How do Firms React to Minimum Wage Changes?

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Abstract

This paper provides the first systematic study of how China's firms react to minimum wage changes over the 2000–07 period. Using an administrative dataset of minimum wage regulations matched with the data of manufacturing firms, we find that minimum wage hikes had negative effect on firm employment and profit, positive effect on firm wage, and insignificant effect on firm product price. This evidence shows that welfare was internally redistributed between employers and minimum wage workers. Along the time horizon during which a national tightening was implemented in 2004, we find that employment elasticities became increasingly negative while firm wage elasticities became increasingly smaller. We investigate heterogeneous firm responses in terms of firm characteristics and labor market conditions at firm locations. One particular finding is that minimum wage hikes in neighbor cities provided firms the externality of inter-regional labor flow.

JEL classifications: J24; J31; 014, F10, F14

Keywords: China, Employment, Minimum Wages

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1 Introduction

The impact of minimum wages on employment is the subject of challenging debates among economists and policy makers. While traditional research tells us that an increase in the minimum wage reduces employment (Brown, 1999), substantial subsequent literature arrives at little consensus on its impact. Recent theoretical development introduces the possibility of a relationship between the minimum wage and firm employment in the context of bargaining and search models (Burdett and Mortensen, 1998; Acemoglu, 2001; Flinn, 2006), (dynamic) monopsony, and efficiency wage models (Lang and Kahn, 1998; Manning, 1995; Bhaskar, Manning, and To, 2002). The "New Minimum Wage Research" based on firm-level evidence also shows that employment responses are negligible or even positive (see: Katz and Krueger, 1992; Card and Krueger, 1994; and also the studies cited in Neumark and Wascher, 2008).

Our paper contributes to these debates by providing comprehensive and more reliable estimates of the employment elasticity with respect to minimum wage hikes. During the period 1992–2007, the average real wage in urban China increased by 202 percent (Ge and Yang, 2014). As China became the "world factory" in the 2000s, the rising cost of labor in China has always been topical, which motivates us to study China's minimum wage policy. The minimum wage policy raises the income of poorly paid workers, but meanwhile it causes some of them to lose their jobs. The effectiveness of income transfer hinges on whether employers are willing to retain minimum wage workers by either passing on the cost rise to consumers or bearing the cost by themselves. In this paper, we provide evidence from the employer side and explore how firms respond differently to local minimum wage hikes.

To the best of our knowledge, this is the first study to show the heterogeneous effect of minimum wages on employment using a dataset that tracks firms across China. China's Annual Survey of Industrial Firms provides a representative sample of firm data in the manufacturing sector. For example, in 2004 this survey covered more than 90 percent of China's manufacturing output and 70 percent of its manufacturing employment (Brandt, Van Biesebroeck, and Zhang, 2012). Considering its share in the national economy and employment, the manufacturing sector is of great significance in China's labor market, and therefore the major concerns about the rising labor cost in China have been related to this sector. The overall wage rate of China's manufacturing sector is also relatively low when compared to the average city wage, which makes this sector a pertinent target for policy debates on the minimum wage.

This paper aims to fill the gap in the literature by dealing with unobservable bias associated with the minimum wage policy and employment. We collect a novel administrative dataset of minimum wages across more than 2,800 counties in China. At the county level, our paper benefits from the granular variation in minimum wages, in contrast to most policy studies at the provincial level or the prefectural level. The endogenous nature of government policies poses a challenge in measuring the impact of the minimum wage. Freeman (2010) argues that governments could set minimum wages while considering the risk that they can cause more harm than good. In this regard, governments must maintain a balance in order not to draw opposition from local employers. This stresses the necessity of exploring and controlling for observable factors of the minimum wage in the employment estimation.

China is special for its high frequency of minimum wage adjustment. We show that after being detrended, few economic indicators are still related to the minimum wage growth. Furthermore, the county data allows us to identify minimum wage shocks by within-city variations, for which we can control for time-varying trends at the city level. In other words, in the first step, for any county we search for control groups in the nearby counties within the same city. This use of geographic proximity pioneered by Card and Krueger (1994) in minimum wage research is particularly helpful for studies of firms due to their relatively low mobility. Compared to other variations controlled at much larger regions, the difference in market conditions between treatment and control counties is substantially smaller, especially for labor supply factors, such as labor mobility in China's *Hukou* (household registration) system, which are crucial to our research.

Our sample spans the period from 2000 to 2007, during which a national tightening of the minimum wage regulation was implemented around 2004. We study the trend of minimum wage impact over the pre-transition, transition, and post-transition episodes. Our first finding is that the employment elasticity with respect to the minimum wage is generally negative. The average elasticity on an annual basis, is -0.163 if estimated from the model with firm fixed effect (FE), or -0.114 if estimated from the model with firm specific trend. This suggests that a 10 percent increase in the minimum wage lowered employment growth by about 1.1 to 1.6 percent. This impact of the minimum wage is of economic significance considering that our sample includes almost all manufacturing firms and the underlying labor force is vast. For firm wage elasticities in terms of the minimum wage, the estimates range from 0.229 to 0.27. Meanwhile, we find the product price elasticity of the minimum wage is statistically insignificant from zero. When firms cannot pass on the wage rise to their buyers, they bear the cost. We find that firm profit is lowered by about 3 percent on average over the period in response to a 10 percent minimum wage hike. In a nutshell, we observe market distortions from job loss, and we also learn that some minimum wage workers are retained and welfare redistribution is mainly between firms and their employees.

If some of labor market factors are positively related to minimum wage hikes, they are very likely to be favorable labor market conditions that are also positively related to employment growth. Not being able to control for these factors thereby causes upward bias. For employment elasticities, we show that the model using the within-city variation gives markably larger negative estimates than the model using the within-province variation.

Our findings show a peculiar trend of firm employment and wage elasticities. From the beginning of the millennium to the run-up of the global financial crisis, employment elasticities became increasingly negative while firm wage elasticities became increasingly smaller. This trend coincides with the structural change in China's labor market as labor demand and supply has become more balanced.

We emphasize that firms exhibit significant heterogeneity in their employment responses to minimum wage changes in terms of their characteristics like exposure to minimum wage hikes, ownership types, and profit margins. In particular, on the one hand, the mostly exposed firm, measured at the first percentile of the distribution for the ratios of firm wage to minimum wage,

has an employment elasticity twice as large in size as the average elasticity, in the presence of a minimum wage hike. On the other hand, the wage increase of minimum wage workers transmits to high-wage workers, and we also find moderate increases in firm wages for high-wage firms. State firms, among all firms that include private and foreign firms, have the lowest employment elasticity in size, although the estimate of the difference is small: 0.9 percentage if compared to private firms or 0.5 percentage if compared to foreign firms. When we compare firms receiving government subsidies with the non-subsidized firms, the evidence shows that the employment elasticity is larger in size for subsidized firms. If state firms retain more minimum wage workers because of their political constraint, getting subsidies may signal a firm's poor performance.

We investigate employment heterogeneity in terms of labor market conditions. Two proxies for the degree of local market flexibility are used: a employer concentration measure in terms of low-wage firm employment and an index of labor mobility. We do not find a significant difference in the estimates due to labor mobility. By contrast, if the market is too thin with only a few low-wage employers, the employment elasticity is smaller in size. This indicates that monopsonistic firms may find ways negotiating with employees other than simply shedding jobs.

The preference of China's policy makers has been widely studied in recent policy analysis. We take on the issue whether a city governor's pro-growth ambition is relevant to employment elasticities of the minimum wage. The result shows that the cities with the lowest elasticity in size have governors around fifty years old, the age of a "political hopeful" who would exert much effort to get promoted before the retirement age.

Finally, we provide evidence of inter-regional labor flow as a spillover effect of minimum wage policy. Quantitatively, an additional 10 percent increase in the minimum wage leads to labor inflow and reduces neighbor employment growth further by 2.9 percentage in the elasticity of their minimum wages. We argue that this justifies the hierarchical and cooperative style of China's economic and welfare policies. The existential externality would undermine a local government's incentive to implement welfare enhancing policies without the coordination of superior authorities.

Among the minimum wage research, our analysis has relevance to the recent debate on the estimation design that uses regional controls and policy discontinuities to control for "spatial heterogeneity". The studies that support this design include that by Allegretto, Dube, and Reich (2011) which considers time-specific fixed effects of census divisions and state-specific linear trends, and those by Dube, Lester, and Reich (2010, 2015) and Allegretto, Dube, Reich, and Zipperer (2013) which study employment stocks and flows with controls for time-specific fixed effects of neighbor county pairs crossing a state border. The studies that rebut this design include those by Neumark, Salas, and Wascher (2014a,b) who argue that synthetic controls for treatment counties may not comprise proximate regions. China's minimum wages vary across counties and are adjusted at the high frequency of one or two years. Our research subject is a large set of countrywide manufacturing firms, rather than a single treatment region. Therefore, our regression-based empirical strategy takes into account the matching based upon the explanatory variables for each county. The introduction of the time-specific fixed effect of city and industry is effectively aimed at controlling for unobservable factors that lead to the

endogeneity of minimum wages.

Among labor market policy tools, the minimum wage policy in China has been considered to be a major force driving increases in wages and putting pressure on firms. Several recent studies examining the effects of the minimum wage policy in China focus on individual employment from the data obtained from household surveys, but they mostly ignore the endogenous nature of minimum wage setting. Wang and Gunderson (2011) show that the minimum wage has negative employment effects in regions with slower growth, and even greater negative effects for non-state enterprises. Fang and Lin (2013) find that minimum wage increases have resulted in employment reduction for females, young adults, and less-skilled workers. We instead introduce a county-level dataset of detailed monthly minimum wages across all 31 provinces in China matched with representative firm-level data.[1] Moreover, we take the endogeneity of minimum wage policy, firm characteristics, and macro conditions seriously by implementing a battery of empirical tests and specifications. Importantly, besides the average effects discussed in the literature, we also emphasize the heterogeneous effects across firms, and the potential explanation linked with local market competition and the institutional features of China.

The remainder of our paper is structured as follows. We discuss China's minimum wage policy in the next section. In Section 3, we present the sources of the data, and some descriptive statistics for the dynamics of minimum wages and the wages in the manufacturing sector. We demonstrate our identification strategy and empirical framework in Section 4. In Section 5, we show the results concerning the homogeneous and heterogeneous effects of minimum wage hikes. In Section 6, we conduct several robustness checks. Section 7 concludes.

2 Institutional Background: Minimum Wages in China

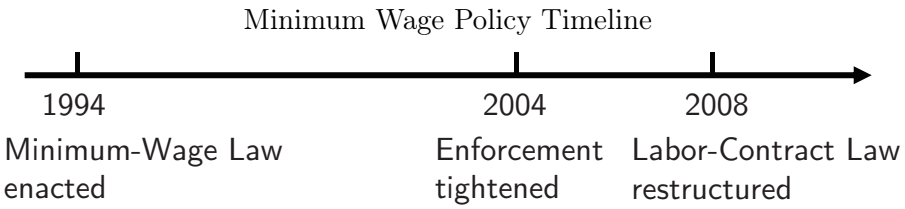
In early 1984, during the early phase of its economic reform, China approved the International Labor Organization's (ILO) *Minimum Wage-Fixing Machinery Convention* (1928). In July 1994 the Labor Law stated a requirement to implement a system of guaranteed minimum wages. According to Article 48 of the Labor Law, firms were specifically required to comply with local minimum wage policies. Provincial governments were authorized to set their own minimum wage standards. The levels of minimum wages were not universally the same within a province, in that cities and counties could negotiate their local minimum wages with the higher authorities (Casale and Zhu, 2013). As a common style of China's polices, the minimum wage policy is implemented mainly by local government and the higher authorities may take heed of the enforcement. Before 2003, the adjustment of minimum wages was less frequent than in subsequent years. In 1998, during the Asian financial crisis, only one-fifth of all counties adjusted their minimum wages.

As China had advanced in its market reforms when it joined the WTO in 2001, the framework of minimum wage policies had become outdated and it therefore was in need of change. In March 2004, the MHS issued a new policy that established a more comprehensive coverage of minimum

[1] After our work was first circulated and presented (Huang, Loungani, and Wang, 2013, 2014a,b), Poncet, Mayneris, and Zhang (2014) and Xing and Xu (2014) followed our panel estimation approach but used city-level minimum wage information. However, their IV approach incorrectly treats the minimum wage as a predetermined variable and the contemporaneous city wage as an exogenous variable. Because they ignore the endogeneity of firm characteristics and the serial correlation of the disturbance in their estimation, their estimators are susceptible to inconsistent results.

wage standards and increased the non-compliance penalties. This new phase of minimum wage reform in 2004 made the process of minimum wage adjustment more formal and more regular. In particular, this reform emphasized the following major changes: (1) an explicit extension of coverage to town-village enterprises and self-employed businesses; (2) a new standard for hourly minimum wages; (3) an increase in the penalty for violators from 20–100% to 100–500% of the wage owed; and (4) more frequent minimum-wage adjustment (at least once every two years). The new policy states that local departments of labor exercise supervision within the scope of each hierarchical administration. Although little is explicit about the intensity of enforcement, like how and how often local departments of labor should actively inspect the compliance with the minimum wage policy, Su and Wang (2014) state that after the new policy was implemented, supervision at the local level has been intensified and that the enforcement has been more effective.

Local governments may have enacted the new policy with delays from several months to more than a year. Therefore, the new policy was not completely implemented in the whole country initially in 2004. Seven provinces did not adjust minimum wages in 2004, and, based on our records, four of them (Henan, Hunan, Shaanxi, and Tibet) enacted provincial policies in the following years. Nonetheless, the central government pushed hard for this reform. In April 2005, the MHS issued a decree that urged those who did not raise minimum wages by the end of 2004 to conform to the rule. Furthermore, the MHS emphasized again that it is a top priority to protect the legal rights of workers by implementing the new minimum wage policy. By the end of 2005, with only the exception of Tibet, all provinces had adjusted their minimum wage levels at least once since 2004. Following the transition year of 2004, 2005 was really the year when the post-reform era started.



When the global financial crisis hit China in 2008, the MHS provided policy guidelines that allowed for a delay in minimum wage adjustment. Meanwhile, the new Labor Contract Law enacted in 2008 established the importance of minimum wage policies, and thereafter the minimum wage became one of the key components of China's labor market policies. The above timeline depicts the evolution of China's minimum wage policies over time.

3 Data and Descriptions

Our empirical estimation focuses on the effect of minimum wages on firm employment. We match a dataset of China's manufacturing firms with local minimum wages at the county level, as well as with other regional data on economic conditions. A detailed description of how we construct our sample can be found in the Online Appendix. Here, we briefly introduce our data sources and the criteria of sample construction.

3.1 Minimum Wages

Our minimum wage data are collected from the MHS and the China Academy of Labor and Social Security. The data span ranges from 1992 to 2012, covering our sample of manufacturing firms. This dataset contains detailed information on all the adjustments of minimum wages at the county level. To match minimum wages with the annual firm data, we aggregate monthly minimum wages for every year, which we refer to as the annual minimum wage.

China's minimum wages are specified in the forms of monthly wages, part-time hourly wages, and full-time hourly wages. One the one hand, hourly minimum wages are set by local governments based on monthly minimum wages and an estimate of monthly working hours about 170. On the other hand, the hiring in the manufacturing sector usually involves relatively long and stable employment contracts compared with the service sector. We choose to use full-time monthly minimum wages in our estimation due to its relevance to the manufacturing sector.

To the best of our knowledge, this is one of the first papers to study this dataset. Other than minimum wages, empirical research on China's policies rarely finds a target for which a complete panel at the county level can be acquired. Using more disaggregated policy data not only enlarges the variation of minimum wages in the estimation, but it also improves identification by allowing county-wise comparisons.

A Chinese county (*xian*) is a division administered by a prefectural city (*shi*), which is in turn administered by a province (*sheng*). Counties, prefectural cities, and provinces represent the top three levels of China's administrative divisions. As of 2007, there were 2,867 counties, 333 cities, and 31 provinces in mainland China. This paper refers to 337 cities which include four municipalities controlled by the central government as well as the 333 prefectural cities. Directly controlled municipalities are administered at the highest level, and are much larger in terms of their economic size, but their area size is similar to that of prefectural cities.

County surface areas vary in China. The size of a typical county in China is one-tenth of the size of a prefectural city. For counties where more than a few manufacturing firms are located, a typical county has an area between 20 and 2000 square kilometers. For reference, the area of Hong Kong is 1,104 square kilometers. Therefore, nearby counties within a city are more ideal comparison groups than nearby cities if we want to control for time-varying unobservables. The data show that 22 percent of cities have uniform levels of minimum wages for their counties and sub-districts, like Beijing; however, the other 78 percent have within-variation in minimum wages. Figure III shows the spatial distribution of cities according to variations in their county minimum wages. Minimum wages are invariant within a city if the city's minimum wages are same as those among its counties, and *vice versa*. We find that those cities with uniform minimum wages are concentrated in several provinces, especially two western provinces with low population density, namely, Tibet and Qinghai, and two northeastern provinces, namely, Heilongjiang and Jilin.

Geographic and Time Variation

Figure I shows the geographic variation of China's minimum wages over the period 2001–06. Each county on the map is grouped into four quartiles measured at the national level according

to their monthly minimum wages. Darker color represents higher quartile of minimum wages. The spatial distribution is clearly not stable throughout this period. For instance, the major origin of counties at the top level of minimum wages changed from the Pearl River Delta to the Yangtze River Delta during this period. In addition, regions populated with ethnic minorities, for example, Tibet and Xinjiang, have relatively higher minimum wage standards than regions with similar levels of economic development.

Figure II shows the geographic variation of annual growth rates of county minimum wages over the period. Similarly, counties are grouped into four quartiles according to their growth rates relative to the national level. It is noticeable that some provinces uniformly raised local minimum wages in a year at a high rate, such as Sichuan in 2003 and Gansu in 2004, because, as we will discuss, minimum wage adjustment is led mainly by the provincial government. We also find that there is no local government that always kept minimum wages growing at a high rate. Minimum wages can be adjusted at a frequency longer than one year, so it is reasonable to see that the spatial distribution of minimum wage growth changes over time.

