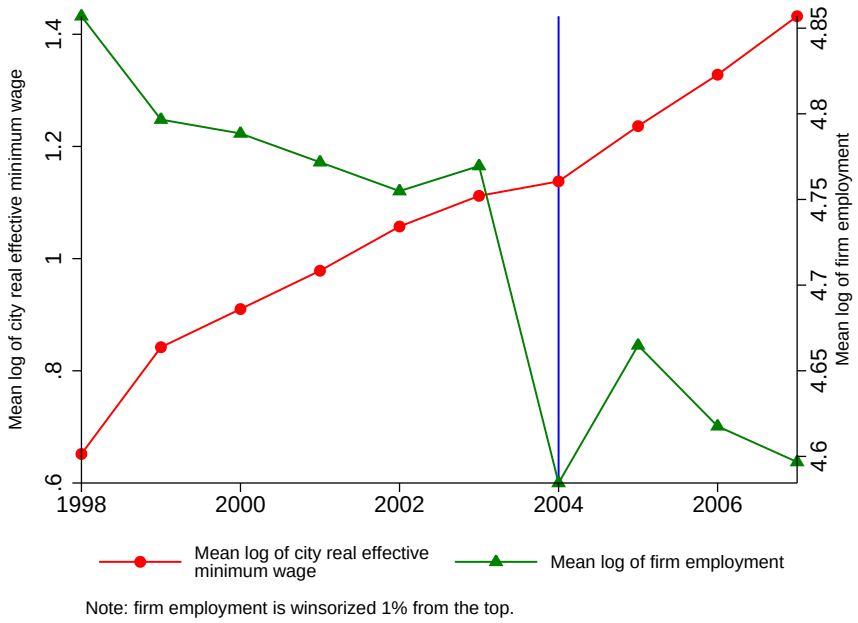
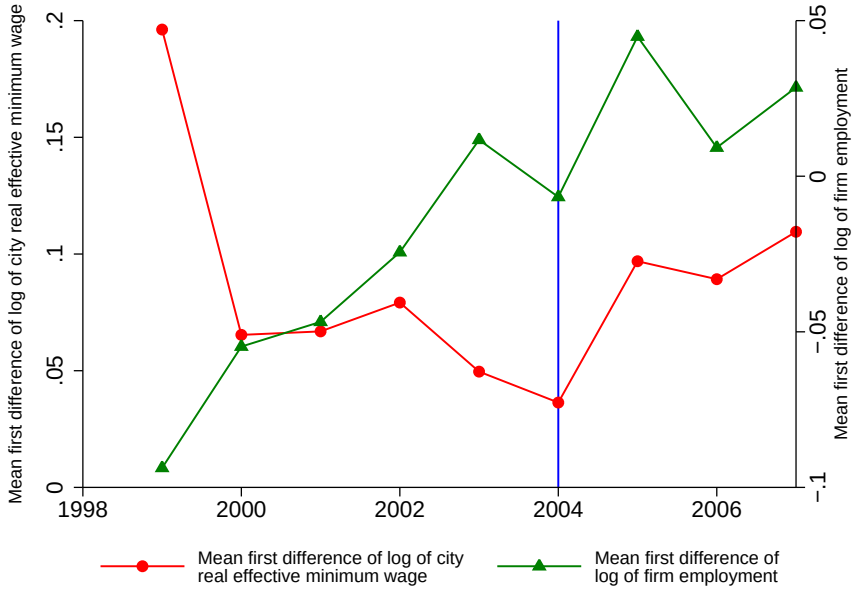


Figure A.5: Mean city real effective minimum wage and mean firm employment in 1998-2007



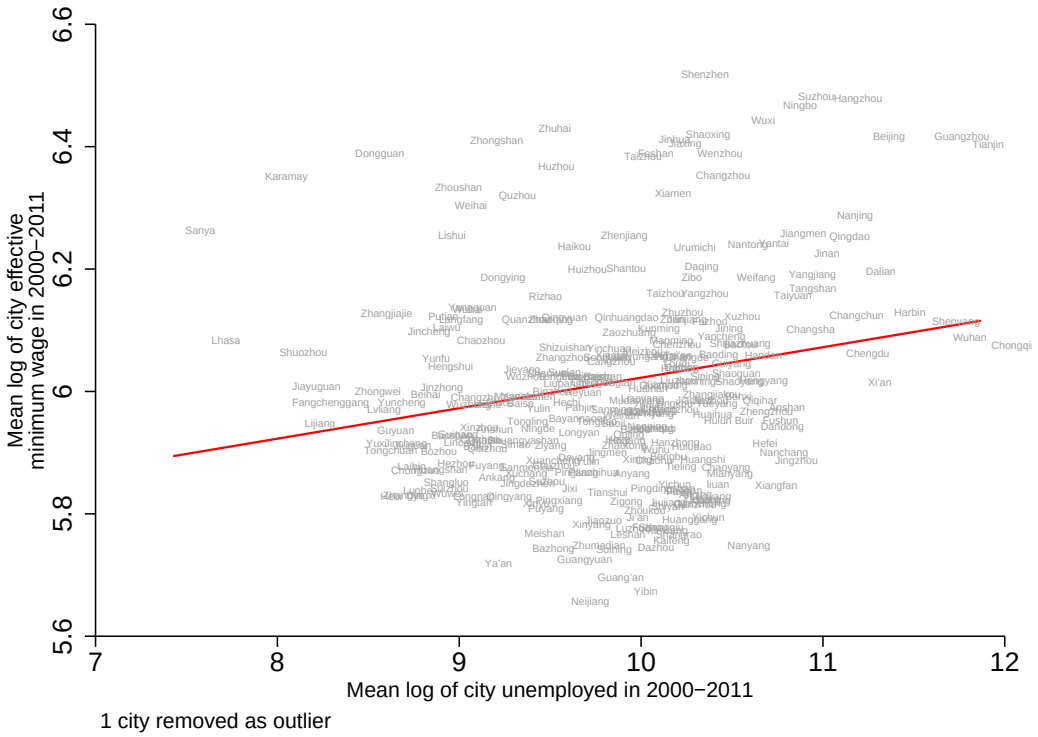
Note: firm employment is winsorized 1% from the top.