Figure IV shows the trend of median monthly minimum wages and median employee wages for all counties nationwide over the period 1995–2011. Both wages rose rapidly during this period, one which witnessed China's fast growth. When we examine the ratio between these two wages, it appears that the ratio was actually declining in most years during this period. Evidently, the ratio fell from 0.37 in 2000 to 0.25 in 2010. This may not simply indicate that citizen welfare has been less taken care of. Since official statistics of employee wages are measured by mean wages, rather than median wages that are more indicative as reference wages compared to minimum wages, enlarging wage inequalities and evolving wage distributions can also be a reason for this pattern. At the county level overall, the ratios of the minimum wage to the local average wage are in the range between 0.2 and 0.5 throughout this time.

Figure V shows the upward trends of both nominal and real minimum wages. The minimum wage rises along with many other macroeconomic variables, and it is hard to make predictions by itself. Unit root tests for individual counties often fail to reject the null hypothesis that the processes of minimum wages and local wages contain a unit root, by including a linear trend, though unit root tests for panel datasets as in Harris and Tzavalis (1999) and Levin et al. (2002) strongly reject the null hypothesis.

Adjustment Frequency and Adjustment Range

Figure VI shows the variation of adjustment frequencies for county minimum wages. The proportion of counties that adjusted minimum wages in each year varied from 40 percent to 80 percent before 2006. Most counties adjusted minimum wages on an annual basis after 2006, except in 2009 when the global financial crisis made an impact in China. Minimum wage hikes also exhibited noticeable variations. Some counties changed their minimum wage levels after a considerably long pause. In general, a large part of minimum wage hikes were lower than 20 percent, although some much higher hikes occasionally occurred.

3.2 Firm Data

Our firm data are mainly from the Annual Survey of Industrial Firms (ASIF), also known as the Chinese Industrial Enterprise Database (CIED). According to 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 key statistics for industrial output, such as those in the China Statistical Yearbook. Our main sample spans the period 1998–2007 and it contains exactly the same number of observations used by NBS during these years.

This survey is representative of China's manufacturing industry. Compared with the first economic census in 2004, this 2004 survey includes 20 percent of industrial firms, but covers 91 percent of China's industrial output and 71 percent of China's 93.4 million industrial employees. The 2008 survey is not included in our sample. For reference, compared with the second economic census in 2008, the 2008 survey includes 22 percent of industrial firms, but covers 88 percent of China's industrial sales and 72 percent of its industrial employment.

The ASIF data contain each firm's end-of-year balance sheet as well as information on input and output. The data also show a firm's average number of employees over a year and its annual wage bills. Although we cannot identify the number of firm employees being paid below the level of the minimum wage, we are able to calculate each firm's average wage per employee, which can arguably be used as an indicator of a firm's exposure to minimum wage shocks.

The 2004 economic census is merged into the ASIF data, since the ASIF data undersampled small firms in 2004 relative to other years. After the construction of a panel sample for the firms in the manufacturing sector, we have in total 1,892,033 observations in the unbalanced panel in the main sample. The attrition rate in the sample varies from 8.2 percent to 20.3 percent. Since the rate of re-entry is around 10 percent over time, it is likely that a significant number of firms left the sample not because they went out of business but because of sampling omissions. The period 2000–2007 which we analyze spans both the pre-transition episode and the post-transition episode.

Our main reason for choosing the manufacturing sector, instead of the service sector, for the study of minimum wages is that this sector is of great significance in China's labor market. Due to local government policies, the service sector has usually discriminated against migrant workers more than has the manufacturing sector. Also, the overall wage rate of China's manufacturing sector is relatively low. Our sample shows that the wage rate of China's manufacturing sector was always below city average wages over the sample period.[2] Ge and Yang (2014) also show that the average real wage of the manufacturing sector is 2 percent below that of the whole sample in 2007 using countywide data from the Urban Household Survey. Finally, the choice of the manufacturing sector is also consistent with the vast literature studying the ASIF data; this means that our results can be easily compared.

[2]The wage rate of China's manufacturing sector is calculated by the median of firm average wages over the county. City average wages are denoted by the median of city average wages over those of the county. At the national level, the ratio between them was 65 percent in 2004, and it remained stable over the period of 2001–07. We can also examine the gap between them at the city level. In 2004, the wages of manufacturing firms were below city average wages in 96 percent of cities.

3.3 Household Data and the Non-Compliance Rate

Previous studies have frequently documented the imperfect compliance with minimum wage laws. For instance, Ashenfelter and Smith (1979) find an overall compliance rate of only 65 percent, as well as significant geographic heterogeneity, across the various states in the United States. Based on empirical evidence from developing countries, Basu, Chau, and Kanbur (2010) argue that a legislated wage floor and the intensity of enforcement are two indispensable arms of a minimum wage policy. Correspondingly, we obtain evidence of minimum wage compliance from the data of Urban Household Survey.

To show how binding the minimum wage policy is, we calculate two measures of minimum wage exposures. Figure VII reports the average non-compliance rate for the minimum wage policy based on a representative sample of employee wages from the Urban Household Survey. The non-compliance rate is calculated by the share of the employees with wages lower than their county minimum wages. Our data cover 18 provinces during the period 2002–06. Employers and employees from small businesses that are not legal entities are excluded. The sample also excludes those who worked for less than 140 hours or more than 200 hours in the month (December) when they are surveyed. We find that the non-compliance rate is in the range of between 6 percent to 8 percent, and the trend is also mostly flat during the reform period. The wage-to-minimum-wage ratio is below 1 for a non-compliance incident. When the trend of non-compliance rates is compared with the fractions of the group with the wage-to-minimum-wage ratio falling within the range of $[1, 1.5]$, we find that these two trends after 2002 are similar, which shows that the reform which started in 2004 did not change minimum wage non-compliance.

3.4 Firm Wage Dynamics

Because the growth of China's minimum wages has been behind the growth of average wages, how does it compare to the growth of firm wages in the manufacturing industry? Figure VIII gives the answer with descriptive statistics. It shows the annual density distributions of firm wages relative to local minimum wages during the period 2001–06. As we can clearly see, a turning point happened in 2004 for these annual distributions. After 2004, firm relative wages became higher. The thinner left tails after 2004 are pronounced, which indicates that the proportion of low-wage firms relative to local minimum wages became smaller.

This does not necessarily mean that these firms are non-compliant with the legislation, because the measure of firm wages is based on the average wage, better interpreted as minimum wage exposure. We find that the data of firm wage bills in the ASIF data have greater measurement errors than firm employment because employee wages are easily confused with the corresponding accounting subjects with similar names. Other than this, one well-known issue of the ASIF data is that the information of employee earnings omits substantial fringe benefits and the social security contributions paid by employers (Hsieh and Klenow, 2009; Song, Storesletten, and Zilibotti, 2011). Therefore, employee earnings are systematically under-reported if they are compared with other market wage measures such as the minimum wage, and the statistics of non-compliance based on firms' employee wages should be regarded with caution.

3.5 Macroeconomic and Political Factors

Economic variables at the city level are collected to control for the factors of minimum wage policies and the market factors affecting firm employment. The major source of city variables is the China City Statistical Yearbook. We introduce the characteristics of city governors, which arguably represent their ambitions of making economic policies, to our data. The characteristics we use include age and tenure years.

Occasionally cities and counties were divided up and/or combined into other regions. This divisional restructuring occurred more frequently in the 1990s and much less after 2003. We collect the corresponding information, and adjust the city and county code for all the affected firms.

4 Identification and Empirical Framework

4.1 Minimum Wage Shocks in China

As a policy instrument, the rise of the minimum wage is often a concerted movement with local economic factors. The minimum wages within an administrative division also go hand in hand because of the style of hierarchical adjustment. Since the late 1990s, the adjustment of local minimum wages has been a regular policy formulation first initiated by the provincial government, and in later stages delegated to the city and county governments, who play an important role in determining the rates eventually enacted. The idiosyncrasies of minimum wage growth among nearby counties even with the same city is not uncommon given that we have a nationwide sample.

Minimum wage growth may not be closely associated with local economic indicators. A real example from the municipality Chongqing is shown in Figure X. There are 40 counties in Chongqing. In 2004, county minimum wages in Chongqing grew at three different rates: 12, 17, or 18 percent. If we compare the growth rates of minimum wage hikes and the growth rates of GDP per capita, those counties with higher minimum wage growth are not necessarily the counties with higher GDP growth. A significant amount of within-city variations in minimum wage hikes remain for us to identify their impact on firm employment. Our findings in the Online Appendix statistically show that after being detrended, the minimum wage variation at the city level is not closely related to other macroeconomic variables, in the dimension of either time series or the cross-section.

The primary challenge for labor economists to identify minimum wage shocks is the convolutions of wage policy with labor market aspects. Minimum wage shocks in China can sometimes result from personnel changes of key policy makers. Political life often shifts the focus of government officials away from local economy and welfare. Any change in the composition of local government officials could extend to their policy marking. The outcome can be a delay or a unusual size of minimum wage adjustment. The expectation errors of local government officials, as often evident by their misjudgment of growth prospects and industry capacity needs, stand to cause minimum wage adjustments unrelated to local labor markets. We attempt to address the influence of policy markers by introducing the personal characteristics of city governors, includ-

ing their ages and tenure years, to our estimations. As Yao and Zhang (2015) have found, young and new Chinese officials have a tendency to implement new reforms to boost the economy and improve citizen welfare.

4.2 Identification with Within-City Variations

A common way of studying the minimum wage policy in the US is to control for state-by-year fixed effects. The distinct feature of China's minimum wage policy is the granular policy-making down to the county level. Since the 2000s, China's regional labor markets have been largely integrated. As counties within a city are mostly adjacent neighbors, their labor market conditions are considerably similar. We explore the county minimum wage variations within a city and in a specific year. This allows us to control for time-varying factors in the city labor market that we do not observe but can still exert influence on minimum wage adjustment and firm employment. As the largest city in our sample is Chongqing, which has a surface area of 82 thousand square kilometers, the average city size is about 30 thousand. When time-varying conditions in such small regions can be controlled for, the concern of unidentifiable minimum wage shocks is reliably alleviated[3].

The strategy of considering variations within a small region is analogous to the boundary discontinuity design. Card and Krueger (1994) pioneered this use of geographic proximity in minimum wage analysis in an event study. Dube, Lester, and Reich (2010) extend their research by studying all US counties straddling across state border. As they argue, contiguous regions are more likely to have similar labor markets and employment trends. The recent debate between Allegretto et al. (2013) and Neumark et al. (2014a,b) on the research design of controlling for spatial heterogeneity has attracted wide attention. The synthetic control, which they use to evaluate the estimation method, is not well applicable in the analysis of China's minimum wage policy. China's minimum wages vary across counties and they have been adjusted at a frequency of one or two years. These regional and time variations of the minimum wage can be used to identify the minimum wage shocks in a standard framework of linear regressions. Counties that experience high minimum wage growth, while other factors being controlled for, are thus identified as treatment groups and those with low (within-city) minimum wage growth are conceptually control groups. As we include the countrywide sample in the regression, we do not need to search for synthetic controls out of sample. The control groups are by themselves identified according to their within-city minimum wage growth.

4.3 Welfare Implications

An empirical model of firm employment sheds light on the role of firms that they play in welfare redistribution when a minimum wage hike occurs. With the only aid of firm data, we are able to identify welfare implications for three groups involved: firms, workers, and consumers. We consider several aspects of a firm's response.

[3]The formation of China's city borders is mainly related to historical and racial integrity, which also implies cultural, dialectal, and institutional coherence. The similarity of cities inside a province is comparatively weaker. Most studies on China's government policies measured at the city level can only explore time-varying variations within a province at best.

1. Employment and wage. If some firms choose to reduce employment, the welfare implication for minimum wage workers is ambiguous since the resulting unemployed are worse off and the workers holding their jobs are better off if their wages are raised. Firms are in general worse off when the market price is distorted and they cannot achieve first-best employment.

2. Product price and profit. A firm can pass on cost hikes and add them to the product price. If this happens, firm profit will be stable if product demand is inelastic. In this case, the welfare is mostly redistributed between minimum wage workers and general consumers, while the employer is neutral. Here general consumers include downstream manufacturers, who pass on further any of the cost hikes. If a firm is unable to adjust product price and bear the cost, income is internally transferred between employers and workers.

4.4 Empirical Model

We present the theoretical background relating to labor market competition, and its implications for the minimum wage in the Main Appendix. One of the advantages of using firm employment over regional employment is that it is straightforward to lay down a framework for a firm's employment demand. Other than the minimum wage and other proxies of market wages, the market factors relevant to regional labor demand and labor supply enter the model to represent a firm's marginal cost of labor. In our theoretical framework, equation (6) leads to a linear function for $\ln L_{it}$:

$$\ln L_{it} = \ln f\left(L_{i,t-1}, A_{it}, \left(\frac{\omega_{it}}{P_{it}}\right), \left(\frac{P_k}{P_{it}}\right), \left(\frac{P_m}{P_{it}}\right), \ldots\right),$$

where i and t denote firm and year respectively, ω denotes the marginal cost of labor, P_k and P_M are market prices of capital input and intermediate goods. The introduction of lagged firm employment L_{t-1} helps to address the problem of slow labor adjustment and essentially narrow down our focus to employment growth.

Based on our panel dataset, we estimate a dynamic model with unobserved firm-specific constant or trend. The dynamic model includes the dependent variable lagged by one period as explanatory variables. Since we use first difference (FD) to remove firm fixed effect or firm-specific trend, we choose Anderson and Hsiao (1982)'s two-stage least-squares (2SLS) estimation as a parsimonious way to correct the dynamic bias. Our results are robust to other specifications such as difference GMM or structural GMM.

Two of our main regressors are firm employment and wage. For firm employment, we estimate the equation

$$\Delta \ln L_{it} = \beta_L \ln L_{i,t-1} + \beta_{MW} \ln MW_{ct} + X_{it}\beta + \mu_c \times \tau_t + \mu_I \times \tau_t + \mu_i + \varepsilon_{it}, \qquad (1)$$

where the variable $\Delta \ln L_{it} \equiv \ln L_{it} - \ln L_{it-1}$ is the log change of firm employees and MW_{ct} is county minimum wage at year t. $\mu_c \times \tau_t$ denotes city-by-year fixed effect, $\mu_I \times \tau_t$ denotes industry-by-year fixed effect, and μ_i denotes firm fixed effect. X_{it} is a vector of firm characteristics and also includes all interaction terms with MW_{ct}. ε_{it} is the error term, which we assume satisfies

the condition of sequential exogeneity with explanatory variables. β_{MW} measures the elasticity of minimum wages on firm employment, and it is the key parameter we estimate.

After differencing equation (1) and reorganizing fixed effect to keep the notation $\mu_c \times \tau_t$ and $\mu_I \times \tau_t$, it yields that

$$\Delta_2 \ln L_{it} = \beta_L \Delta \ln L_{i,t-1} + \beta_{MW} \Delta \ln MW_{ct} + \Delta X_{it}\beta + \mu_c \times \tau_t + \mu_I \times \tau_t + \eta_{it}, \qquad (2)$$

where $\Delta_2 \ln L_{it} \equiv \Delta \ln L_{it} - \Delta \ln L_{it-1}$ and $\eta_{it} \equiv \varepsilon_{it} - \varepsilon_{it-1}$. Since $\Delta \ln L_{i,t-1}$ is correlated with η_{it}, we instrument $\Delta \ln L_{i,t-1}$ with $\ln L_{i,t-2}$ and implement a 2SLS estimation. Without the correction of the dynamic bias, the estimate of β_L will have a downward bias, which in turns leads to inconsistency of other estimates.

Equation (2) is equivalent to a regression using all differenced variables but without firm fixed effect. As we can see, the dynamic specification (1) with variables in levels implies a same linear relationship for variables in growth rates. This is more restrictive than the specification if we start with equation (2), but it allows us to say something about how firm employment growth differs in cities with high minimum wages and low minimum wages, and that is also the effect of a minimum wage hike on a firm across years.

Corresponding to popular empirical models that include firm fixed effect in the difference equation, we specify an alternative model. Starting with equation (1), but replacing firm fixed effect μ_i with firm-specific trend $\mu_i \times t$:

$$\Delta \ln L_{it} = \beta_L \ln L_{i,t-1} + \beta_{MW} \ln MW_{ct} + X_{it}\beta + \mu_c \times \tau_t + \mu_I \times \tau_t + \mu_i \times t + \varepsilon_{it}, \qquad (3)$$

which after differencing leads to

$$\Delta_2 \ln L_{it} = \beta_L \Delta \ln L_{i,t-1} + \beta_{MW} \Delta \ln MW_{ct} + \Delta X_{it}\beta + \mu_c \times \tau_t + \mu_I \times \tau_t + \mu_i + \eta_{it}, \qquad (4)$$

and with further differencing

$$\Delta_3 \ln L_{it} = \beta_L \Delta_2 \ln L_{i,t-1} + \beta_{MW} \Delta_2 \ln MW_{ct} + \Delta_2 X_{it}\beta + \mu_c \times \tau_t + \mu_I \times \tau_t + \upsilon_{it}, \qquad (5)$$

where $\Delta_3 \ln L_{it} \equiv \Delta_2 \ln L_{it} - \Delta_2 \ln L_{it-1}$ and $\upsilon_{it} \equiv \eta_{it} - \eta_{it-1}$. Equation (5) uses double differencing to remove more sophisticated firm unobservables, but its statistical power is lower than equation (2). We report results for both models in section (5).

We utilize the whole sample from 1998 to 2007. Because the models involve differencing and instrumenting with lagged variables, the effective sample in the regression is for the period 2000-07. The standard errors of our results are clustered at the level of county-by-year.

A firm's employees or employment we refer to is the average of a firm's end-of-month employees in a year. Other than employment, we also include firm wage, product price, profit, and debt as dependent variables. We investigate them in the same way as firm employment with the linear models of equation (2) and (5). We compute a firm's total wage bill as the sum of its

reported wages, monetary allowances, and unemployment insurance provided by the employer, and firm wage is defined as the average wage per employee. The inference of wage elasticity, therefore, is unclear under some circumstances. See Appendix (C) for more discussions.

Firm profit is treated in a slightly different wage since many firms earn negative profit. Specifically, $\Delta\text{Profit}_t/\text{Sales}_{t-1}$ is used the left-hand-side variable in (1) and (3) as we normalize profit growth by firm revenue. Firm debt is denoted by the debt-to-asset ratio.

4.5 Specifications of Explanatory Variables

Other than showing the elasticities of the minimum wage directly on firm employment and wages, we include an array of interaction terms involving the minimum wage to study the heterogeneous response of minimum wages for firms in various regional or industry characteristics. All the macroeconomic controls available to us are at the city or industry level. We only need them when we construct the interaction terms with the minimum wage, because we focus on within-city and within-industry variations. For example, the so-called Kaitz index defined by the ratio of the minimum wage and the local average wage is often used as the key variable in minimum wage research. In our specification, the minimum wage variation is within each city already. In the same sense, other than interaction variables, all variables in the regressions are in real terms if we accept price indices at the city and industry level.

Firm Characteristics

We control for firm characteristics to improve the model's ability of predicting firm dynamics. Sales growth is commonly used in the literature of corporate finance to proxy Tobin's Q at the firm level if the market value of a firm cannot be determined. Therefore, high sales growth indicates there are investment opportunities motiving firms to expand capacity and increase hirings. The type of controlling ownership[4] is a important feature of China's firms. It is closely related to corporate governance and also a firm's political network with local government. Starting from the late 1990s, China's state firms (commonly referred to as State-Owned Enterprises or SOE) experienced massive layoff as most of them sought to go bankruptcy or restructure themselves to appeal private capital. It is necessary and also of great interest to see the difference of firm dynamics in terms of firm ownership types. A firm's ability to pass on cost hikes to product price depends on its demand elasticity, which we measure and control for by a firm's profit margin, the profit-to-sales ratio. Finally, we include a firm's total asset as a measure of firm size. Because the ownership type is constant for most of the firms over time, we include the dummy variables of firm ownership directly in equation (2) and (5) without differencing these dummy variables. The variable of ownership type dummy μ_{SOE}, for example, should be interpreted as $\mu_{SOE} \times t$ in equation (1) and $\mu_{SOE} \times \frac{t^2}{2}$ in equation (3).

Firm exposure to minimum wage hikes is the first firm heterogeneity of employment elasticities we need to examine and control for. We use the one-period lagged ratio of local minimum

[4]In this paper, firm ownership types are categorized as state, collective, private, or foreign if they are explicitly stated in the data, otherwise they are attributed to the stockholder using the share of paid-in capital. We also follow the standard definition of a foreign firm in China, which requires no more than 25 percent of stock shares to be controlled by foreigners.

wage to firm wage as the measure of firm exposure, denoted by EXPO. Our data filtering excludes date points outside the first percentile at both ends, which correspond the ratio of firm average wage to local minimum wage (the inverse of EXPO) approximately at 0.5 and 12. In order to reduce the measurement error from high-wage firms, we further exclude firms with the wage ratio above 5 from the regression (see the distribution in Figure VIII), which is the 90th percentile of the ratio distribution. As a result, EXPO is in the range of $[0.2, 2]$. We still include a significant amount of high-wage firms because we need to consider the existence of spillover effect of the minimum wage change on better-paid workers, and because we expect high-wage firms may have better compliance for which we do not observe in the data.

In line with our emphasis on firm ownership, we also study elasticity heterogeneity due to ownership type. Correspondingly, we examine further the effect of government subsidies on employment elasticities. In particular, we consider both the intensive and the extensive margins by including a dummy variable ($\mathbb{1}$ subsidized$_{t-1}$) to indicate whether a firm receives subsidies and a continuous subsidy variable (subsidy/sales$_{t-1}$) to indicate the amount received. One important component in government subsidies is the tax rebate from export. We additionally control for the intensive and the extensive margins of firm export to complement the analysis.

If a firm employs a Cobb-Douglas production function of multiple factors with constant returns to scale, the aggregate marginal cost elasticity of labor input is equal to the labor income share. We use the industry labor income share as a robust measure to quantify the sensitivity of wage cost in a firm's production. The calculation based upon reported wages and firm output in the ASIF survey under-estimates the true labor share, as documented in, for example, Hsieh and Klenow (2009). Because only within-variations matter for our estimation, we assume the downward bias in the calculated labor share is systemic in the whole sample and does not correlate with industry distribution.

City Characteristics

At the aggregate level, the difference of cities reveals more implications for minimum wage impacts. The effect of minimum wage hikes hinges on every aspect of the local labor market. The first heterogeneity we study is the policy-maker impact. This not only improves the identification, but can also shed light on the policy effectiveness due to enforcement. We utilize the dataset of city heads for the past two decades. The data contains information for both the top-ranked party secretary and the mayor ranked second from the top. For simplicity, we only choose the information of the party secretary to represent each city and refer to them as city governors. Two variables are constructed for each city governor. The first is age, which is categorized into four groups to account for the non-linearity of its impact. The cutoffs for the four groups are 48, 52, and 56. If top-ranked city officials do not want to retire at the age 60, they need to get promoted to the minister level before then. Yao and Zhang (2015) find that city governors at the age around 50 years old are most pro-growth and competitive in every economic and political contest. By contrast, government officials close to retirement ages are more likely to care about short-term personal interest. The second characteristics are the tenure years. It is also believed that newcomers exert more influence on short-term targets. The average tenure of

China's city governors is only 3.6 years. During such a short period, the first one or two years of tenure can be crucial.

To qualify the demand and supply side of the local labor market, we consider two heterogeneities in the model. The first is the employment concentration of low-wage firms. We construct a concentration measure similar to the Herfindahl index. This concentration index represents the monopsonistic power of low-wage firms in the local labor market. High concentration generally implies low mobility of low-wage workers and a thinner labor market, in which inside negotiations between employers and workers are more likely to happen. The second is city migrant share, denoted by the ratio of migrant workers to the total labor force. The size of migrant network is an indicator of worker mobility.

We additionally include three macroeconomic variables to examine how the effect of minimum wage can differ in different places. These three variables are growth rates of GDP per capita, growth rates of Foreign Direct Investment (FDI), and growth rates of labor.

Neighbor Spillover

Neighbor spillover is often an ignored issue in city policy regressions, but as the physical distance between sample units are not small enough, it is more reasonable to control for peripheral conditions. Labor migration has been phenomenal in China since the market reform started in the late 1970s, as many barriers for workers from poor regions to find jobs in developed areas have been demolished. As the wave of minimum wage adjustments strikes every corner in China, both the internal and external labor market are of importance for local employment. It is clear that a local hike in the minimum wage tends to attract labor from neighbor areas, ceteris paribus, if the minimum wages in these neighbor areas are relatively stagnant. Because labor inflow improves the search condition in the local labor market, the potentially negative impact of minimum wage rise on employment can be compensated to some extent in a free market.

Our identification strategy implies that the labor market spillover within cities is already accounted for by the estimates, but for two cities located hundreds of miles away, the economic development and policy movement may exhibit different patterns in their peripheral areas. For such heterogeneities, we include interactions terms of local minimum wages and the average minimum wage growth in neighbor cities. We refer to neighbor cities as the prefectural cities sharing same land, rivers, or coastal waters border.

5 Main Results

In this section we present our main results concerning the minimum wage effect on firm employment, wage, and profit. Our analysis proceeds in two steps. We first estimate one homogeneous elasticity of minimum wages for the whole sample over the period 2000–07. Then, we estimate the heterogeneous effects of minimum wages according to various firm and regional characteristics,.

5.1 One Homogeneous Effect

We estimate the elasticity of the minimum wage by equations (1) with firm FE and (3) with firm specific trend. The summary statistics of firm variables are shown in Table I.

Table II shows firm employment elasticities based on different specifications. The baseline results in column 1 are estimated from the model including the complete set of firm variables with FD-2SLS. The elasticity of minimum wages is -0.163, quantitatively large and statistically significant at the level of 5%. This point estimate is remarkably large if compared with numerous estimates from western countries in any sector. To analyze how we achieve this, we alter the specification one at a time in other columns. Column 2 to 6 estimate the model with the same method of FD-2SLS but including different sets of controls compared to the model of column 1. Column 2 removes all firm variables but the lagged dependent variable. While the autoregressive coefficient of $\ln L_{t-1}$ changes little, the elasticity of the minimum wage declines further to -0.19 and becomes statistically significant at the level of 1 percent. Column 3 further dropped $\ln L_{t-1}$ and becomes a barebone FD model with the minimum wage as the sole control. The elasticity of the minimum wage now becomes -0.242. Notice that R^2 becomes considerably smaller at 0.012 when we do not control for firm-level predictors, or equivalently when we restrict their coefficients to zero. In column 4 we return to the model with the full set of firm variables, but discard the industry-by-year fixed effect. The results are quite similar which indicates industry variations do not play an important role. In the above section we put emphasis on the identification with within-city variations for policy variables not to be confounded with the trend of local labor markets. By comparison with column 1, column 5 shows the estimates from the estimation replacing the city-by-year FE with the province-by-year FE. As a result, the elasticity of the minimum wage becomes markably smaller in size, the point estimate being -0.064 and statistically significant at the level of 10 percent. When the regional trend is not controlled for, the estimated elasticity becomes 60 percent smaller. This finding warns us that without credible identification of minimum wage shocks, it should be cautious to accept negligible elasticities of the minimum wage since the estimate could be significantly biased towards zero.

To test the necessity of the 2SLS estimation, we choose not to instrument the lagged dependent variable. The results are shown in column 6. The autoregressive coefficient becomes -1.062, which is significantly lower than the one estimated from 2SLS. This downward bias is consistent with the model's prediction when the difference of error terms is negatively correlated with the lagged dependent variable. The bias in the autoregressive coefficient affects other estimates: we find that the elasticity of the minimum wage becomes 16 percent smaller in size. When we further replace the city-by-year FE with the province-by-year FE in column 7, we find a negligible elasticity of the minimum wage, both in size $(-0,026)$ and in statistically significance. To sum up, model specifications are important for estimating the effect of the minimum wage and we believe our baseline results are the most reliable.

The correlations of firm characteristics and employment growth are in reasonable ranges. Higher employment growth can be predicted by better investment opportunities (higher sales growth), smaller firm (asset) size, higher firm wage, and higher profit margins. The linear trend of employment growth in foreign firms is 2.7 percent higher than state firms, but is 0.9 percent

lower than private firms. This pattern coincides the transition of state firms during the period. Subsidies do not show significant correlations with employment growth with one homogeneous estimate.

Using the same specification sequence, we estimate the models with firm specific trend by double differencing. The sample size shrinks correspondingly. Qualitatively the estimates shown in Table III are similar to those from the models with firm FE. The elasticity of the minimum wage is -0.114, 30 percent lower in size than the one from the model with firm FE (column 1). However, when no firm variable is included, column 3 shows that the elasticity of the minimum wage becomes -0.276, larger in size than -0.242 in Table II. It remains true that the estimated elasticities of the minimum wage are smaller in size when we replace the city-by-year FE with the province-by-year FE, although it is now statistically significant at the level of 5 percent even if we do not use instruments for the lagged dependent variable (column 7). The coefficient of the state ownership now becomes the largest compared to private and foreign firms, but the effect on the quadratic trend of employment growth is less meaningful than the one in the previous table.

In the above we have shown strong evidence that minimum wage hikes hinder employment growth or lead to employment reductions. The results of firm wage regressions shown in Table (IV) shed more light on the significance of minimum wages. We simplify model choices by including three specifications each in the model with firm FE (column 1–3 in the left panel) and the model of firm specific trend (column 4–6 in the right panel). Column 1 and 4 use the method of FD-2SLS with the city-by-year FE, column 2 and 5 use the method of FD-2SLS with the province-by-year FE, and column 3 and 6 use the method FD without instrumenting the lagged dependent variable. The elasticities of the minimum wage in column 1 and 4 are 0.27 and 0.229 respectively, both statistically significant at the level of one percent. We also believe there is a strong spillover effect from minimum wage workers to other workers paid above the minimum wage. Correspondingly, if we do not control for the city-by-year FE, the estimates become smaller for the elasticity of the minimum wage (in column 2 and 5). The wage regression, however, gives similar estimates (in column 3 and 6) when we do not instrument the lagged dependent variable since the autoregression coefficient does not change much. For other control variables, we find that positive wage growth at the firm level responds to positive sales growth, large firm size, foreign firms relative to other ownership types, and high profit margins. Interestingly, the firms with government subsidies compared to those without receiving any subsidies also experienced higher wage growth, though the intensive margin shows a negative correlation between subsidies and wage growth.

Table V shows the results for firm output price, profit, and debt (in the left, middle, and right panel). Due to the data limitation, we estimate the effect of minimum wage hikes on firm price based on the sample during the period 2000–03. Each panel provides results for two model specifications: firm FE and firm specific trend. For output price, we don't find significant effects of the minimum wage. The effect estimated from the model with firm FE is positive (column 1) while being negative from the model with firm specific trend (column 2)[5]. Therefore, during

[5]The difference in two price indices from two consecutive years is approximately equal to the rate of price

the first half of our sample period, there was no sign of firm passing on cost rise to their product price, even though they significantly raised worker wages. The estimated effect of the minimum wage on profit growth is −0.063, marginally significant at the level of 10 percent. In the model with firm specific trend, the estimate loses such significance and also comes smaller at −0.04. So minimum wage hikes deteriorate firm performance, but not as severe as the findings from other studies such as Draca et al. (2011). As for the financial situation, similarly, we don't find any significant effect of minimum wages. The size of model estimates (column 5 and 6) are fairly small, which shows evidence of limited impact from minimum wage hikes.

5.2 Varying Effect Over Years and Periods

A straightforward extension is to estimate the elasticity of the minimum wage separately over years. We proceed simply by interacting the minimum wage with dummy year variables. The results for firm employment and wage are reported in Table VI and also plotted in Figure XII, each with a model with firm FE and firm specific trend. The estimates are quantitatively similar in the two models, but are more significant in the model with firm FE. In the following we mainly discuss the estimates from the model with firm FE.

In all the years, firm employment elasticities are negative while firm wage elasticities are positive, however, their trends are completely different. Employment elasticities are statistically insignificant in earlier years from 2000 to 2002, and then become increasingly negative in later years until 2007. In 2007, the employment elasticity reaches −0.244, 50 percent larger in size than the average homogeneous elasticity in column 1 of Table II. The pattern of wage elasticities is the opposite. The wage elasticity is the highest in 2000 with a point estimate of 0.43, 60 percent higher than the average homogeneous elasticity in column 1 of Table IV. Later in 2007, the wage elasticity drops to 0.105, which is statistically insignificant from zero. The variation of estimates from the model with firm specific trend is smaller, but the decreasing pattern of negative employment elasticities and positive wage elasticities still remains. Therefore, it is evident that at the beginning of the 2000s, the minimum wage policy transferred most of welfare benefits to low-wage workers, while no employment growth was hindered and firm wage was lifted substantially. The regulation tightening around 2004 did not break but reinforced the pattern of both trends. In 2007, minimum wage hikes exerted little influence on firm wages. The main choice for the average firm was to reduce employment or limit new hirings. It appears that the function of welfare redistribution became weaker after the 2004 reform. However, we believe the main reason is the nationwide wave of diminishing labor supply from the rural area. During the run-up of the global financial crisis in 2008, China also experienced an overheated investment and housing boom, which shifted the demand in the labor market. It was against this backdrop that the welfare impact of China's minimum wage policy have also changed.

We observe that the employment and wage elasticities over 2000–07 are more similar in three sub-episodes: the pre-transition episode 2000–02, the transition episode 2003–2005, and the post-transition episode 2006–07. As the statistical power of other regressions is weakened, we

growth. Because firms report negative profits, profit growth is normalized by sales. The coefficient should be conceptually larger than the profit elasticity when normalized by profit itself. For firm debt, the dependent variable is the ratio of debt to asset. The coefficient measures the effect on debt ratios.

estimate varying effect across these three episodes. Here we report the results for the regressions of firm output price, profit and debt (Table VII). For firm output price, we only compare the year of 2003 with previous years. We don't find statistically significant elasticities in either episode. The profit regressions, nonetheless, show that the negative elasticities of the minimum wage mainly came from the post-transition episode. This is consistent with firm behavior when they chose to cut employment rather than retain workers and raise wage. The point estimate of the minimum wage coefficient is -0.103 (column 3). If we assume the average firm has the median profit margin of 0.21 from the sample, it shows that a 10 percent rise in the minimum wage leads to a profit drop by about 5 percent. The size of this effect is moderate, but definitely not negligible. Finally, we don't find significant results for firm financing behavior in the debt regressions, although minimum wage hikes show an upward trend in the effect of raising firm debt.

5.3 Heterogeneous Effect Across Firms and Regions

In this section, we examine how the elasticities of the minimum wage vary among China's manufacturing firms all over the country. We also study the heterogeneity due to the status of local economy and labor market. Table VIII and IX report the results of firm heterogeneity, and Table X and XI report the results of regional heterogeneity. Each panel contains one specification with firm FE and one specification with firm specific trend. For comparison, we present the FD results without instrumenting the lagged dependent variable for employment regressions in Table VIII and IX. We find that other than the base elasticity of the minimum wage shown in the first row, the heterogeneity estimates from the FD-2SLS model or the FD model are quite similar.

Firm Heterogeneity

In principle, the firms with more minimum wage workers are affected more in response to minimum wage hikes. We construct a measure of firm exposure (EXPO) in section . Practically, the wage inflation within a firm can reach workers earning high wages due to people's mindset of fairness (Akerlof, 1982). Maintaining an balanced pay structure is generally the basis of effective management and helps to bolster morale among employees. The substitution of minimum wage workers with high-skilled workers raises the wage level of workers paid above the minimum wage, which also dampens the heterogeneity of firm exposure. Furthermore, although we don't have a direct measure of firm compliance with minimum wage regulation, the evidence that the compliance rate is higher in high-income cities may indicate high-wage firms are more in accordance with the minimum wage policy. The coefficients of the minimum wage interacted with EXPO shown in the second row of Table VIII are all negative for employment regressions and positive for wage regressions. The size of this heterogeneity is moderate, and the estimate from the model with firm specific trend (column 3) is half as large as the one from the model with firm FE (column 1). Figure XI quantitatively illustrates the heterogeneous effect of firm exposure to minimum wage hikes by assuming the firm with the mean exposure (2.8) has the average employment (wage) elasticity as in column 1 of Table II and IV. The dash line shows the point estimates of employment elasticities according to different firm exposure, while the x-axis

variable is the ratio of firm wage to the local minimum wage, the inverse of EXPO. We also show a shaded area indicating the confidence band and a density curve for the distribution of the firm wage ratios. As the statistical power declines for high-wage firms, the firms with wage ratios larger than the median 2.3 have employment elasticities insignificant from zero (panel A). For firms below the median wage ratio, the non-linearity of employment elasticities becomes stronger. The firm with the wage level half as the minimum wage is at the first percentile of the distribution of wage ratios. The employment elasticity for this typical firm reaches -0.33, twice higher than the average elasticity. The wage elasticity is statistically significant for all firms and the heterogeneity is relatively small (panel B) because we use the average wage as the dependent variable (Appendix (C)). The firm with the wage ratio of $1/2$ has a wage elasticity of 0.37, about 37 percent higher than the average.