Figure A.6: Change in mean city real effective minimum wage and change in mean firm employment in 1998-2007



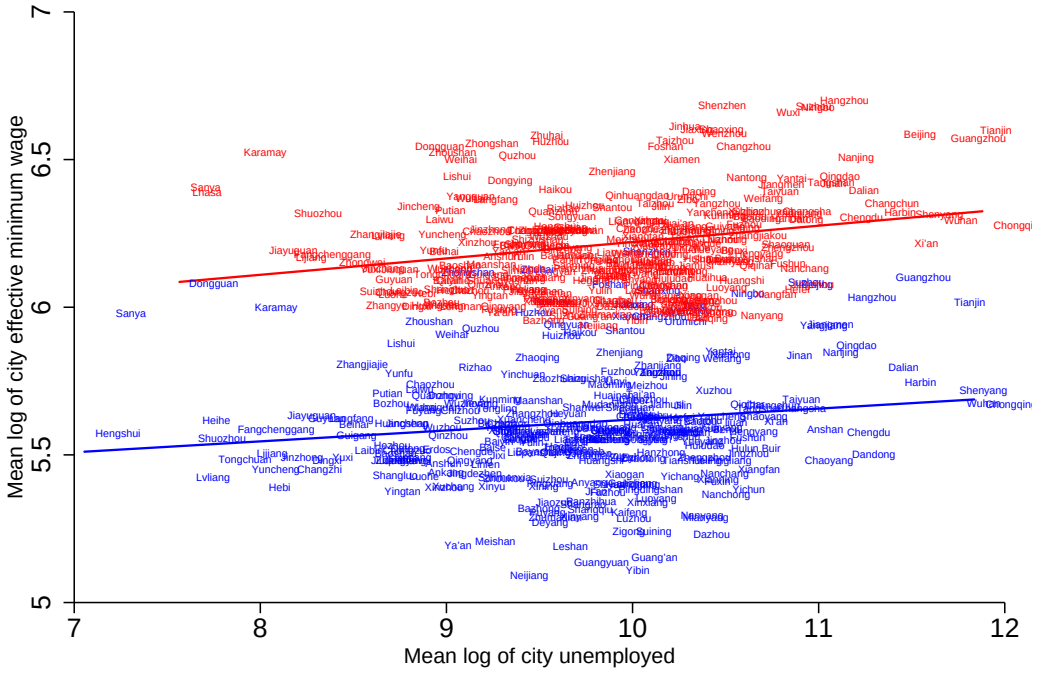
Note: firm employment is winsorized 1% from the top.

Figure A.7: Mean city effective minimum wage and mean city unemployed in 2000–2011



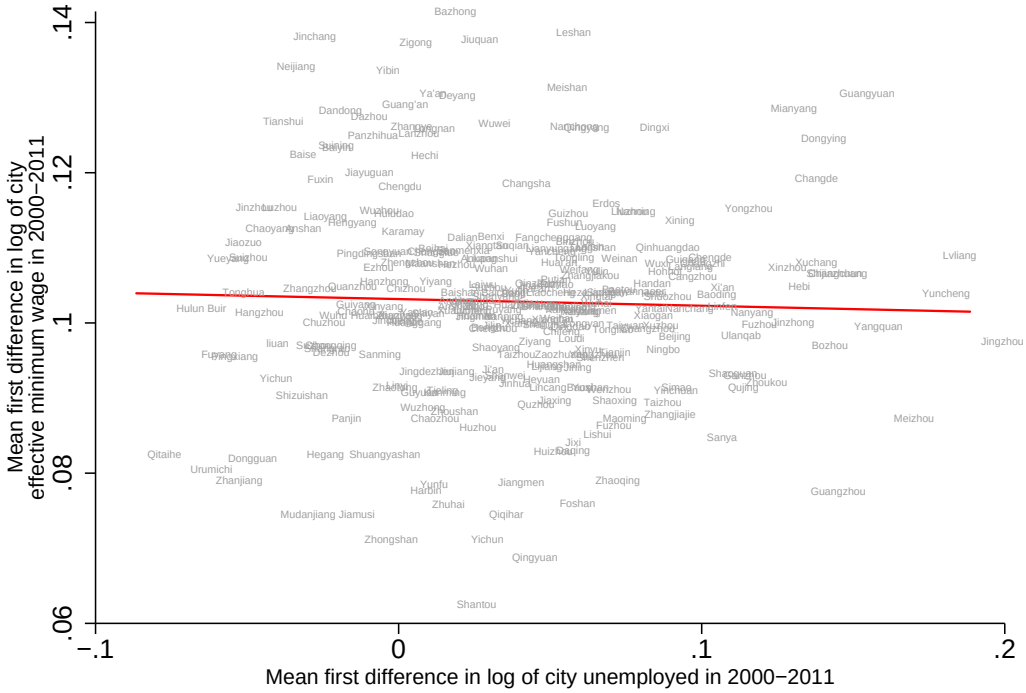
1 city removed as outlier

Figure A.8: Mean log of city nominal effective minimum wage and mean log of city unemployed in 2000–2003 and 2004-2011