The analysis along the time dimension in Table IX sheds more light on the exposure heterogeneity. As the homogeneous elasticity became increasingly negative over time, the heterogeneity also enlarged through the three episodes. The coefficients of the interaction terms in the pre-transition episode 2000–02 are 0.012 and 0.021 for the models of firm FE and firm specific trend. When it came to the post-transition episode 2006–07, the two coefficients are -0.2 and -0.103 respectively.

The heterogeneous effect can be in the same direction for employment and wage elasticities for firms in good shape. This is evident when we consider sales growth, which is an indicator of investment opportunities. Firms with better investment opportunities tend to raise more of their wages. In addition, these firms also cut less employment. The size of a firm does not seem to be a strong factor of minimum wage impact. We find that employment elasticities are quite close for firms with different size in the model with firm FE. Larger firms shows more negative response to minimum wage hikes in the model with firm specific trend: one standard deviation of log asset (1.4) implies a 3.5% change in the size of the employment elasticity. Consistent with the theory of how firms respond to cost rise[6], a firm with high profit margin respond less to minimum wage hikes in our findings.

We find that the employment elasticity of minimum wages in state firms is smaller than private firms by 0.9 percentage , and smaller than foreign firms by 0.5 percentage. The difference therefore is not quantitively large. We also do not find evidence that firms with different ownership types have difference response of raising firm wages. The difference among ownership types is persistent over years for employment elasticities (Table IX). Only for wage elasticities, main heterogeneity came from the post-transition episode 2006–07.

In the above we don't find strong evidence of heterogeneous employment growth between subsidized firms and non-subsidized firms. In terms of the elasticity of the minimum wage, however, it shows that subsidized firms reduce more employment than non-subsidized firms by 1 percentage in elasticity. Subsidized firms also tend to raise more of their wages, but the heterogeneous effect is not statistically significant. This pattern of heterogeneity is similar to the heterogeneity of firm exposure, which implies subsidized firms are more affected by minimum

[6] A firm's demand elasticity is proxied by profit margin. Firms with low demand elasticities have a smoother output variation when then adjust product price in accord with cost rise. So their employment reductions are also smaller.

wage hikes. One explanation is better compliance since subsidized firms may be more closely monitored by the government. In contrast to other heterogeneities, the differential effect for subsidized firms only came from the transition episode 2003–05 when the regulation tightening started. It appears that subsidized firms became the direct target of the policy adjustment. Another explanation is poor performance that is not captured by profit margins.

The nature of a minimum wage hike is a shock of labor cost. The result for labor intensity is shown on the last row in Table X. The coefficient of the labor share interaction is significantly negative, which verifies our expectations. A recent paper by Ji and Wei (2014) studies the authorization of China's 2007 Labor Contract Law. They find that the news triggered a positive stock price response for labor-intensive firms. They argue that the compliance with labor regulations may actually improve labor productivity. From this point of view, a hike in minimum wages is not bad news for firms in the presence of efficiency externalities.

Regional Heterogeneity

The results of regional heterogeneity are shown in Table X and XI. First, for the characteristics of policy markers, represented by city governors, although we don't find the heterogeneous effect of their tenure years, we find that those cities governed by "political hopefuls" around fifty years old (Yao and Zhang, 2015) who need to make a final sprint to aim higher have the smallest employment elasticity in size. The employment elasticity in their cities is 6.9 percentage lower than the cities with governors close to retirement. Younger governors have more incentive to bring forward pro-growth policies, which can serve as an explanation for the less adverse effect of the minimum wage on employment growth.

We describe local labor market by ECI (Employment Concentration Index) and city migrant share. We don't find significant results relevant to the migrant network, but the heterogeneity of ECI is statistically significant for employment elasticities. The result shows that if low-wage firms are more concentrated in a city, the employment elasticity will be smaller in size. One explanation is when a firm has more monopsonistic power, the firm may take a better position in bargaining with workers, so the firm find it easier to boost hirings. Over time, Table XI shows a persistent trend of this heterogeneity.

For all the macroeconomic indicators that we use to find out other city heterogeneities, there are no statistically significant results. The growth rates of GDP per capita, FDI, and labor are included, but only cities with high FDI growth show some signs of large employment elasticities, although still not robust.

Neighbor Spillover

The first row of Table VIII shows the result when we consider the heterogeneity in the growth of neighbor minimum wage. An additional 10 percent increase in the neighbor minimum wage leads to labor outflow and reduces employment growth further by 2.9 percentage in the elasticity of minimum wages. If we consider the model with firm specific trend, the elasticity reduction is 1.8 percentage. Along the time dimension, Table XI shows this spillover only became significant after the transition episode. The labor market integration during the 2000s has changed how

policy impact is transmitted.

The implication of this evidence is twofold. One is relevant to the policy coordination of China's regional labor market regulations. Policy makers often try to maintain a balanced minimum wage structure across regions, so as not to disturb the inter-regional labor market. The other implication is relevant to the public impression that China's minimum wage policy is not quite effective. The reason is that minimum wage adjustment is often implemented simultaneously in nearby areas. People often do not observe large minimum wage shocks.

6 Robustness Checks

6.1 Sample Attrition

The rate of attrition of our sample is about 10 percent every year. Because the rate of re-entry is also high at 10 percent, calculated on the basis of previous exit incidents, a significant number of firms may leave the sample not for the reason of shutdown, but because of omissions.

To understand firm exit behavior, we use a probit model to examine firm attrition for the whole sample. The binary dependent variable is whether a firm will remain in the sample in the next period. The explanatory variables are firm characteristics, including sales, employment, ownership, profit margins, firm age, and squared firm age. The set of these explanatory variables is similar to the regressions on firm employment, except that we add firm age and squared firm age to the model and these variables are included without lags. County minimum wages, minimum wage factors at the county level, and city fixed effects are used as additional controls. The probit model is estimated separately for each year, and the results are shown in Table XII. Generally, we find that firms with larger sales, greater employment, and higher profit margins are more likely to remain in the sample. Foreign firms are the most persistent in the sample compared to state firms or private domestic firms. Firms with a longer history are more likely to drop out. The coefficients of minimum wages are insignificantly positive for most of the years. Only in 2004 are the coefficients of minimum wages significantly positive. Therefore, there is no evidence to show that a minimum wage hike leads more firms to leave the sample.

Because the inferior information of firm entry and exit, it is not feasible to study the extensive margin of firm employment with the ASIF firm data. This paper is restricted to examine employment dynamics of existing firms, which is the intensive margin.

6.2 Single-plant Firms

Five percent of firms in our sample are firms with multiple production units or plants. Literally, a firm is a legal person which assumes legal rights and obligations independently while a production unit may not. Subsidiary firms which are also legal persons file reports separately to their local Statistical Bureaus. A firm may have multiple plants which are not legal persons. In most cases, production units of a multiple-plant firm are located within the same city. The data show that more than 95 percent of the manufacturing firms in the sample are single-plant firms. As a robustness check, we provide results by using only single-plant firms in the Online Appendix. The results remain the same.

7 Conclusion

Welfare redistribution by raising the minimum wage is often a polarizing policy. One side of the argument says that raising the minimum wage will mainly lead to employment reductions, so the minimum wage policy only causes market distortions, and few workers really benefit from it. Those who argue for frequent and large minimum wage hikes downplay the impact on employment and emphasize the positive impact on the living standards of the poor.

Our evidence suggests that a 10 percent increase in the minimum wage lowered employment growth by about 1.1 to 1.6 percent. In economic terms, this represents a sizable impact on the manufacturing industry and minimum wage workers. In the mean time, we show that firms did not pass on the minimum wage hikes to product price while their profit growth were dragged down by about 3 percent. Therefore, we find evidence of both market distortions and income transfer. General consumers are not affected.

Along the time horizon around the 2004 regulation tightening, we find that the pattern of welfare distribution has changed. At the beginning of the 2000s, employment reductions were not significant and firms were able to absorb adverse shocks. Then employment reductions and profit loss became increasingly larger until the run-up of the global financial crisis, following the secular integration of China's regional labor market and more balanced structure of labor demand and supply.

We find firms exhibit sophisticated heterogeneities in response to minimum wage hikes. Low-wage firms were more exposed to these hikes and bore the brunt, but high-wage firms were still affected due to possibly better compliance and wage spillover. Compared to private and foreign firms, state firms cut employment less, but raised worker wages by the same amount.

We provide evidence that the policy-marker's ambition of pushing economic development brought growth opportunities to firms facing minimum wage hikes, which might lead to fewer employment reductions. In addition, we show a city heterogeneity of employment elasticities due to employment concentration and shed light on the role of labor market flexibility.

In our study on neighbor spillover, the evidence supports the insight that minimum wage hikes attract inter-regional labor flow. This is consistent with the coordination of many regional policies in China. In the case of minimum wage adjustment, it is often imposed synchronously within a province.

The evidence in this research on the effect of minimum wages on firm employment dynamics can be extended to more recent policies and reforms in China's labor market, such as the labor-contract law enacted in 2008 and the proposed reform of China's *Hukou* system. There have been heated debates about whether these regulations are so excessively restrictive that they might cause new market distortions and lead to unfavorable consequence for employment. As China's labor market has become tighter in recent years, it is likely the cost of distortions is now above the benefit of income transfer by the minimum wage policy.

This paper does not consider any externality that changes firm or worker behavior other than in a neoclassical framework of labor demand and supply. If, for example, firms pursue internal efficiency by improving corporate governance or utilizing other productivity-enhancing techniques due to cost pressure, the minimum wage policy may have some benefits we haven't

accounted for. We leave this for our future research.

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Main Appendix

A Variable Definition

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

- County variables (from the Ministry of Human Resource and Security)
  - County is defined as the administrative division at the third level, following the national standard.
  - MW: minimum wage. The minimum wage used in the estimation is the average of monthly minimum wages in a year.
- City macroeconomic variables (from China City Statistical Yearbook)
  - City is defined as the administrative division at the second level, following the national standard.
  - city average wage: average wage per employee. Employees are those who work in the formal sector in the urban area of each city.
  - city GDP PC: city GDP per capita.
  - fixed asset investment: the ratio of fixed asset investment to GDP.
  - 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.
  - FDI: foreign direct investment.
  - growth rate of labor: growth rate of urban and rural labor force.
  - unemployment rate: registered unemployment rate. It is defined as the number of registered unemployment, denominated by urban labor force.
  - ECI: employment concentration index. It is defined as the HHI index of firm employment for firms with wages below the 25th percentile in each city.
  - NBMW: the average minimum wage in neighboring cities, weighted by city employment.
- Household Variables
  - City migrant share: the ratio of migrants to total residents, from the 2000 population census and the 2005 population survey.
  - The non-compliance rate of local minimum wages: from the Urban Household Survey (18 provinces)
- Province variables (from China Statistical Yearbook)
  - Province is defined as the administrative division at the first level, following the national standard.

- CPI: consumer price index.

- 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.
  - $\text{HHI}^{\mathbf{IND}}$: Herfindahl index of firm sales in an industry. Industry is classified at the 4-digit level following the code of GB/T4754-2002.
  - $\text{labor share}^{\mathbf{IND}}$: 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 Brandt et al. (2012).

- Firm variables (from the annual survey of industrial firms)
  - L: the number of employees, namely, annual firm employment. 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.
  - W: firm wage per employee. We compute a firm's total wage bill as the sum of its reported wages, monetary allowances, and unemployment insurance. 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 1,000 Yuan a year.
  - firm relative wage: the ratio of the firm wage to the local minimum wage.
  - EXPO: firm exposure to minimum wage hikes. It is the inverse of firm relative wage.
  - sales: annual sales revenue from main business.
  - asset: total firm asset.
  - $\mathbb{1}$ SOE: dummy variable of state firms (cf. firms controlled by foreigners)
  - $\mathbb{1}$ PRV: dummy variable of domestic, private firms (cf. firms controlled by by foreigners)
  - 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.
  - $\mathbb{1}$ export: dummy variable of exporters.
  - subsidy/sales: the ratio of subsidy to sales. This variable is winsorized 0.5% from the top.
  - $\mathbb{1}$ subsidized: dummy variable of subsidized firms.

B A Static Model of Firm Labor Demand

We provide a simple static model of firm labor demand to guide the empirical framework. We don't further enrich the model with a dynamic structure since dynamic completeness in the empirical model is simply achieved by specifying an AR(1) process for the dependent variable. A model with adjustment cost, for example, should suffice to this kind of dynamics.

We assume the labor market is perfectly competitive, and thus the marginal cost of labor is determined mainly by market wages, and firm state variables if adjustment cost exists. It is then straightforward to assume the product market is monopolistically competitive, so a firm determines its own product price and supply. As a result, a firm's hiring depends on its marginal cost of production, firm productivity, and product demand. The cost channel suggests that an increase in the marginal cost of labor must reduce a firm's employment.

Assume a representative firm has a Cobb-Douglas production function given by

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

where Y, K, M, and L denote output, capital input, intermediate input, and labor input respectively. A can be any firm characteristic that determines firm capacity and is in general 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, or explained as the elasticities of marginal cost to each factor's price. Denote aggregate output by $\bar{Y}$. Assume P_k and P_M are market prices of capital input and intermediate goods that measure the firm's nominal marginal cost of each input. The firm also takes market wage rates as given. Denote ω the firm's nominal marginal cost of labor, which is a function of market wages and a firm's state variables such as labor input in the last period. The firm's marginal cost of output and labor demand is given by

$$MC = \frac{1}{A}\left(\frac{P_k}{\alpha}\right)^{\alpha}\left(\frac{\omega}{\beta}\right)^{\beta}\left(\frac{P_M}{1-\alpha-\beta}\right)^{1-\alpha-\beta},$$

$$L = \bar{Y}\left[\frac{1}{A}\left(\frac{P_k/\bar{P}}{\alpha}\right)^{\alpha}\left(\frac{\omega/\bar{P}}{\beta}\right)^{\beta}\left(\frac{P_M/\bar{P}}{1-\alpha-\beta}\right)^{1-\alpha-\beta}\right]^{1-\sigma}\frac{\beta}{\omega/\bar{P}}\left(\frac{\sigma}{\sigma-1}\right)^{-\sigma} \tag{6}$$

This equation shows that the fundamental determinants of firm employment are firm productivity A, price elasticity σ, and market conditions: $\bar{Y}$, $\omega/\bar{P}$, $P_k/\bar{P}$, and $P_M/\bar{P}$. It follows that marginal cost of labor is negatively correlated with firm employment. The employment elasticity of ω is $-(1+\beta(\sigma-1))$. Intuitively, the first term "1" in the sum measures the substitution effect. Because of the constant labor share, the direct elasticity is 1. The second term $\beta(\sigma-1)$ measures the scale effect. Its shows the response of firm output to cost changes. This effect depends on labor share β and price elasticity σ.

If marginal cost of labor ω is set to the market wage rate, equation (6) leads to a linear regression model that we can use to estimate the employment elasticity of the wage rate. With reasonable enforcement and compliance, we assume that the minimum wage is positively related to a firm's marginal cost of labor, but meanwhile the relationship is heterogeneous among firms.

C Inference from Employment and Wage Elasticities

The analysis of firm wage regressions is an important part of our empirical framework. A firm's average wage is not an ideal measure of employee wages, but we can still make inference from the estimates. We consider four possible cases for the estimates of firm employment and wage elasticities in terms of the minimum wage. We denote by > 0 if an estimate is statistically significant positive, by < 0 if an estimate is statistically significant negative, and by $= 0$ if an estimate is statistically insignificant from zero.

1. Employment elasticity $= 0$ and wage elasticity $= 0$. This result implies the minimum wage regulation is not effective.

2. Employment elasticity < 0 and wage elasticity $= 0$. This result implies employment reductions and the affected firms are low-wage firms.

3. Employment elasticity $= 0$ and wage elasticity > 0. This result implies few employment reductions and increasing wages.

4. Employment elasticity < 0 and wage elasticity > 0. This result implies employment reductions. Since low-wage worker reductions in high-wage firms (the extensive margin) also raise firm average wages, the implication is not clear for wage elasticity.

D Online Appendix

Online Appendix

Table I: Summary Statistics of the Main Variables

This table shows summary statistics of the main variables. Without further notes, we tabulate nominal variables, instead of real variables. The top panel shows statistics for macroeconomic variables at the level of prefectual cities for the period 2000–07. Wage variables and city GDP are converted to monthly values for comparison. Growth rates are calculated by the difference in logs. The number of prefectural cities and directly controlled municipalities amounts to 337. The middle panel shows in-sample summary statistics for firm employees, monthly employee wages, firm sales, firm export-to-sales ratios, and firm profit-to-sales ratios, during the period 2000–07. Sales are measured in 1,000 Yuan. Wages are measured in Yuan. The sample consists of the manufacturing firms in the ASIF data that have consecutive presence for at least three years. The bottom panel shows the share distribution of ownership in the years during the period 2002–06.

Variable	Median	Mean	STD	Min	Max
Macroeconomic Variables					
Monthly minimum wage	337	351	92	130	750
Monthly wage per employee	1,027	1,123	432	433	3,432
Monthly GDP per capita	708	1,014	930	134	8,000
Growth rate of GDP per capita	0.13	0.13	0.09	-0.78	1.21
Fixed asset investment to GDP	0.38	0.41	0.17	0.11	1.54
GDP share of secondary industry	0.42	0.43	0.13	0.11	0.98
GDP share of tertiary industry	0.37	0.37	0.08	0.09	0.76
Growth rate of FDI	0.17	0.19	0.81	-3.93	10.14
Growth rate of labor	0.01	0.02	0.10	-0.44	1.50
Registered unemployment rate	0.04	0.04	0.02	0.00	0.13
City Chief Characteristics					
Age	52.00	51.70	3.78	40.00	60.00
Tenure years	2.00	2.80	1.70	1.00	10.00
Firm Variables					
Employees	106	224	527	2	60,834
Sales (in thousand)	16,033	46,295	243,015	10	52,647,208
Monthly firm employee wage	927	986	445	65	3,745
Export/Sales	0.00	0.20	0.37	0.00	1.41
Profit/Sales	0.02	0.02	0.13	-1.83	0.68
Firm Shares over Years					
	2002	2003	2004	2005	2006
State firms	14%	10%	5%	5%	4%
Private firms	68%	71%	75%	75%	76%
HMT firms	11%	11%	11%	11%	11%
Foreign firms	7%	8%	9%	9%	9%

Table II: Effect of Minimum Wages on Firm Employment

Homogeneous estimates with firm fixed effect

This table shows the effect of minimum wages on firm employment over the period 2000–07. The estimation model is based on equation (1) with first difference (FD):

$$\Delta \ln L_{it} = \alpha + \beta_L \ln L_{i,t-1} + \beta_{MW} \ln MW_{ct} + X_{it}\beta + \mu_c \times \tau_t + \mu_I \times \tau_t + \mu_i + \varepsilon_{it},$$

where the variable $\Delta \ln L_{it} \equiv \ln L_{it} - \ln L_{it-1}$ is the log change of firm employees and MW_{ct} is county minimum wage at year t. $\mu_c \times \tau_t$ denotes city-by-year fixed effect, $\mu_I \times \tau_t$ denotes industry-by-year fixed effect, and μ_i denotes firm fixed effect. The prefix notation $\mathbb{1}$ denotes dummy variables. Foreign firm is the reference group of ownership type.

Each column shows a set of results from one specification. Column 1 shows the baseline result from the two-stage least-squares estimation, instrumenting $\Delta \ln L_{it-1}$ with $\ln L_{it-2}$. The estimations used in column 2–5 remove certain controls from the baseline estimation. The estimations for column 6 and 7 correspond to column 1 and 5, but they do not instrument $\Delta \ln L_{it-1}$. Standard errors in the parentheses below the coefficient estimates are clustered at the level of county-by-year. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided).

	Dependent variable: $\Delta \ln L_t$ (with firm fixed effect)						
	FD 2SLS Basline	FD 2SLS Different controls				FD $\Delta \ln L_{t-1}$ not instrumented	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\ln MW_t$	-0.163^{**}	-0.190^{***}	-0.242^{**}	-0.166^{**}	-0.064^{*}	-0.138^{**}	-0.026
	(0.069)	(0.072)	(0.099)	(0.070)	(0.034)	(0.065)	(0.033)
$\ln L_{t-1}$	-0.603^{***}	-0.615^{***}		-0.588^{***}	-0.601^{***}	-1.062^{***}	-1.061^{***}
	(0.011)	(0.010)		(0.011)	(0.011)	(0.003)	(0.003)
$\Delta \ln \text{sales}_t$	0.087^{***}			0.088^{***}	0.087^{***}	0.051^{***}	0.051^{***}
	(0.002)			(0.002)	(0.002)	(0.001)	(0.001)
$\ln \text{asset}_{t-1}$	-0.012^{***}			-0.014^{***}	-0.013^{***}	0.065^{***}	0.065^{***}
	(0.002)			(0.003)	(0.003)	(0.002)	(0.002)
EXPO_{t-1}	-0.090^{***}			-0.092^{***}	-0.090^{***}	-0.025^{***}	-0.025^{***}
	(0.004)			(0.004)	(0.004)	(0.002)	(0.002)
$\mathbb{1}$ SOE_t	-0.027^{***}			-0.023^{***}	-0.028^{***}	-0.061^{***}	-0.062^{***}
	(0.002)			(0.002)	(0.002)	(0.002)	(0.002)
$\mathbb{1}$ PRV_t	0.009^{***}			0.012^{***}	0.009^{***}	0.003^{**}	0.004^{**}
	(0.002)			(0.002)	(0.002)	(0.002)	(0.002)
profit margin_{t-1}	0.108^{***}			0.108^{***}	0.106^{***}	0.110^{***}	0.109^{***}
	(0.006)			(0.006)	(0.006)	(0.005)	(0.005)
$\mathbb{1}$ exporter_{t-1}	0.006^{***}			0.006^{***}	0.007^{***}	0.016^{***}	0.016^{***}
	(0.002)			(0.002)	(0.002)	(0.002)	(0.002)
$\text{export/sales}_{t-1}$	-0.013^{***}			-0.013^{***}	-0.015^{***}	-0.002	-0.002
	(0.003)			(0.003)	(0.004)	(0.003)	(0.003)
$\mathbb{1}$ subsidized_{t-1}	0.002			0.002	0.003^{**}	0.009^{***}	0.010^{***}
	(0.002)			(0.002)	(0.002)	(0.001)	(0.001)
$\text{subsidy/sales}_{t-1}$	-0.076^{*}			-0.083^{**}	-0.085^{**}	-0.148^{***}	-0.159^{***}
	(0.042)			(0.042)	(0.042)	(0.037)	(0.038)
Observations	481,361	481,361	481,361	481,361	481,361	481,361	481,361
R^2 (adjusted)	0.547	0.533	0.012	0.539	0.543	0.654	0.652
FE Controls							
City × Year	+	+	+	+		+	
Industry × Year	+	+	+		+	+	+

Table III: Effect of Minimum Wages on Firm Employment

Homogeneous estimates with firm-specific trend

This table shows the effect of minimum wages on firm employment over the period 2000–07. The estimation model with firm-specific trend is based on equation (4) with first difference (FD):

$$\Delta_2 \ln L_{it} = \alpha + \beta_L \Delta \ln L_{i,t-1} + \beta_{MW} \Delta \ln MW_{ct} + \Delta X_{it}\beta + \mu_c \times \tau_t + \mu_I \times \tau_t + \mu_i + \varepsilon_{it},$$

where the variable $\Delta_2 \ln L_{it} \equiv \Delta \ln L_{it} - \Delta \ln L_{it-1}$ and $\Delta \ln MW_{ct}$ is county minimum wage growth at year t. $\mu_c \times \tau_t$ denotes city-by-year fixed effect, $\mu_I \times \tau_t$ denotes industry-by-year fixed effect, and μ_i denotes firm-specific trend. The prefix notation $\mathbb{1}$ denotes dummy variables. Foreign firm is the reference group of ownership type.

Each column shows a set of results from one specification. Column 1 shows the baseline result from the two-stage least-squares estimation, instrumenting $\Delta_2 \ln L_{it-1}$ with $\Delta \ln L_{it-2}$. The estimations used in column 2–5 remove certain controls from the baseline estimation. The estimations for column 6 and 7 correspond to column 1 and 5, but they do not instrument $\Delta_2 \ln L_{it-1}$. Standard errors in the parentheses below the coefficient estimates are clustered at the level of county-by-year. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided).

	Dependent variable: $\Delta \ln L_t$ (with firm-specific trend)						
	FD 2SLS Basline	FD 2SLS Different controls				FD $\Delta \ln L_{t-1}$ not instrumented	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\ln MW_t$	-0.114^{*}	-0.145^{**}	-0.276^{**}	-0.111^{*}	-0.069^{**}	-0.083	-0.056^{**}
	(0.062)	(0.061)	(0.115)	(0.063)	(0.028)	(0.056)	(0.025)
$\ln L_{t-1}$	-1.096^{***}	-1.125^{***}		-1.096^{***}	-1.095^{***}	-1.471^{***}	-1.471^{***}
	(0.003)	(0.003)		(0.003)	(0.003)	(0.003)	(0.003)
$\Delta \ln \text{sales}_t$	0.053^{***}			0.053^{***}	0.053^{***}	0.025^{***}	0.025^{***}
	(0.001)			(0.001)	(0.001)	(0.001)	(0.001)
$\ln \text{asset}_{t-1}$	-0.020^{***}			-0.020^{***}	-0.020^{***}	0.018^{***}	0.019^{***}
	(0.002)			(0.002)	(0.002)	(0.002)	(0.002)
EXPO_{t-1}	-0.050^{***}			-0.050^{***}	-0.050^{***}	-0.004^{***}	-0.004^{***}
	(0.002)			(0.002)	(0.002)	(0.001)	(0.001)
$\mathbb{1}$ SOE_t	0.024^{***}			0.026^{***}	0.024^{***}	0.029^{***}	0.030^{***}
	(0.003)			(0.003)	(0.003)	(0.003)	(0.003)
$\mathbb{1}$ PRV_t	0.013^{***}			0.015^{***}	0.013^{***}	0.014^{***}	0.015^{***}
	(0.002)			(0.002)	(0.003)	(0.002)	(0.002)
$\text{profit margin}_{t-1}$	0.077^{***}			0.077^{***}	0.076^{***}	0.063^{***}	0.062^{***}
	(0.005)			(0.005)	(0.005)	(0.004)	(0.004)
$\mathbb{1}$ exporter_{t-1}	0.003			0.003	0.004^{**}	0.006^{***}	0.007^{***}
	(0.002)			(0.002)	(0.002)	(0.002)	(0.002)
$\text{export/sales}_{t-1}$	-0.010^{***}			-0.010^{***}	-0.012^{***}	-0.004	-0.005^{**}
	(0.003)			(0.003)	(0.003)	(0.003)	(0.003)
$\mathbb{1}$ subsidized_{t-1}	0.000			0.000	0.001	0.002	0.002^{*}
	(0.001)			(0.001)	(0.001)	(0.001)	(0.001)
$\text{subsidy/sales}_{t-1}$	-0.049			-0.051	-0.052	-0.072^{**}	-0.077^{**}
	(0.035)			(0.035)	(0.035)	(0.031)	(0.031)
Observations	371,488	371,488	371,488	371,488	371,488	371,488	371,488
R^2 (adjusted)	0.777	0.778	0.013	0.777	0.776	0.826	0.825
FE Controls							
City × Year	+	+	+	+		+	
Industry × Year	+	+	+		+	+	+

Table IV: Effect of Minimum Wages on Firm Wages

Baseline homogeneous estimates

This table shows the effect of minimum wages on firm wages over the period 2000–07. The estimation model with fixed effect is based on equation (1) with first difference (FD):

$$\Delta \ln W_{it} = \alpha + \beta_L \ln W_{i,t-1} + \beta_{MW} \ln MW_{ct} + X_{it}\beta + \mu_c \times \tau_t + \mu_I \times \tau_t + \mu_i + \varepsilon_{it},$$

and the estimation model with firm-specific trend is based on equation (4) with first difference (FD):

$$\Delta_2 \ln W_{it} = \alpha + \beta_L \Delta \ln W_{i,t-1} + \beta_{MW} \Delta \ln MW_{ct} + \Delta X_{it}\beta + \mu_c \times \tau_t + \mu_I \times \tau_t + \mu_i + \varepsilon_{it},$$

where W_{it} is firm (average) wage and MW_{ct} is county minimum wage at year t. $\mu_c \times \tau_t$ denotes city-by-year fixed effect, $\mu_I \times \tau_t$ denotes industry-by-year fixed effect, and μ_i denotes firm fixed effect or specific trend. The prefix notation $\mathbb{1}$ denotes dummy variables. Foreign firm is the reference group of ownership type.

The left panel for column 1–3 shows the results with firm fixed effect, and the right panel for column 4–6 shows the results with firm-specific trend. Column 1(4) and column 2(5) use 2SLS estimation as $\Delta \ln W_{it-1}$ ($\Delta_2 \ln W_{it-1}$) is instrumented with $\ln W_{it-2}(\Delta \ln W_{it-2})$, while column 3(6) does not. Standard errors in the parentheses below the coefficient estimates are clustered at the level of county-by-year. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided).

	Dependent variable: $\Delta \ln W_t$					
	Firm FE			Firm-specific trend		
	FD 2SLS (1)	FD 2SLS (2)	FD (3)	FD 2SLS (4)	FD 2SLS (5)	FD (6)
$\ln MW_t$	0.270***	0.197***	0.301***	0.229***	0.048	0.219***
	(0.075)	(0.049)	(0.076)	(0.070)	(0.053)	(0.062)
$\ln W_{t-1}$	−0.945***	−0.943***	−1.142***	−1.257***	−1.257***	−1.463***
	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
$\Delta \ln \text{sales}_t$	0.036***	0.036***	0.026***	0.027***	0.027***	0.015***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$\ln \text{asset}_{t-1}$	0.010***	0.010***	0.019***	−0.002	−0.002	0.006***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
$\mathbb{1}$ SOE_t	−0.014***	−0.012***	−0.015***	−0.017***	−0.019***	−0.017***
	(0.002)	(0.003)	(0.002)	(0.004)	(0.004)	(0.003)
$\mathbb{1}$ PRV_t	−0.005***	−0.004	−0.002	−0.022***	−0.023***	−0.021***
	(0.002)	(0.003)	(0.002)	(0.003)	(0.004)	(0.003)
$\text{profit margin}_{t-1}$	0.057***	0.054***	0.061***	0.037***	0.034***	0.029***
	(0.005)	(0.006)	(0.005)	(0.005)	(0.006)	(0.005)
$\mathbb{1}$ exporter_{t-1}	0.006***	0.006**	0.007***	0.005**	0.005*	0.004**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)
$\text{export/sales}_{t-1}$	−0.003	−0.005	−0.000	−0.003	−0.004	0.000
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
$\mathbb{1}$ subsidized_{t-1}	0.004**	0.003**	0.006***	0.001	0.002	0.003*
	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)
$\text{subsidy/sales}_{t-1}$	−0.141***	−0.144***	−0.083**	−0.116***	−0.114***	−0.060
	(0.043)	(0.044)	(0.041)	(0.042)	(0.042)	(0.039)
Observations	481,361	481,361	481,361	371,488	371,488	371,488
R^2 (adjusted)	0.732	0.727	0.754	0.870	0.869	0.887
FE Controls						
City × Year	+		+	+		+
Industry × Year	+	+	+	+	+	+

Table V: Effect of Minimum Wages on Firm Output Price, Profit and Debt

Baseline homogeneous estimates

This table shows the effect of minimum wages on firm output price over the period 2000-2003, firm profit and debt over the period 2000–07. The estimation model with fixed effect is based on equation (1) with first difference (FD):

$$\Delta \ln Y_{it} = \alpha + \beta_L \ln Y_{i,t-1} + \beta_{MW} \ln MW_{ct} + X_{it}\beta + \mu_c \times \tau_t + \mu_I \times \tau_t + \mu_i + \varepsilon_{it},$$

and the estimation model with firm-specific trend is based on equation (4) with first difference (FD):

$$\Delta_2 \ln Y_{it} = \alpha + \beta_L \Delta \ln Y_{i,t-1} + \beta_{MW} \Delta \ln MW_{ct} + \Delta X_{it}\beta + \mu_c \times \tau_t + \mu_I \times \tau_t + \mu_i + \varepsilon_{it},$$

where Y_{it} is firm profit or debt and MW_{ct} is county minimum wage at year t. $\mu_c \times \tau_t$ denotes city-by-year fixed effect, $\mu_I \times \tau_t$ denotes industry-by-year fixed effect, and μ_i denotes firm fixed effect or specific trend. The prefix notation $\mathbb{1}$ denotes dummy variables. Firm profit change is further normalized by sales in the previous period. The Firm debt is normalized by asset, denoted by the debt-to-asset ratio. Foreign firm is the reference group of ownership type.

The left (middle, right) panel for column 1–2 (3–4, 5–6) shows the results with firm output price (profit, debt). Column 1, 3, 5 (2, 4, 6) show the results with firm fixed effect (firm-specific trend). Standard errors in the parentheses below the coefficient estimates are clustered at the level of county-by-year. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided).

	Dependent variable: ΔY_t					
	ΔOutput Price$_t$		ΔProfit$_t$/Sales$_{t-1}$		Δ(Debt/Asset)$_t$	
	Firm FE (1)	Firm trend (2)	Firm FE (3)	Firm trend (4)	Firm FE (5)	Firm trend (6)
$\ln MW_t$	−0.055	0.043	−0.063*	−0.040	0.025	−0.005
	(0.034)	(0.056)	(0.037)	(0.025)	(0.047)	(0.028)
$\Delta \ln \text{sales}_t$	−0.001	−0.004	0.076***	0.031***	−0.002***	−0.001
	(0.005)	(0.007)	(0.009)	(0.002)	(0.001)	(0.000)
$\ln \text{asset}_{t-1}$	−0.000	0.007	0.001	−0.001	−0.013***	−0.006***
	(0.003)	(0.004)	(0.002)	(0.001)	(0.002)	(0.001)
EXPO_{t-1}	0.001	0.003	−0.006***	−0.002***	−0.000	0.000
	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)
$\mathbb{1}$ SOE_t	−0.012***	0.002	−0.013***	−0.002	0.009***	−0.000
	(0.004)	(0.008)	(0.003)	(0.003)	(0.002)	(0.001)
$\mathbb{1}$ PRV_t	0.003	−0.000	0.001	0.002*	−0.003**	−0.003***
	(0.003)	(0.005)	(0.001)	(0.001)	(0.001)	(0.001)
$\mathbb{1}$ exporter_{t-1}	−0.003	−0.007	0.002	0.000	0.003	0.002**
	(0.005)	(0.005)	(0.002)	(0.001)	(0.002)	(0.001)
$\text{export/sales}_{t-1}$	0.008	0.013*	−0.004*	−0.003*	−0.006**	−0.002
	(0.009)	(0.008)	(0.002)	(0.001)	(0.003)	(0.001)
$\mathbb{1}$ subsidized_{t-1}	0.006**	0.002	0.003***	0.000	−0.002	−0.000
	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
$\text{subsidy/sales}_{t-1}$	−0.151***	−0.088*	0.275***	0.172***	0.018	−0.001
	(0.056)	(0.052)	(0.082)	(0.037)	(0.036)	(0.017)
Observations	138,507	107,297	481,361	371,488	438,633	331,238
FE Controls						
City × Year	+	+	+	+	+	+
Industry × Year	+	+	+	+	+	+

Table VI: Effect of Minimum Wages on Firm Employment and Wages

Varying effect over years

This table shows the effect of minimum wages on firm employment and wages estimated for each year over the period 2000–07. The estimation model with fixed effect is based on equation (1) with first difference (FD):

$$\Delta \ln Y_{it} = \alpha + \beta_L \ln Y_{i,t-1} + \beta_{MW} \ln MW_{ct} + X_{it}\beta + \mu_c \times \tau_t + \mu_I \times \tau_t + \mu_i + \varepsilon_{it},$$

and the estimation model with firm-specific trend is based on equation (4) with first difference (FD):

$$\Delta_2 \ln Y_{it} = \alpha + \beta_L \Delta \ln Y_{i,t-1} + \beta_{MW} \Delta \ln MW_{ct} + \Delta X_{it}\beta + \mu_c \times \tau_t + \mu_I \times \tau_t + \mu_i + \varepsilon_{it},$$

where Y_{it} is firm employment or (average) wage and MW_{ct} is county minimum wage at year t. $\mu_c \times \tau_t$ denotes city-by-year fixed effect, $\mu_I \times \tau_t$ denotes industry-by-year fixed effect, and μ_i denotes firm fixed effect or specific trend. The prefix notation $\mathbb{1}$ denotes dummy variables. The symbol "$\times$" denotes year dummy variables interacted with $\ln MW_{ct}$. Other coefficients of non-interacted terms are not reported.