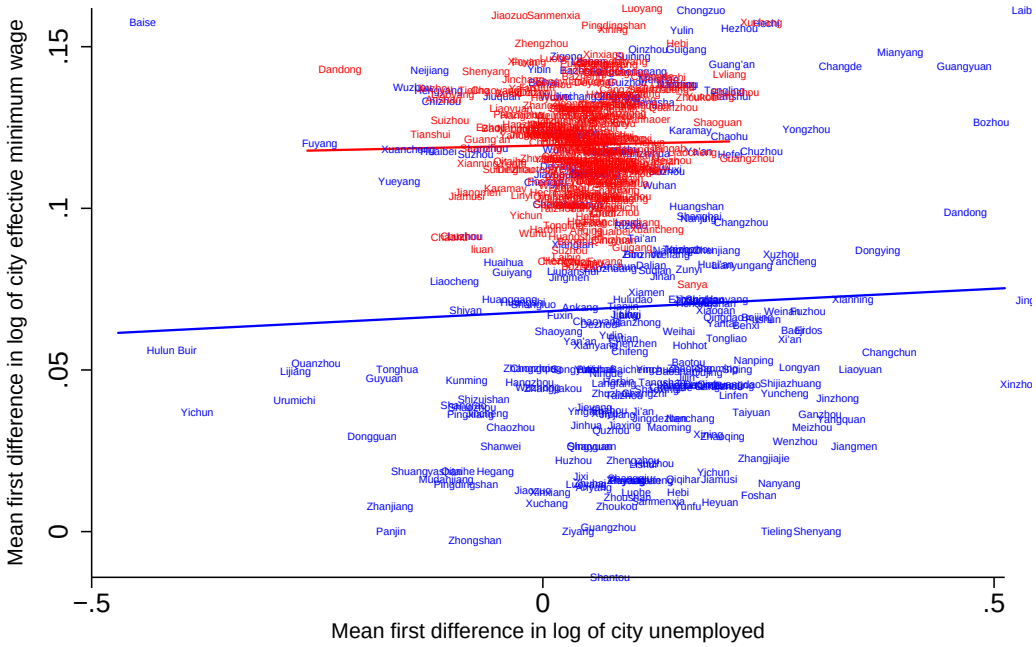
Note: blue names show city means for 2000−2003, red names show city means for 2004−2011, thick lines: linear scatterplot smoothers for respective groups, 1 city removed as outlier

Figure A.9: Change in log of mean city effective minimum wage and change in log of mean city unemployed in 2000–2011



Note: 9 cities removed as outliers

Figure A.10: Change in log of mean city nominal effective minimum wage and change in log of mean city unemployed in 2000–2003 and 2004-2011



Note: blue names show changes in city means for 2000−2003, red names show changes in city means for 2004−2011, thick lines: linear scatterplot smoothers for respective groups. 9 cities remov as outliers

Table A.1: Summary statistics for city-level variables

year	City minimum wage	City effective minimum wage	City GDP per capita	City average monthly wage	City GDP per capita growth	City FDI growth	City fixed asset investment growth	% GDP in secondary industry	% GDP in tertiary industry
2000	251.9	251.8	8,152.0	673.0	6.5	0.5	17.1	41.7	37.0
2001	273.1	270.3	8,878.4	785.8	8.1	18.0	17.8	41.5	37.8
2002	299.1	288.0	9,936.1	896.6	10.0	33.0	19.8	42.3	38.1
2003	312.8	305.3	11,344.5	1,000.1	12.4	24.4	30.7	44.0	37.4
2004	360.7	333.8	13,482.7	1,145.1	18.6	4.5	26.7	45.6	36.3
2005	392.6	379.1	15,545.7	1,289.9	14.9	5.5	25.5	46.4	36.9
2006	462.7	420.0	18,063.3	1,481.5	15.2	33.7	21.8	47.8	36.4
2007	513.7	484.8	21,526.1	1,778.7	18.7	31.8	24.9	48.8	36.0
2008	574.9	558.1	25,713.0	2,076.2	18.6	26.7	25.5	50.0	35.5
2009	574.9	574.9	28,589.3	2,309.1	11.3	3.9	31.6	49.4	36.8
2010	719.7	654.2	34,194.6	2,615.1	19.0	21.4	23.9	50.8	35.7
2011	840.1	790.4	38,821.7	3,153.2	11.7	22.9	9.9	52.1	35.0

Table A.2: Summary statistics for firm-level variables

year	Firm age	Firm employment	Firm wage	Industry wage	Firm sales (thsnd Yuan)	Firm profit margin	# firms	% firms below minimum wage
1998	8	133	526.71	740.85	9,970	0.01	148,526	8.22
1999	8	129	578.17	811.10	10,580	0.01	145,840	9.87
2000	8	125	631.17	881.51	11,909	0.01	146,996	8.90
2001	8	120	736.58	986.53	12,458	0.01	155,486	7.70
2002	8	116	839.58	997.00	13,680	0.02	165,663	6.92
2003	8	113	929.81	1,131.44	15,880	0.02	181,022	6.95
2004	6	93	1,065	1,259.56	14,757	0.02	256,611	1.75
2005	6	100	1,200.95	1,429.92	19,105	0.03	251,370	2.16
2006	6	95	1,374.38	1,679.86	21,550	0.03	279,083	1.98
2007	6	90	1,655.63	1,997.69	25,225	0.03	312,922	2.29

Table A.3: Median statistics of firm-level variables by industries

industry	employees	average wage	sales	profit margin	# of observations
13	68	1,125	32,015	0.038	17,913
14	95	1,233	27,150	0.039	6,543
15	90	1,205	25,040	0.045	4,351
16	465	4,246	111,765	0.128	142
17	105	1,299	25,858	0.024	27,555
18	172	1,361	21,082	0.023	14,562
19	155	1,311	26,119	0.030	7,328
20	81	1,194	18,920	0.044	8,289
21	109	1,440	23,990	0.031	4,052
22	81	1,323	23,456	0.028	8,242
23	78	1,502	15,766	0.025	5,022
24	132	1,361	19,945	0.024	4,081
25	80	1,456	55,760	0.028	2,619
26	69	1,520	29,719	0.038	22,133
27	115	1,389	32,380	0.041	5,651
28	80	1,439	40,321	0.023	1,539
29	97	1,366	23,250	0.037	3,648
30	76	1,435	20,823	0.028	15,203
31	102	1,329	24,979	0.041	23,915
32	94	1,477	52,998	0.024	6,989
33	71	1,471	50,697	0.021	6,031
34	80	1,519	22,233	0.030	17,755
35	79	1,533	21,089	0.036	26,481
36	85	1,622	22,360	0.038	13,226
37	103	1,579	27,706	0.032	14,316
39	92	1,562	28,440	0.029	19,101
40	160	1,754	36,023	0.027	11,000
41	94	1,730	21,455	0.033	4,468
42	115	1,316	17,884	0.030	5,842
43	54	1,569	38,334	0.034	635

This table shows in-sample summary statistics of medians for effective monthly minimum wages (MW) and other relevant variables, during the period from 1998 to 2007. Without further note, we tabulate all nominal variables, instead of real variables.