The left (right) panel for column 1–2 (3–4) shows the results with firm employment (wages). Column 1 and 3 (2 and 4) show the results with firm fixed effect (firm-specific trend). Standard errors in the parentheses below the coefficient estimates are clustered at the level of county-by-year. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided).

	Dependent variable			
	$\Delta \ln L_t$		$\Delta \ln W_t$	
	Firm FE (1)	Firm trend (2)	Firm FE (3)	Firm trend (4)
$\ln MW_t \times$ 2000	−0.034	−0.075	0.430***	0.307***
	(0.067)	(0.075)	(0.072)	(0.084)
× 2001	−0.046	−0.072	0.429***	0.327***
	(0.063)	(0.065)	(0.068)	(0.065)
× 2002	−0.070	−0.062	0.370***	0.267***
	(0.064)	(0.067)	(0.070)	(0.060)
× 2003	−0.141**	−0.104	0.389***	0.274***
	(0.067)	(0.072)	(0.073)	(0.066)
× 2004	−0.186***	−0.154**	0.256***	0.201**
	(0.071)	(0.074)	(0.079)	(0.081)
× 2005	−0.197**	−0.152*	0.241***	0.180
	(0.081)	(0.087)	(0.088)	(0.112)
× 2006	−0.191**	−0.148	0.181**	0.120
	(0.079)	(0.105)	(0.085)	(0.152)
× 2007	−0.244***	−0.177	0.105	−0.006
	(0.080)	(0.141)	(0.091)	(0.217)
Observations	481,361	371,488	481,361	371,488
R^2 (adjusted)	0.547	0.777	0.733	0.870
FE Controls				
City × Year	+	+	+	+
Industry × Year	+	+	+	+

Table VII: Effect of Minimum Wages on Firm Output Price, Profit and Debt

Varying effect over three episodes

This table shows the effect of minimum wages on firm output price over the period 2000-2003, firm profit and debt over the period 2000–07. The estimation model with fixed effect is based on equation (1) with first difference (FD):

$$\Delta \ln Y_{it} = \alpha + \beta_L \ln Y_{i,t-1} + \beta_{MW} \ln MW_{ct} + X_{it}\beta + \mu_c \times \tau_t + \mu_I \times \tau_t + \mu_i + \varepsilon_{it},$$

and the estimation model with firm-specific trend is based on equation (4) with first difference (FD):

$$\Delta_2 \ln Y_{it} = \alpha + \beta_L \Delta \ln Y_{i,t-1} + \beta_{MW} \Delta \ln MW_{ct} + \Delta X_{it}\beta + \mu_c \times \tau_t + \mu_I \times \tau_t + \mu_i + \varepsilon_{it},$$

where Y_{it} is firm employment or (average) wage and MW_{ct} is county minimum wage at year t. $\mu_c \times \tau_t$ denotes city-by-year fixed effect, $\mu_I \times \tau_t$ denotes industry-by-year fixed effect, and μ_i denotes firm fixed effect or specific trend. The prefix notation $\mathbb{1}$ denotes dummy variables. The symbol "$\times$" denotes year dummy variables interacted with $\ln MW_{ct}$. Other coefficients of non-interacted terms are not reported.

The left (middle, right) panel for column 1–2 (3–4, 5–6) shows the results with firm output price (profit, debt). Column 1, 3, 5 (2, 4, 6) show the results with firm fixed effect (firm-specific trend). Standard errors in the parentheses below the coefficient estimates are clustered at the level of county-by-year. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided).

	Dependent variable: ΔY_t					
	ΔOutput Price$_t$		ΔProfit$_t$/Sales$_{t-1}$		Δ(Debt/Asset)$_t$	
	Firm FE (1)	Firm trend (2)	Firm FE (3)	Firm trend (4)	Firm FE (5)	Firm trend (6)
$\ln MW_t \times$ 2000–02	−0.059*	−0.045	−0.032	−0.036	0.015	−0.008
	(0.034)	(0.069)	(0.039)	(0.029)	(0.048)	(0.031)
$\times$ 2003–05	−0.028	−0.035	−0.058	−0.043	0.018	−0.001
	(0.035)	(0.075)	(0.038)	(0.029)	(0.049)	(0.032)
$\times$ 2006–07			−0.103***	−0.057*	0.049	0.012
			(0.039)	(0.030)	(0.047)	(0.032)
Observations	138,507	78,223	481,361	335,296	438,633	300,636
FE Controls						
City $\times$ Year	+	+	+	+	+	+
Industry $\times$ Year	+	+	+	+	+	+

Table VIII: Effect of Minimum Wages on Firm Employment and Wages

Firm Heterogeneity

This table shows the heterogeneous effect of minimum wages on firm employment and wages due to firm characteristics over the period 2000–07. The estimation model with fixed effect is based on equation (1) with first difference (FD):

$$\Delta \ln Y_{it} = \alpha + \beta_L \ln Y_{i,t-1} + \beta_{MW} \ln MW_{ct} + X_{it}\beta + \mu_c \times \tau_t + \mu_I \times \tau_t + \mu_i + \varepsilon_{it},$$

and the estimation model with firm-specific trend is based on equation (4) with first difference (FD):

$$\Delta_2 \ln Y_{it} = \alpha + \beta_L \Delta \ln Y_{i,t-1} + \beta_{MW} \Delta \ln MW_{ct} + \Delta X_{it}\beta + \mu_c \times \tau_t + \mu_I \times \tau_t + \mu_i + \varepsilon_{it},$$

where Y_{it} is firm employment or (average) wage and MW_{ct} is county minimum wage at year t. $\mu_c \times \tau_t$ denotes city-by-year fixed effect, $\mu_I \times \tau_t$ denotes industry-by-year fixed effect, and μ_i denotes firm fixed effect or specific trend. The prefix notation $\mathbb{1}$ denotes dummy variables. The symbol "$\times$" denotes interaction terms with $\ln MW_{ct}$. Other coefficients of non-interacted terms are not reported. Foreign firm is the reference group of ownership type.

The left (right) panel for column 1–4 (5–6) shows the results with firm employment (wages). The estimations used in column 1, 3, 5, 6 use 2SLS while the estimations in column 2, 4 do not. Column 1, 2, 5 show the results with firm fixed effect and column 3, 4, 6 show the results with firm-specific trend. Standard errors in the parentheses below the coefficient estimates are clustered at the level of county-by-year. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided).

	Dependent variable: $\Delta \ln L_t$				$\Delta \ln W_t$	
	Firm FE		Firm trend		Firm FE	Firm trend
	FD 2SLS (1)	FD (2)	FD 2SLS (3)	FD (4)	FD 2SLS (5)	FD 2SLS (6)
$\ln MW_t$	−0.113	−0.150*	0.162**	0.212***	0.100	0.421***
	(0.080)	(0.079)	(0.076)	(0.067)	(0.097)	(0.095)
$\times$ EXPO$_{t-1}$	−0.109***	−0.075***	−0.057***	−0.043***	0.069***	0.062***
	(0.014)	(0.007)	(0.009)	(0.005)	(0.003)	(0.002)
$\times \Delta \ln$ sales$_t$	0.069***	0.081***	0.050***	0.046***	0.013***	0.006*
	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)
$\times \ln$ asset$_{t-1}$	−0.000	0.004	−0.025***	−0.028***	0.010**	−0.011**
	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)	(0.005)
$\times \mathbb{1}$ SOE$_t$	0.005***	0.008***	0.003***	0.002**	0.001	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$\times \mathbb{1}$ PRV$_t$	−0.004***	−0.004***	−0.002**	−0.002***	−0.002*	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$\times$ profit margin$_{t-1}$	0.126***	0.241***	0.056***	0.076***	0.039**	0.002
	(0.018)	(0.016)	(0.016)	(0.014)	(0.019)	(0.020)
$\times \mathbb{1}$ exporter$_{t-1}$	−0.013*	−0.016***	−0.015**	−0.018***	0.004	−0.002
	(0.007)	(0.006)	(0.006)	(0.006)	(0.009)	(0.011)
$\times$ export/sales$_{t-1}$	−0.025**	−0.013	−0.001	0.009	−0.028**	−0.003
	(0.011)	(0.009)	(0.010)	(0.009)	(0.013)	(0.014)
$\times \mathbb{1}$ subsidized$_{t-1}$	−0.010**	−0.002	−0.013***	−0.011***	0.003	0.005
	(0.005)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
$\times$ subsidy/sales$_{t-1}$	0.040	−0.096	−0.015	−0.020	−0.077	−0.074
	(0.131)	(0.115)	(0.112)	(0.101)	(0.147)	(0.150)
Observations	481,361	481,361	371,488	371,488	481,361	371,488
R^2 (adjusted)	0.553	0.656	0.778	0.826	0.686	0.844
FE Controls						
City $\times$ Year	+	+	+	+	+	+
Industry $\times$ Year	+	+	+	+	+	+

Table IX: Effect of Minimum Wages on Firm Employment and Wages

Firm heterogeneity over episodes

This table shows the heterogenous effect of minimum wages on firm employment and wages due to some firm characteristics. The effect is estimated separately for three episodes over the period 2000–07: 2000–02, 2003–05, and 2006–07. The estimation model with fixed effect is based on equation (1) and equation (4) with first difference (FD). The prefix notation $\mathbb{1}$ denotes dummy variables. The symbol "$\times$" denotes episode dummy variables interacted with $\ln MW_{ct}$. Foreign firm is the reference group of ownership type. Other coefficients of non-interacted terms are not reported.

The left (right) panel for column 1–2 (3–4) shows the results with firm employment (wages). Column 1 and 3 (2 and 4) show the results with firm fixed effect (firm-specific trend). Standard errors in the parentheses below the coefficient estimates are clustered at the level of county-by-year. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided).

	Dependent variable			
	$\Delta \ln L_t$		$\Delta \ln W_t$	
	Firm FE (1)	Firm trend (2)	Firm FE (3)	Firm trend (4)
$\ln MW_t \times \text{EXPO}_{t-1} \times$ 2000–02	0.012	0.021**	0.048***	0.050***
	(0.016)	(0.010)	(0.002)	(0.002)
$\times \text{EXPO}_{t-1} \times$ 2003–05	−0.067***	−0.035***	0.059***	0.064***
	(0.020)	(0.012)	(0.003)	(0.002)
$\times \text{EXPO}_{t-1} \times$ 2006–07	−0.200***	−0.103***	0.154***	0.190***
	(0.034)	(0.039)	(0.003)	(0.003)
$\ln MW_t \times \mathbb{1}\,\text{SOE}_t \times$ 2000–02	0.006***	0.003**	−0.000	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)
$\times \mathbb{1}\,\text{SOE}_t \times$ 2003–05	0.004***	0.003***	0.002*	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
$\times \mathbb{1}\,\text{SOE}_t \times$ 2006–07	0.006***	0.004***	0.003**	0.002
	(0.001)	(0.001)	(0.002)	(0.002)
$\ln MW_t \times \mathbb{1}\,\text{PRV}_t \times$ 2000–02	−0.005***	−0.003***	−0.001	−0.002
	(0.001)	(0.001)	(0.001)	(0.001)
$\times \mathbb{1}\,\text{PRV}_t \times$ 2003–05	−0.004***	−0.001	−0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
$\times \mathbb{1}\,\text{PRV}_t \times$ 2006–07	−0.003***	−0.001	−0.004***	−0.006***
	(0.001)	(0.001)	(0.001)	(0.001)
$\ln MW_t \times \mathbb{1}\,\text{subsidized}_{t-1} \times$ 2000–02	−0.007	−0.005	0.021	0.018
	(0.011)	(0.011)	(0.013)	(0.014)
$\times \mathbb{1}\,\text{subsidized}_{t-1} \times$ 2003–05	−0.029***	−0.028***	−0.002	−0.006
	(0.008)	(0.007)	(0.008)	(0.009)
$\times \mathbb{1}\,\text{subsidized}_{t-1} \times$ 2006–07	0.009	0.001	−0.002	−0.011
	(0.011)	(0.011)	(0.011)	(0.012)
$\ln MW_t \times \text{subsidy/sales}_{t-1} \times$ 2000–02	0.034	0.037	−0.064	−0.230
	(0.249)	(0.218)	(0.284)	(0.300)
$\times \text{subsidy/sales}_{t-1} \times$ 2003–05	−0.014	0.329*	0.025	0.136
	(0.214)	(0.186)	(0.222)	(0.238)
$\times \text{subsidy/sales}_{t-1} \times$ 2006–07	0.442	−0.347	−0.363	−0.289
	(0.315)	(0.312)	(0.321)	(0.355)

Table X: Effect of Minimum Wages on Firm Employment and Wages

Regional and industry heterogeneity

This table shows the heterogeneous effect of minimum wages on firm employment and wages due to city and industry characteristics over the period 2000–07. The estimation model with fixed effect is based on equation (1) with first difference (FD):

$$\Delta \ln Y_{it} = \alpha + \beta_L \ln Y_{i,t-1} + \beta_{MW} \ln MW_{ct} + X_{it}\beta + \mu_c \times \tau_t + \mu_I \times \tau_t + \mu_i + \varepsilon_{it},$$

and the estimation model with firm-specific trend is based on equation (4) with first difference (FD):

$$\Delta_2 \ln Y_{it} = \alpha + \beta_L \Delta \ln Y_{i,t-1} + \beta_{MW} \Delta \ln MW_{ct} + \Delta X_{it}\beta + \mu_c \times \tau_t + \mu_I \times \tau_t + \mu_i + \varepsilon_{it},$$

where Y_{it} is firm employment or (average) wage and MW_{ct} is county minimum wage at year t. $\mu_c \times \tau_t$ denotes city-by-year fixed effect, $\mu_I \times \tau_t$ denotes industry-by-year fixed effect, and μ_i denotes firm fixed effect or specific trend.

$NBMW$ denotes the average minimum wage in neighboring cities weighted by city employment, and $\frac{\Delta NBMW_t}{NBMW_{t-1}}$ denotes the growth rate of neighbor minimum wages. ECI is employment concentration index for each firm's city. The prefix notation $\mathbb{1}$ denotes dummy variables. The symbol "$\times$" denotes interaction terms with $\ln MW_{ct}$. Other coefficients of non-interacted terms are not reported.

The left (right) panel for column 1–2 (3–4) shows the results with firm employment (wages). Column 1 and 3 (2 and 4) show the results with firm fixed effect (firm-specific trend). Standard errors in the parentheses below the coefficient estimates are clustered at the level of county-by-year. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided).

	Dependent variable			
	$\Delta \ln L_t$		$\Delta \ln W_t$	
	Firm FE (1)	Firm trend (2)	Firm FE (3)	Firm trend (4)
$\ln MW_t \times \frac{\Delta NBMW_t}{NBMW_{t-1}}$	-0.289^{***}	-0.180^{**}	-0.172	-0.148
	(0.111)	(0.089)	(0.137)	(0.118)
$\times$ City governor Age$_t \leqslant 48$	0.025	-0.042	0.011	-0.018
	(0.043)	(0.037)	(0.044)	(0.047)
$\times$ City governor Age$_t \in [49, 52]$	0.069^{*}	0.012	-0.014	-0.048
	(0.039)	(0.031)	(0.039)	(0.045)
$\times$ City governor Age$_t \in [53, 56]$	0.027	0.016	-0.007	-0.055
	(0.038)	(0.029)	(0.035)	(0.035)
$\times$ City governor tenure$_t$	0.001	-0.002	-0.002	-0.007
	(0.006)	(0.005)	(0.007)	(0.006)
$\times$ City Migrant share	0.460	0.621	0.594	0.595
	(0.821)	(0.668)	(0.765)	(0.617)
$\times$ City ECI$_t$	0.062^{**}	0.050^{**}	0.056^{**}	-0.008
	(0.025)	(0.022)	(0.028)	(0.028)
$\times$ City GDP PC growth$_{t-1}$	0.009	-0.014	0.069	0.010
	(0.044)	(0.035)	(0.082)	(0.072)
$\times$ City FDI growth$_{t-1}$	-0.009	-0.019^{**}	-0.022	-0.015
	(0.011)	(0.009)	(0.014)	(0.013)
$\times$ City labor growth$_{t-1}$	0.081	-0.050	-0.093	-0.074
	(0.184)	(0.135)	(0.282)	(0.211)
$\times$ Industry labor intensity$_{t-1}$	-0.010^{**}	-0.008^{*}	-0.004	0.001
	(0.005)	(0.005)	(0.005)	(0.005)
Observations	448,585	345,491	448,585	345,491
R^2 (adjusted)	0.547	0.777	0.732	0.870
FE Controls				
City $\times$ Year	+	+	+	+
Industry $\times$ Year	+	+	+	+

Table XI: Effect of Minimum Wages on Firm Employment and Wages

Regional heterogeneity over episodes

This table shows the heterogenous effect of minimum wages on firm employment and wages due to city characteristics. The effect is estimated separately for three episodes over the period 2000–07: 2000–02, 2003–05, and 2006–07. The estimation model with fixed effect is based on equation (1) and equation (4) with first difference (FD). The symbol "×" denotes episode dummy variables interacted with $\ln MW_{ct}$. $NBMW$ denotes the average minimum wage in neighboring cities weighted by city employment, and $\frac{\Delta NBMW_t}{NBMW_{t-1}}$ denotes the growth rate of neighbor minimum wages. ECI is employment concentration index for each firm's city. The prefix notation $\mathbb{1}$ denotes dummy variables. Other coefficients of non-interacted terms are not reported.