Table A.4: 2-digit Industry Descriptions

industry	description
13	agricultural and sideline foods processing
14	food producing
15	beverage
16	tobacco products processing
17	textile industry
18	textile clothes, shoes and hat
19	leather, furs, feather (down) and related products
20	timber processing, bamboo, cane, palm fiber and straw products
21	furniture
22	papermaking and paper products
23	printing and recording medium duplicating
24	cultural, educational and sports articles
25	petroleum processing, coking and nuclear fuel processing
26	raw chemical material and chemical products
27	medical and pharmaceutical products
28	chemical fiber
29	rubber products
30	plastic products
31	nonmetal mineral products
32	smelting and rolling of ferrous metals
33	smelting and pressing of nonferrous metals
34	metal products
35	ordinary machinery manufacturing
36	special equipment
37	traffic and transport equipment
39	electric machines and apparatuses
40	communication equipment, computer and other electronic equipment
41	instruments, meters, cultural and office machinery manufacture
42	craftwork and other manufactures
43	waste resources and old material recycling and processing

This table shows descriptions for industries at the 2-digit level of classification.

Table A.5: Minimum Wage Adjustment

	Dependent variable: Log(Minimum Wage)					
	1994 ~ 2011			2004 ~ 2011		
	(1)	(2)	(3)	(4)	(5)	(6)
log(city average wage)	0.031	0.037*	0.036*	0.183***	0.111***	0.113***
	(0.023)	(0.021)	(0.021)	(0.030)	(0.029)	(0.029)
log(CPI)	1.311***	1.466***	1.476***	3.202***	3.123***	3.129***
	(0.144)	(0.130)	(0.132)	(0.132)	(0.140)	(0.139)
growth rate of GDP per capita		−0.014	−0.014		−0.077***	−0.079***
		(0.016)	(0.016)		(0.020)	(0.020)
log(fixed asset investment)		0.012*	0.012*		0.048***	0.046***
		(0.007)	(0.007)		(0.013)	(0.013)
GDP share of the secondary industry		0.000***	0.000***		0.025	0.028
		(0.000)	(0.000)		(0.083)	(0.083)
GDP share of the tertiary industry		−0.008	−0.006		0.000	−0.003
		(0.008)	(0.008)		(0.112)	(0.112)
growth rate of FDI		−0.001	−0.000		0.001	0.001
		(0.002)	(0.002)		(0.002)	(0.002)
growth rate of labor			−0.009			−0.031*
			(0.006)			(0.018)
unemployment rate			0.144			−0.217
			(0.138)			(0.179)
Observations	5601	5414	5414	2672	2584	2584
Cities	334	323	323	334	323	323
Within R-Square	0.96	0.96	0.96	0.93	0.94	0.94
Between R-Square	0.00	0.01	0.00	0.00	0.00	0.00
Overall R-Square	0.81	0.82	0.81	0.42	0.48	0.48
City FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

This table shows how minimum wages adjust to policy variables. The sample is a unbalanced panel including 334 cities during the period from 1994 to 2011. The dependent variable is the logarithm of effective city minimum wages. At year t, a county's effective minimum wage is equal to the average of minimum wages that take effect at year t. A city's effective minimum wage averages minimum wages of its counties. Column 1 to column 3 contains results for the whole period, and column 4 to column 6 use the sample from 2004 to 2011, the period after the legislative tightening of policy enforcement on minimum wages.

The explanatory variables are grouped into three sets and lagged for one year. The first set measures living cost in a city, which includes the logarithmic variable of city average wages and CPI. The second set of variables considers a city's growth opportunity. These variables are the growth rate of GDP per capita, the logarithm of annual fixed asset investment, GDP shares of the secondary and tertiary industries, and the growth rate of FDI. The third set of variables represent the condition of local labor markets, which include the growth rate of labor employed and the unemployment rate.

The panel estimation uses fixed effects for years and cities. Heteroskedasticity-consistent standard errors clustered at the city level are shown in the parentheses underneath the coefficient estimates. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided).

Table A.6: Effect of Minimum Wages on Firm Employment — only city controls

	Dependent variable L_t: log(employees)			
	(1)	(2)	(3)	(4)
MW_t	-0.033^{***}	-0.021^{***}	-0.017^{**}	-0.017^{**}
	(0.006)	(0.006)	(0.007)	(0.007)
industry wage_t		-0.040^{***}	-0.050^{***}	-0.065^{***}
		(0.006)	(0.006)	(0.006)
$P_{k,t}$			-0.109^{***}	-0.134^{***}
			(0.018)	(0.018)
$P_{m,t}$			-0.007	0.008
			(0.011)	(0.011)
city GDPPC_t			0.113^{***}	0.111^{***}
			(0.006)	(0.006)
industry output_t			0.015^{***}	0.028^{***}
			(0.002)	(0.003)
HHI_t				-0.012^{***}
				(0.001)
labor $\text{share}_t^{\mathbf{IND}}$				0.000^{***}
				(0.000)
Observations	1,643,785	1,643,785	1,643,785	1,643,785

This table shows the effect of minimum wages on firm employment without explanatory variables at the firm level. The observations include all firms during the period from 1998 to 2007 which can be matched with our data of minimum wages and city variables. The dependent variable L_t is the logarithmic number of a firm's employees. Column 1 to column 4 include different sets of explanatory variables. MW_t denotes the logarithm of county or city effective minimum wages at year t. Industry wage measures the average wage of the industry at the 4-digit level for each firm. P_k and P_m are the (real) price of fixed asset investment and intermediate input for each 4-digit industry denominated with the price of industry output. MW, city wage, P_k, and P_m together are basic proxies for market factor prices. Industry output is the logarithm of 4-digit output which indicates a firm's aggregate demand. HHI is the variable of the log of Herfindahl index for each 4-digit industry. This variable is an indicator of industry product varieties, which is related to a firm's markup in pricing. Labor share measures the wage share of each 4-digit industry's output. This variable is related to a firm's elasticity of labor demand to the market wage. The determinants of minimum wages examined in the regressions of Table A.5 are also controlled for in column 1-4, but their coefficients are not shown.

Column 1 includes the variable MW in addition to year dummy variables. Column 2 adds the variable of city wage. Column 3 adds a further set of explanatory variables which include P_k, P_m, and industry output. These variables are used to control for the determinants of market factor prices, and aggregate demand. Column 4 adds industry HHI and industry labor share to represent a firm's markup, and a firm's labor share. We use these two variables to control for varying intercept terms across firms in different industries.

The estimation uses fixed effect with year dummy variables. Heteroskedasticity-consistent standard errors clustered at the firm level are shown in the parentheses underneath the coefficient estimates. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided).

Table A.7: Effect of Minimum Wages on Firm Employment

	Dependent variable L_t: log(employees)				
	(1) 2SLS FD	(2) OLS	(3) Fixed Effect	(4) FD	(5) GMM FD
L_{t-1}	0.513***	0.882***	0.355***	−0.151***	0.507***
	(0.007)	(0.001)	(0.002)	(0.001)	(0.005)
sales_{t-1}	−0.056***	0.067***	0.118***	0.097***	−0.054***
	(0.002)	(0.000)	(0.001)	(0.001)	(0.002)
SOE_t	0.015**	−0.019***	0.047***	0.018***	0.016**
	(0.006)	(0.001)	(0.006)	(0.005)	(0.006)
PRV_t	−0.026***	−0.020***	−0.053***	−0.041***	−0.026***
	(0.005)	(0.001)	(0.005)	(0.005)	(0.006)
HMT_t	−0.001	−0.004***	−0.018***	−0.004	−0.001
	(0.004)	(0.001)	(0.004)	(0.003)	(0.004)
$\text{profit margin}_{t-1}$	0.079***	0.029***	−0.001	0.001	0.079***
	(0.004)	(0.003)	(0.004)	(0.004)	(0.005)
$\text{export/sales}_{t-1}$	−0.011***	0.052***	0.024***	0.019***	−0.011***
	(0.003)	(0.001)	(0.002)	(0.002)	(0.003)
MW_t	0.001	−0.003	−0.016***	0.004	0.000
	(0.006)	(0.003)	(0.006)	(0.005)	(0.007)
industry wage_t	−0.014***	0.025***	−0.029***	−0.018***	−0.015***
	(0.005)	(0.002)	(0.005)	(0.004)	(0.005)
$P_{k,t}$	−0.044**	0.013***	−0.072***	−0.040***	−0.040**
	(0.018)	(0.004)	(0.014)	(0.015)	(0.017)
$P_{m,t}$	−0.018	0.005**	−0.006	−0.011	−0.016
	(0.012)	(0.002)	(0.008)	(0.010)	(0.011)
city GDPPC_t	0.032***	−0.007***	0.036***	0.027***	0.031***
	(0.005)	(0.001)	(0.005)	(0.004)	(0.005)
industry output_t	0.014***	−0.004***	0.014***	0.012***	0.014***
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
HHI_t	−0.004***	0.003***	−0.007***	−0.004***	−0.004***
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$\text{labor share}_t^{\mathbf{IND}}$	0.000**	0.000***	0.000***	0.000***	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	1,042,727	1,344,632	1,344,632	1,042,727	1,042,727

This table examines the effect of minimum wages on firm employment using different estimation methods. They use a same set of explanatory variables which include firm controls besides city determinants shown in Table A.6. Column (1) considers dynamic bias incurred by the introduction of L_{t-1}. We use L_{t-2} as an instrument for ΔL_t and run a regression of two-stage least squares with first difference. Column (2) uses the estimation of standard ordinary least squares. This is a pooled regression. Column (3) uses panel estimation with fixed effects based on each firm. Column (4) chooses panel estimation with first difference. Column (5) introduces GMM-style instruments of L_{t-2}, a.k.a. the Arellano-Bond estimation.

The estimation uses fixed effects and controls for year dummy variables and minimum-wage determinants. Export/sales is winsorized 0.5% from the top. Profit margin is winsorized 0.5% at two sides with replacement. Heteroskedasticity-consistent standard errors clustered at the firm level are shown in the parentheses underneath the coefficient estimates. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided).

Table A.8: Effect of Minimum Wages on Firm Employment — different city-variable controls

	Dependent variable L_t: log(employees)			
	(1)	(2)	(3)	(4)
L_{t-1}	0.514***	0.514***	0.512***	0.513***
	(0.007)	(0.007)	(0.007)	(0.007)
sales_{t-1}	−0.056***	−0.056***	−0.056***	−0.056***
	(0.002)	(0.002)	(0.002)	(0.002)
SOE_t	0.016**	0.016**	0.015**	0.015**
	(0.006)	(0.006)	(0.006)	(0.006)
PRV_t	−0.026***	−0.026***	−0.026***	−0.026***
	(0.005)	(0.005)	(0.005)	(0.005)
HMT_t	−0.001	−0.001	−0.001	−0.001
	(0.004)	(0.004)	(0.004)	(0.004)
$\text{profit margin}_{t-1}$	0.079***	0.079***	0.079***	0.079***
	(0.004)	(0.004)	(0.004)	(0.004)
$\text{export/sales}_{t-1}$	−0.011***	−0.011***	−0.011***	−0.011***
	(0.003)	(0.003)	(0.003)	(0.003)
MW_t	−0.007	−0.006	0.001	0.001
	(0.006)	(0.006)	(0.006)	(0.006)
industry wage_t		−0.008*	−0.011**	−0.014***
		(0.004)	(0.005)	(0.005)
$P_{k,t}$			−0.041**	−0.044**
			(0.018)	(0.018)
$P_{m,t}$			−0.019	−0.018
			(0.012)	(0.012)
city GDPPC_t			0.032***	0.032***
			(0.005)	(0.005)
industry output_t			0.011***	0.014***
			(0.002)	(0.002)
HHI_t				−0.004***
				(0.001)
$\text{labor share}_t^{\mathbf{IND}}$				0.000**
				(0.000)
Observations	1,042,727	1,042,727	1,042,727	1,042,727