The left (right) panel for column 1–2 (3–4) shows the results with firm employment (wages). Column 1 and 3 (2 and 4) show the results with firm fixed effect (firm-specific trend). Standard errors in the parentheses below the coefficient estimates are clustered at the level of county-by-year. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided).

	Dependent variable			
	$\Delta \ln L_t$		$\Delta \ln W_t$	
	Firm FE (1)	Firm trend (2)	Firm FE (3)	Firm trend (4)
$\ln MW_t \times \frac{\Delta NBMW_t}{NBMW_{t-1}} \times$ 2000–02	−0.016	0.019	−0.197	−0.236*
	(0.110)	(0.096)	(0.122)	(0.122)
$\times \frac{\Delta NBMW_t}{NBMW_{t-1}} \times$ 2003–05	−0.420**	−0.344**	−0.446**	−0.314
	(0.202)	(0.164)	(0.223)	(0.204)
$\times \frac{\Delta NBMW_t}{NBMW_{t-1}} \times$ 2006–07	−0.376*	−0.066	−0.029	0.113
	(0.207)	(0.255)	(0.280)	(0.317)
$\ln MW_t \times$ City $\text{ECI}_t \times$ 2000–02	0.047*	0.048**	0.036	0.001
	(0.024)	(0.023)	(0.029)	(0.028)
$\times$ City $\text{ECI}_t \times$ 2003–05	0.059**	0.054**	0.033	−0.014
	(0.024)	(0.022)	(0.029)	(0.028)
$\times$ City $\text{ECI}_t \times$ 2006–07	0.048**	0.049**	0.055*	−0.004
	(0.024)	(0.023)	(0.031)	(0.031)
$\ln MW_t \times$ City Migrant $\text{share}_t \times$ 2000–02	0.246	0.556	0.260	0.847
	(0.790)	(0.681)	(0.752)	(0.660)
$\times$ City Migrant $\text{share}_t \times$ 2003–05	0.290	0.652	0.279	0.713
	(0.847)	(0.715)	(0.801)	(0.677)
$\times$ City Migrant $\text{share}_t \times$ 2006–07	−0.140	0.278	0.116	0.595
	(0.977)	(0.796)	(0.964)	(0.852)
Observations	478,193	333,089	478,193	333,089
R^2 (adjusted)	0.546	0.776	0.732	0.871
FE Controls				
City × Year	+	+	+	+
Industry × Year	+	+	+	+

Table XII: Estimation of Firm Attrition in the ASIF Sample, 2001–06

This table estimates how firm attrition is determined in the ASIF data for the period 2001–06.

The binary dependent variable is whether a firm will stay in the sample in the next period. The explanatory variables are firm characteristics, including sales, employment, ownership, profit margins, firm age, and squared firm age. County minimum wages, county controls, and city fixed effects are used as additional controls. A pooled probit model is estimated separately for each year. Each column shows results for one year denoted on the column header.

Robust standard errors clustered at the city level are shown in the parentheses below the coefficient estimates. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided). Variables are all in logs except the variables denoted by ratios.

	Dependent variable: firm stay_{t+1}					
	(1) 2001	(2) 2002	(3) 2003	(4) 2004	(5) 2005	(6) 2006
MW_t	0.107	0.145	0.973^{***}	0.065	0.144	0.128
	(0.373)	(0.282)	(0.198)	(0.141)	(0.217)	(0.195)
sales_t	0.227^{***}	0.252^{***}	0.206^{***}	0.184^{***}	0.210^{***}	0.248^{***}
	(0.013)	(0.012)	(0.009)	(0.034)	(0.021)	(0.015)
L_t	0.115^{***}	0.080^{***}	0.095^{***}	0.126^{***}	0.108^{***}	0.124^{***}
	(0.011)	(0.010)	(0.008)	(0.008)	(0.010)	(0.010)
SOE_t	-0.156^{**}	-0.193^{***}	-0.255^{***}	-0.503^{***}	-0.170^{***}	-0.452^{***}
	(0.065)	(0.062)	(0.035)	(0.062)	(0.037)	(0.052)
PRV_t	-0.213^{***}	-0.178^{***}	-0.264^{***}	-0.102^{**}	-0.096^{***}	0.032
	(0.046)	(0.039)	(0.032)	(0.050)	(0.023)	(0.023)
HMT_t	-0.110^{***}	-0.090^{**}	-0.115^{***}	-0.100^{***}	-0.095^{***}	−0.034
	(0.030)	(0.041)	(0.029)	(0.025)	(0.020)	(0.022)
profit margin_t	0.442^{***}	0.497^{***}	0.633^{***}	0.329^{***}	1.026^{***}	1.160^{***}
	(0.037)	(0.032)	(0.041)	(0.046)	(0.065)	(0.060)
firm age_t	-0.030^{***}	-0.025^{***}	-0.030^{***}	−0.003	-0.017^{***}	-0.015^{***}
	(0.005)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
firm age_t^2	0.001^{***}	0.001^{***}	0.001^{***}	0.000^{***}	0.000^{***}	0.000^{***}
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	140,176	154,715	172,520	247,156	243,919	271,164

Figure I: Spatial Variation of County Minimum Wages, 2001–06

The following figures show the spatial distribution of counties at different quartiles of their minimum wages. The years shown here are from 2001 to 2006. The minimum wage is measured by the end-of-year monthly minimum wage. Counties are grouped according to the quartile that their minimum wages is attributed at the national level. Darker color represents a higher quartile level of minimum wages.

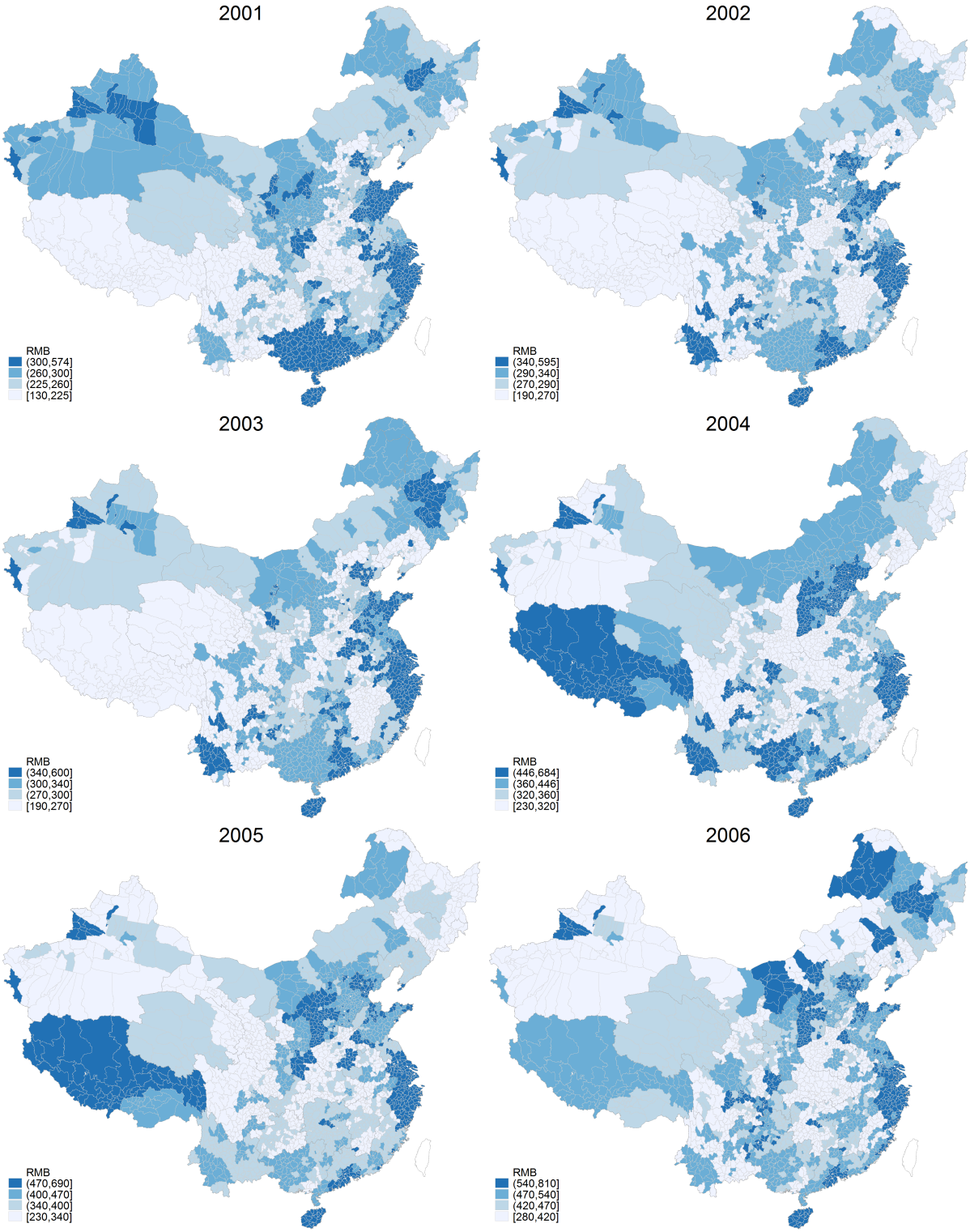


Figure II: Spatial Variation of County Minimum Wage Growth, 2001–06

The following figures show the spatial distribution of counties at different quartiles of their minimum wage growth. The years shown here are from 2001 to 2006. The minimum wage is measured by the end-of-year minimum wage. Counties are grouped according to the quartile their minimum wages belong to at the national level. Darker color means a higher quartile of minimum wage growth rates.

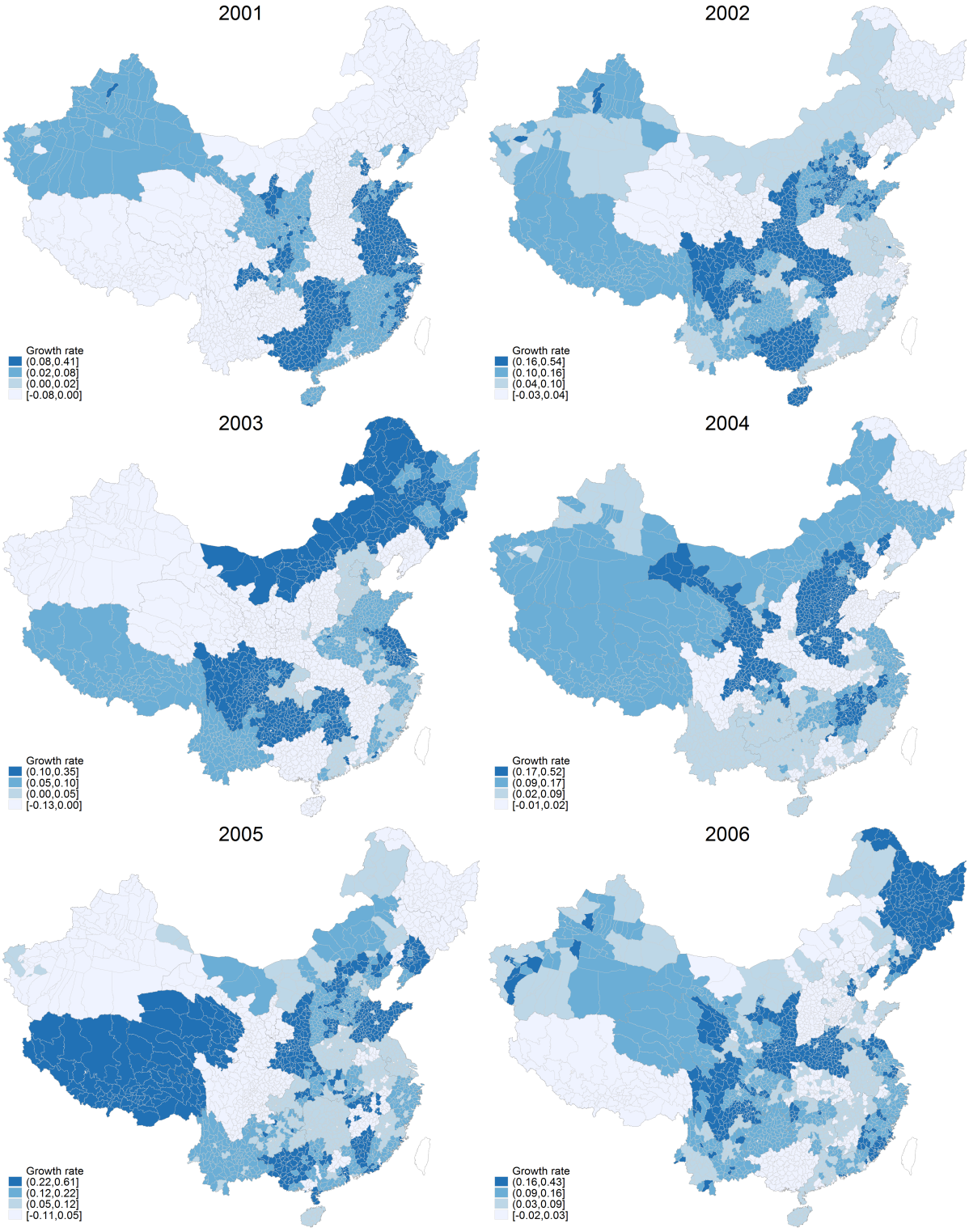


Figure III: Spatial City Distribution According to Within-City Minimum Wage Variations

The figure shows the spatial distribution of China's municipal city capitals, represented by dots (with solid fill color) or squares (with transparent fill color) according to within-city variations of their county minimum wages during the period 2001–06. If a city's counties have same minimum wages during the period, it is represented by a square. If a city's counties have different minimum wage levels, it is represented by a dot. The total number of municipal cities shown here is 337, not including those in Hong Kong SAR, Macau SAR, and Taiwan.

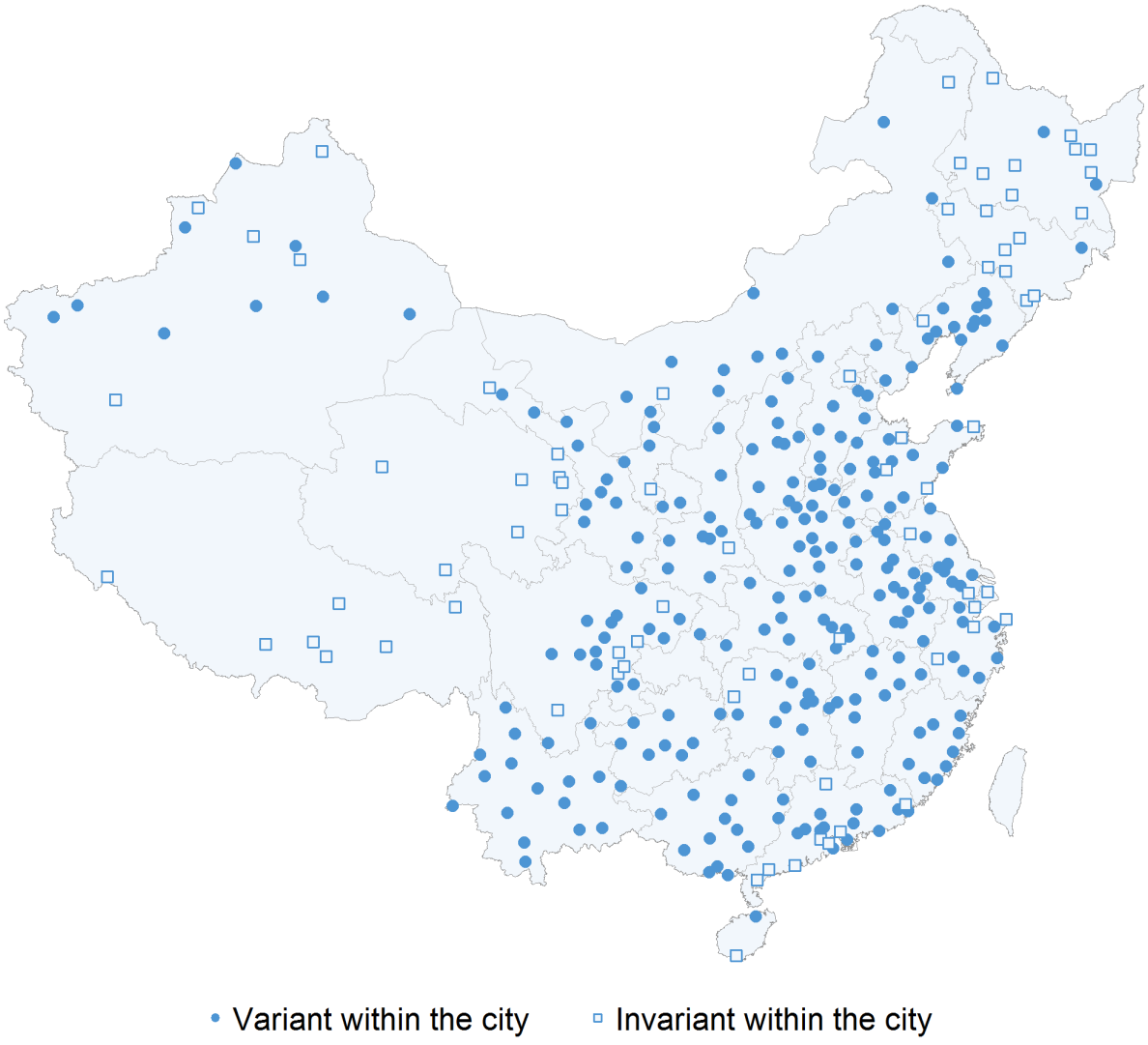


Figure IV: The Trend of China's Minimum Wages and Employee Wages, 1995–2011

The figure shows the trend of median county minimum wages and median county employee wages over the period 1995–2011. County minimum wages are calculated by average monthly minimum wages. Both wages are in nominal terms. The left axis measures the ratio between the two median county wages. The right axis measures the two wage levels.