This table estimates the effect of minimum wages on firm employment based on 2SLS first-difference regressions with different sets of city explanatory variables. The observations include all firms during the period from 1998 to 2007. The dependent variable L_t is the logarithmic number of a firm's employees. Column 1 to column 4 include different sets of city explanatory variables. For ease of comparison, column 4 essentially replicates the results from column 4 in Table A.7. MW denotes the log of city minimum wage. City wage measures the average wage of a city's employees. P_k and P_m are the (real) price of fixed asset investment and intermediate input for each 4-digit industry denominated with the price of industry output. MW, city wage, P_k, and P_m together are basic proxies for market factor prices. Industry output is the log of 4-digit output which indicates a firm's aggregate demand. HHI is the variable of the log of Herfindahl index for each 4-digit industry. This variable is an indicator of industry product varieties, which is related to a firm's markup in pricing. Labor share measures the wage share of each 4-digit industry's output. This variable is related to a firm's elasticity of labor demand to the market wage.

The estimation controls for year dummy variables and minimum-wage determinants. Export/sales is winsorized 0.5% from the top. Profit margin is winsorized 0.5% at two sides with replacement. Heteroskedasticity-consistent standard errors clustered at the firm level are shown in the parentheses underneath the coefficient estimates. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided).

Table A.9: Effect of Minimum Wages on Firm Per Employee Wages

	Dependent variable W_t: log(firm average wage)			
	(1)	(2)	(3)	(4)
L_{t-1}	−0.095***	−0.094***	−0.077***	−0.079***
	(0.008)	(0.008)	(0.007)	(0.007)
sales_{t-1}	0.028***	0.028***	0.024***	0.024***
	(0.002)	(0.002)	(0.002)	(0.002)
SOE_t	0.011*	0.011*	0.013*	0.013*
	(0.007)	(0.007)	(0.007)	(0.007)
PRV_t	−0.004	−0.004	−0.003	−0.003
	(0.006)	(0.006)	(0.006)	(0.006)
HMT_t	0.002	0.002	0.003	0.003
	(0.005)	(0.005)	(0.005)	(0.005)
$\text{profit margin}_{t-1}$	0.028***	0.028***	0.030***	0.030***
	(0.005)	(0.005)	(0.005)	(0.005)
$\text{export/sales}_{t-1}$	0.009***	0.009***	0.008***	0.008***
	(0.003)	(0.003)	(0.003)	(0.003)
MW_t	0.347***	0.325***	0.150***	0.150***
	(0.006)	(0.006)	(0.007)	(0.007)
industry wage_t		0.102***	0.026***	0.030***
		(0.005)	(0.005)	(0.005)
$P_{k,t}$			0.673***	0.678***
			(0.020)	(0.020)
$P_{m,t}$			0.024**	0.020
			(0.012)	(0.012)
city GDPPC_t			0.044***	0.045***
			(0.006)	(0.006)
industry output_t			0.007***	0.009***
			(0.002)	(0.002)
HHI_t				−0.005***
				(0.001)
$\text{labor share}_t^{\mathbf{IND}}$				−0.000***
				(0.000)
Observations	1,024,008	1,024,008	1,024,008	1,024,008

This table estimates the effect of minimum wages on firm per employee wages based on 2SLS first-difference regressions with different sets of city explanatory variables. The observations include all firms during the period from 1998 to 2007. The dependent variable W_t is the log number of a firm's per employee wage.

As a complementary check, the regressions use the same sets of explanatory variables as in Table A.8.

The estimation controls for year dummy variables and minimum-wage determinants. Export/sales is winsorized 0.5% from the top. Profit margin is winsorized 0.5% at two sides with replacement. Heteroskedasticity-consistent standard errors clustered at the firm level are shown in the parentheses underneath the coefficient estimates. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided).

Table A.10: Effect of Minimum Wages on Firm Profit Margin

	Dependent variable: profit margin$_t$			
	(1)	(2)	(3)	(4)
sales$_{t-1}$	0.014***	0.014***	0.014***	0.014***
	(0.002)	(0.002)	(0.002)	(0.002)
SOE$_t$	−0.004**	−0.004**	−0.004**	−0.004**
	(0.002)	(0.002)	(0.002)	(0.002)
PRV$_t$	0.003**	0.003**	0.003**	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)
HMT$_t$	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
export/sales$_{t-1}$	−0.000	−0.000	−0.000	−0.000
	(0.001)	(0.001)	(0.001)	(0.001)
MW$_t$	0.002	0.003*	0.017***	0.017***
	(0.002)	(0.002)	(0.002)	(0.002)
industry wage$_t$		−0.004***	0.001	0.002
		(0.001)	(0.001)	(0.001)
$P_{k,t}$			−0.056***	−0.055***
			(0.005)	(0.005)
$P_{m,t}$			−0.005*	−0.006**
			(0.003)	(0.003)
city GDPPC$_t$			0.003*	0.003*
			(0.002)	(0.002)
industry output$_t$			0.002***	0.003***
			(0.001)	(0.001)
HHI$_t$				−0.001***
				(0.000)
labor share$_t^{\mathbf{IND}}$				−0.000***
				(0.000)
Observations	1,042,727	1,042,727	1,042,727	1,042,727

This table estimates the effect of minimum wages on firm profit margin based on 2SLS first-difference regressions with different sets of city explanatory variables. The observations include all firms during the period from 1998 to 2007. The dependent variable is the firm's profit over sales margin.

As a complementary check, the regressions use the same sets of explanatory variables as in Table A.8.

The estimation controls for year dummy variables and minimum-wage determinants. Export/sales is winsorized 0.5% from the top. Profit margin is winsorized 0.5% at two sides with replacement. The estimation uses fixed effect with year dummy variables. Heteroskedasticity-consistent standard errors clustered at the firm level are shown in the parentheses underneath the coefficient estimates. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided).

Table A.11: Effect of Minimum Wages on Firm Employment — by decile

	Dependent variable L_t: log(employees)
	(1)
MW × FW Group 1	−0.038***
	(0.007)
MW × FW Group 2	−0.030***
	(0.007)
MW × FW Group 3	−0.023***
	(0.007)
MW × FW Group 4	−0.017***
	(0.007)
MW × FW Group 5	−0.012*
	(0.007)
MW × FW Group 6	−0.007
	(0.007)
MW × FW Group 7	0.001
	(0.007)
MW × FW Group 8	0.010
	(0.007)
MW × FW Group 9	0.028***
	(0.007)
MW × FW Group 10	0.058***
	(0.007)
Observations	1,014,113

This table estimates the effect of minimum wages on firm employment based on 2SLS first-difference regressions. We divide all firms in a city at one year into ten groups based on their lagged firm wages and estimate the heterogeneous effect of minimum wages. The observations include all firms during the period from 1998 to 2007. The dependent variable L_t is the logarithmic number of a firm's employees.

The estimation controls for year dummy variables and minimum-wage determinants. Export/sales is winsorized 0.5% from the top. Profit margin is winsorized 0.5% at two sides with replacement. The estimation uses fixed effect with year dummy variables. Heteroskedasticity-consistent standard errors clustered at the firm level are shown in the parentheses underneath the coefficient estimates. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided).

Table A.12: Effect of Minimum Wages on Firm Employment — continuous interactions

	Dependent variable L_t: log(employees)	
	(1)	(2)
$MW_t \times FW_{t-1}$	0.033***	0.043***
	(0.004)	(0.004)
$MW_t \times sales_{t-1}$		−0.027***
		(0.002)
$MW_t \times SOE_t$		−0.126***
		(0.011)
$MW_t \times PRV_t$		−0.032***
		(0.010)
$MW_t \times HMT_t$		−0.053***
		(0.010)
$MW_t \times$ profit $margin_{t-1}$		0.086***
		(0.012)
$MW_t \times export/sales_{t-1}$		−0.033***
		(0.007)
$MW_t \times HHI_t^{\mathbf{IND}}$		−0.005**
		(0.003)
$MW_t \times$ labor $share_t^{\mathbf{IND}}$		−0.000***
		(0.000)
Observations	1,014,113	1,014,113

This table estimates the effect of minimum wages on firm employment based on 2SLS first-difference regressions. We examine how various firm characteristic affects the effect of minimum wages on firm employment. The observations include all firms during the period from 1998 to 2007. The dependent variable L_t is the log number of a firm's employees.
Column 1 only adds the interaction term of minimum wages with lagged firm wages. In contrast to the results in Table A.11, this table only uses interaction terms with continuous variables. Column 2 adds a full set of interaction terms. These interaction terms are constructed with the products of minimum wages with all firm explanatory variables other than lagged firm employment.
The estimation also controls for the full set of firm and city explanatory variables besides year dummy variables same as in Table A.8. Export/sales is winsorized 0.5% from the top. Profit margin is winsorized 0.5% at two sides with replacement. The estimation uses fixed effect with year dummy variables. Heteroskedasticity-consistent standard errors clustered at the firm level are shown in the parentheses underneath the coefficient estimates. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided).

Table A.13: Effect of Minimum Wages on Firm Employment — heterogeneity across time

	Dependent variable L_t: log(employees)	
	(1)	(2)
MW_t × Before	−0.010	
	(0.007)	
MW_t × After 2004	0.011	
	(0.007)	
MW_t × 1999		−0.057***
		(0.010)
MW_t × 2000		−0.029***
		(0.009)
MW_t × 2001		−0.008
		(0.008)
MW_t × 2002		0.024***
		(0.008)
MW_t × 2003		0.025***
		(0.008)
MW_t × 2004		0.041***
		(0.008)
MW_t × 2005		−0.002
		(0.008)
MW_t × 2006		0.023***
		(0.008)
MW_t × 2007		−0.005
		(0.009)
Observations	1,042,727	1,042,727

This table estimates the effect of minimum wages on firm employment based on 2SLS first-difference regressions. We examine how the effects of minimum wages on firm employment change over time. The observations include all firms during the period from 1998 to 2007. The dependent variable L_t is the log number of a firm's employees.

Because the observations of 1998 are used to construct lagged variables, in practice, column 1 divides the whole period from 1999 to 2007 into two episodes: pre-tightening episode from 1999 to 2003 and post-tightening episode from 2004 to 2007. Column 2 simply estimates the effect of minimum wages separately for each year.

The estimation also controls for the full set of firm and city explanatory variables besides year dummy variables same as in Table A.8. Export/sales is winsorized 0.5% from the top. Profit margin is winsorized 0.5% at two sides with replacement. The estimation uses fixed effect with year dummy variables. Heteroskedasticity-consistent standard errors clustered at the firm level are shown in the parentheses underneath the coefficient estimates. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided).

Table A.14: Effect of Minimum Wages on Firm Employment

	Dependent variable L_t: log(employees)	
	(1)	(2)
$MW_t \times FWage_{t-1} \times$ Before	0.035***	
	(0.004)	
$MW_t \times FWage_{t-1} \times$ After 2004	0.041***	
	(0.004)	
$MW_t \times FWage_{t-1} \times 1999$		0.020***
		(0.005)
$MW_t \times FWage_{t-1} \times 2000$		0.039***
		(0.005)
$MW_t \times FWage_{t-1} \times 2001$		0.042***
		(0.005)
$MW_t \times FWage_{t-1} \times 2002$		0.034***
		(0.005)
$MW_t \times FWage_{t-1} \times 2003$		0.029***
		(0.005)
$MW_t \times FWage_{t-1} \times 2004$		0.041***
		(0.004)
$MW_t \times FWage_{t-1} \times 2005$		0.028***
		(0.004)
$MW_t \times FWage_{t-1} \times 2006$		0.035***
		(0.004)
$MW_t \times FWage_{t-1} \times 2007$		0.054***
		(0.004)
Observations	1,014,113	1,014,113

This table estimates the effect of minimum wages on firm employment based on 2SLS first-difference regressions. We examine how the heterogeneous effects of minimum wages on firm employment change over time for firms with different levels of firm wages. The observations include all firms during the period from 1998 to 2007. The dependent variable L_t is the log number of a firm's employees.

Essentially we estimate the coefficients of interaction terms $MW_t \times Fwage_{t-1}$ change over time. Because the observations of 1998 are used to construct lagged variables, in practice, column 1 divides the whole period from 1999 to 2007 into two episodes: pre-tightening episode from 1999 to 2003 and post-tightening episode from 2004 to 2007. Column 2 simply estimates the coefficients of these interaction terms separately for each year.

The estimation also controls for the full set of firm and city explanatory variables and year dummy variables same as in Table A.8. Export/sales is winsorized 0.5% from the top. Profit margin is winsorized 0.5% at two sides with replacement. Heteroskedasticity-consistent standard errors clustered at the firm level are shown in the parentheses underneath the coefficient estimates. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided).

Table A.15: Effect of Minimum Wages on Firm Employment with 2004 Census Weighting to Correct Survey Sampling Bias

	Dependent variable: log(employees)				
	(1) 2SLS FD	(2) OLS	(3) Fixed Effect	(4) FD	(5) GMM FD
MW_t	0.048	0.032	0.052	0.029	0.045
	(0.052)	(0.042)	(0.040)	(0.022)	(0.053)
industry $wage_t$	0.023	0.020	−0.003	0.011	0.024
	(0.039)	(0.037)	(0.031)	(0.013)	(0.042)
city $GDPPC_t$	0.027	0.064*	0.042	−0.017*	0.025
	(0.050)	(0.038)	(0.039)	(0.009)	(0.049)
industry $output_t$	0.012	0.015	0.020	−0.008*	0.012
	(0.016)	(0.011)	(0.013)	(0.004)	(0.016)
labor $share_t^{\mathbf{IND}}$	−0.000	0.000**	0.000	0.000***	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
HHI_t	−0.000	−0.010	−0.001	0.004	−0.000
	(0.008)	(0.006)	(0.007)	(0.003)	(0.009)
Observations	547,355	629,587	547,355	629,587	547,355

standard errors in parentheses ($^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$)

This table examines the effect of minimum wages on firm employment using different estimation methods when survey sampling bias correction is performed. They use a same set of explanatory variables which include firm controls besides city determinants shown in Table A.6. Column (1) considers dynamic bias incurred by the introduction of L_{t-1}. We use L_{t-2} as an instrument for ΔL_t and run a regression of two-stage least squares with first difference. Column (2) uses the estimation of standard ordinary least squares. This is a pooled regression. Column (3) uses panel estimation with fixed effects based on each firm. Column (4) chooses panel estimation with first difference. Column (5) introduces GMM-style instruments of L_{t-2}, a.k.a. the Arellano-Bond estimation. Therefore, the results can be compared with those from Table A.7 that does not account for sampling bias.

The estimation uses fixed effects and controls for year dummy variables and minimum-wage determinants. Export/sales is winsorized 0.5% from the top. Profit margin is winsorized 0.5% at two sides with replacement. Heteroskedasticity-consistent standard errors clustered at the firm level are shown in the parentheses underneath the coefficient estimates. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided).

Table A.16: Determinants of non-compliance with minimum wage legislation

	Dummy = 1 if firm wage$_t$ < minimum wage$_t$
year$_{2001}$	0.094***
	(0.010)
year$_{2002}$	0.125***
	(0.009)
year$_{2003}$	0.172***
	(0.010)
year$_{2004}$	−1.003***
	(0.030)
year$_{2005}$	−0.866***
	(0.031)
year$_{2006}$	−0.941***
	(0.032)
year$_{2007}$	−0.872***
	(0.033)
Observations	1,034,660
Firms	296211

Population-averaged probit model. Coefficients from standard controls and constant not reported. Standard errors in parentheses
This table estimates the determinats of non-compliance with minimum wage legislation based on population-averaged probit model.. We examine what governs firms' decisions to set wages below the minimum wage threshold. The observations include all firms during the period from 2001 to 2007. The dependent variable is the dummy equal to unity if a firm set wage below the minimum wage.
The estimation also controls for the full set of firm explanatory variables and year dummy variables. We report only coefficients for year dummies to show an enforcement shock in 2004. Standard errors are shown in the parentheses underneath the coefficient estimates. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided).

Table A.17: Firm employment and financial constraint

	Dependent variable L_t: log(employees)		
	(1)	(2)	(3)
interest payments$_{t-1}$	−0.135***	−0.042	0.007
	(0.021)	(0.070)	(0.078)
MW$_t$ × interest payments$_{t-1}$		−0.085	
		(0.058)	
MW$_t$ × interest payments$_{t-1}$ × Before			−0.107
			(0.070)
MW$_t$ × interest payments$_{t-1}$ × After 2004			0.274**
			(0.114)
Observations	1,027,362	1,027,362	1,027,362

Firm- and city-level dummies as in previous models and constant are not reported. Robust standard errors in parentheses