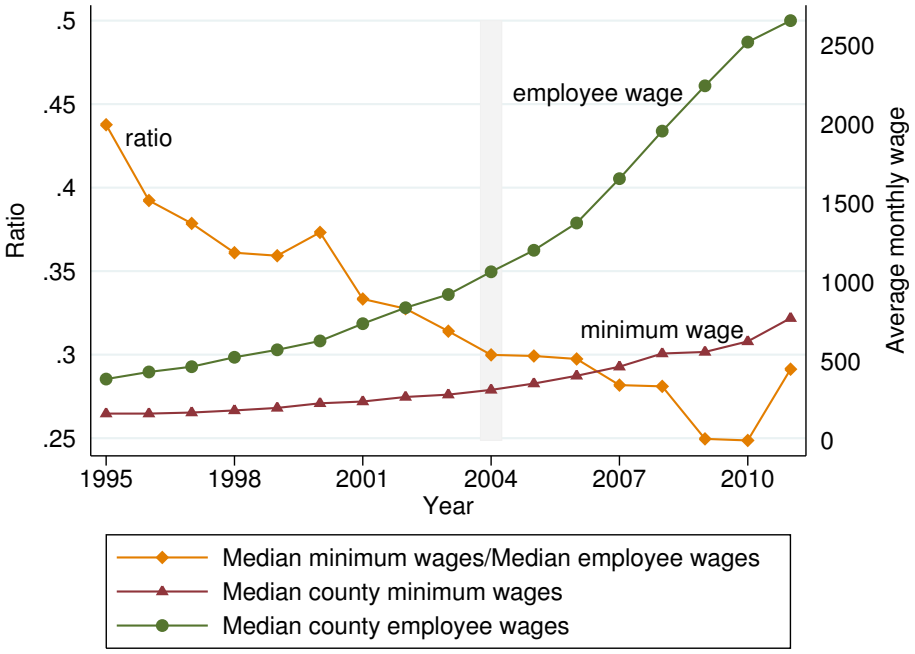


Figure V: Nominal and Real Minimum Wages

The figure shows the trend of median county minimum wages and real median county minimum wages over the period 1998–2011. County minimum wages are denoted by the end-of-year (December) monthly minimum wages.

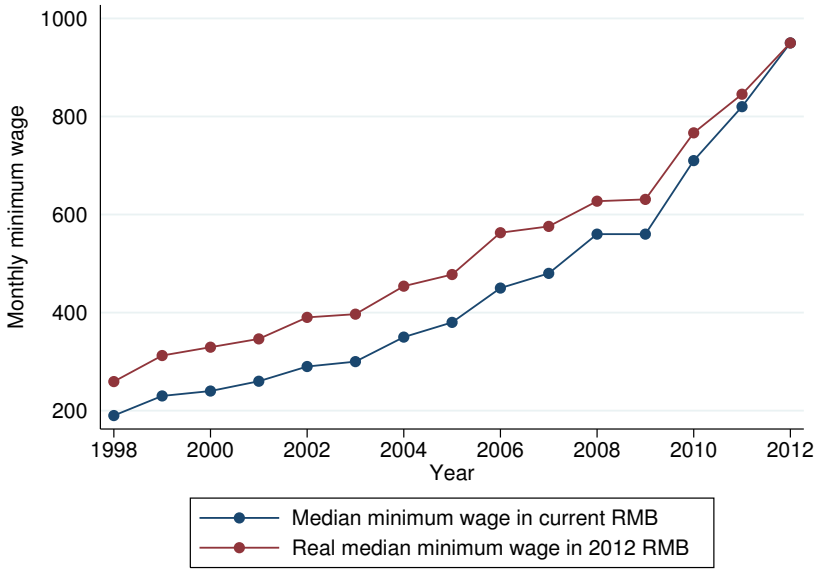


Figure VI: Proportion of Counties with Positive Minimum Wage Hikes, 1996–2012

This figure shows the proportion of counties with positive minimum wages hikes in every year from 1996 to 2012. The number of counties in the nationwide sample is 2,878. Minimum wage hikes are measured by the annual growth rate of each county's minimum wages. Counties with positive minimum wage hikes are further grouped according to the hike range, $(0, 10\%]$, $(10\%, 20\%]$, and $(20\%, \infty)$ respectively. The height of each bar stacked for each year measures the proportion of counties whose minimum wage hikes fall into the corresponding range. The overall bar height for each year measures the proportion of counties with positive minimum wage hikes.

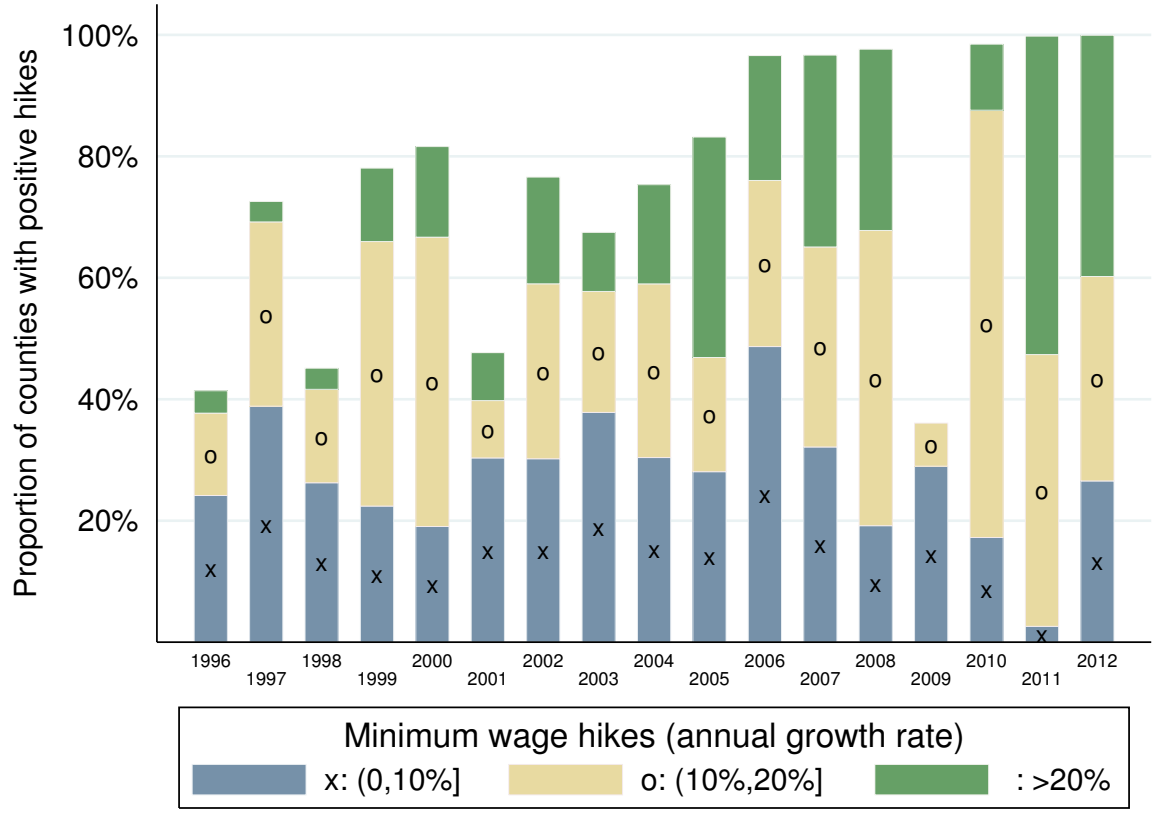


Figure VII: Minimum Wage Non-Compliance Rates, 2002–06

The table shows the average non-compliance rates of the minimum wage policy at the national level during the period 2002–06. The data of annual individual wages are from the Urban Household Survey, which covers 18 provinces (about 60 percent of the total) in China. The non-compliance rate is calculated by the share of the employees with wages lower than their county minimum wages. Our employee sample excludes employers and employees from small businesses that are not legal entities. The sample also excludes those who worked for less than 140 hours or more than 200 hours in the month (December) when they are surveyed. (Notation: Wage - individual wage; MW - local minimum wage)

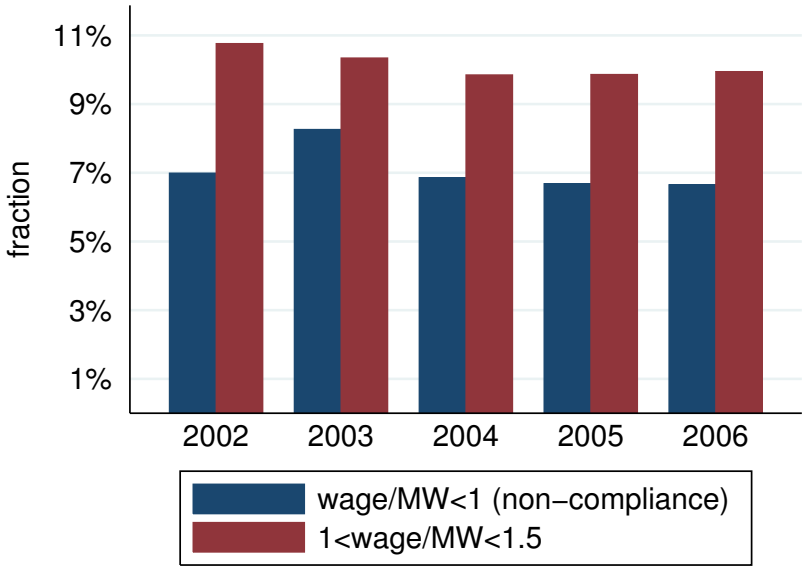


Figure VIII: Distribution of Relative Firm Wages, 2001–06

This figure shows annual distributions of relative firm wages during the period 2001–06. The relative firm wage for each firm is denoted by the ratio of the average employee wage to the local minimum wage. Dash lines represent the years from 2001 to 2003. Solid lines represent the years from 2004 to 2006.

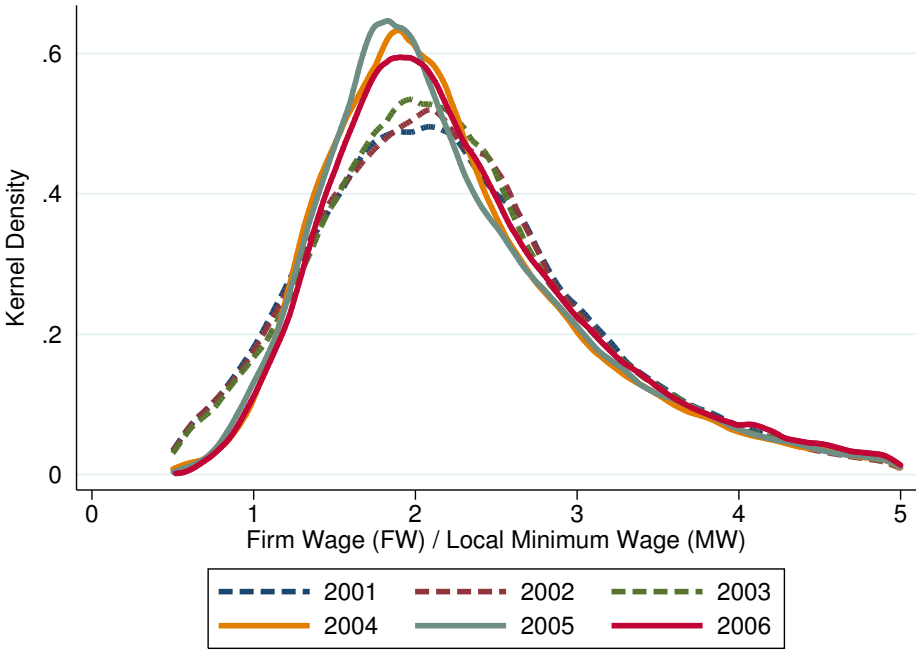


Figure IX: Proportion of Neighboring Counties with Positive Hike Difference, 1996–2012

This figure shows the proportion of neighboring counties with positive hike difference in minimum wages from 1996 to 2012. There are 6,965 neighbor county pairs in the nationwide sample, among which 6,223 pairs are within the same province. Minimum wage hikes are measured by the annual growth rate of each county's minimum wages. Neighboring counties with positive hike difference in minimum wages are further grouped according to the difference range, $(0, 5\%]$, $(5\%, 10\%]$, and $(10\%, \infty)$ respectively. The height of each bar stacked for each year measures the proportion of neighboring counties whose minimum wage hike differences fall into the corresponding range. The overall bar height for each year measures the proportion of counties with positive minimum wage hike difference.
The statistics for cross-province and within-province pairs of neighboring counties are calculated separately. For each year, the bar on the left is for cross-province neighboring county pairs, while the bar on the right is for within-province neighboring county pairs.

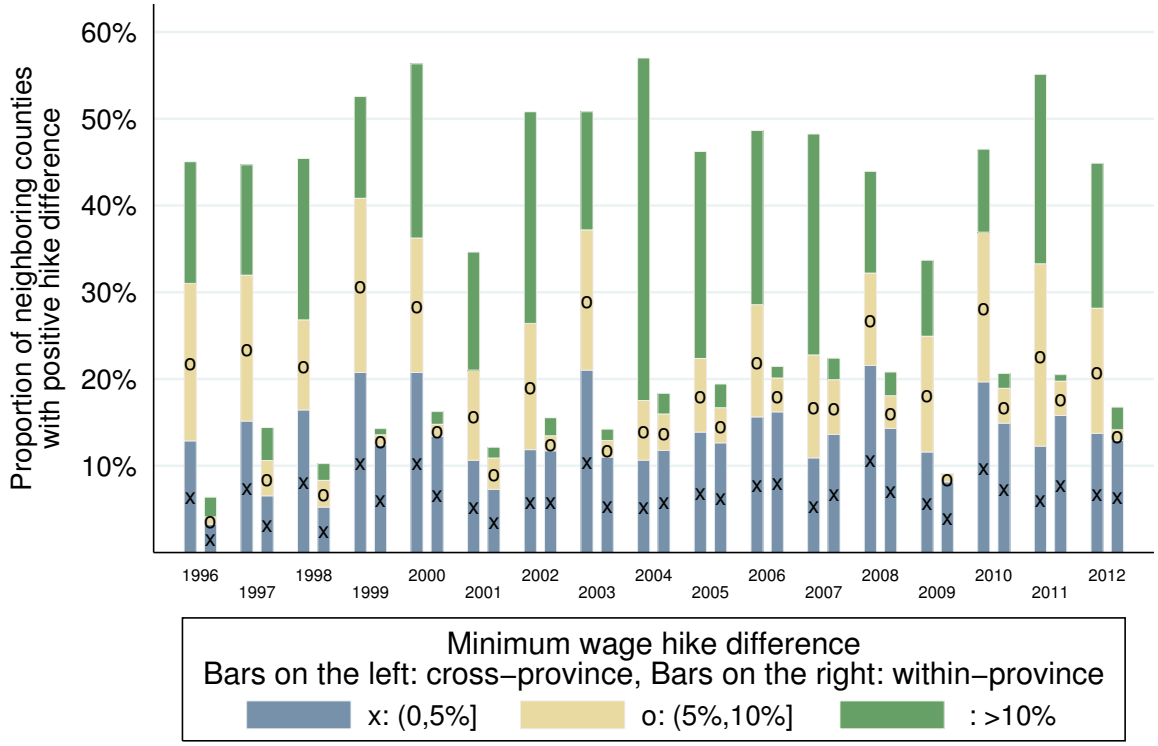


Figure X: Minimum Wage Hikes in Neighboring Counties

The case of Chongqing Municipality in 2004

The figure shows an example of one directly controlled municipality to clarify how minimum wage hikes vary at the county level. This municipality city is Chongqing, which has 40 counties. Minimum wage hikes are measured by the annual growth rate of each county's minimum wages. Darker color means higher values of growth rates. The left panel shows county minimum wage hikes. The right panel shows county growth rates of GDP per capita.

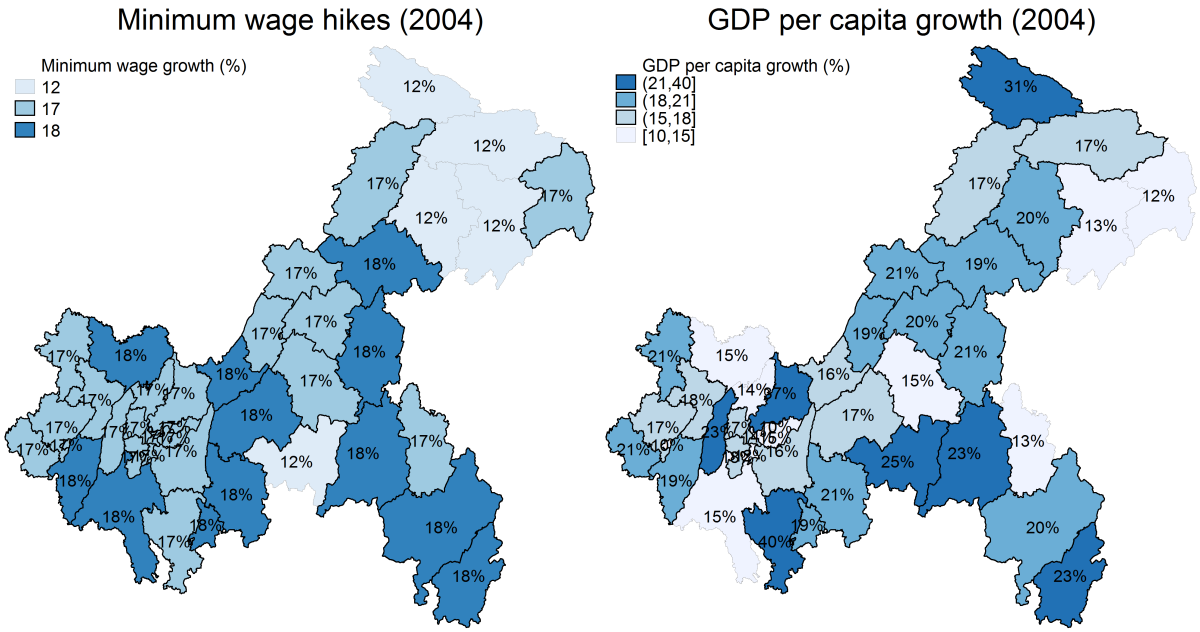
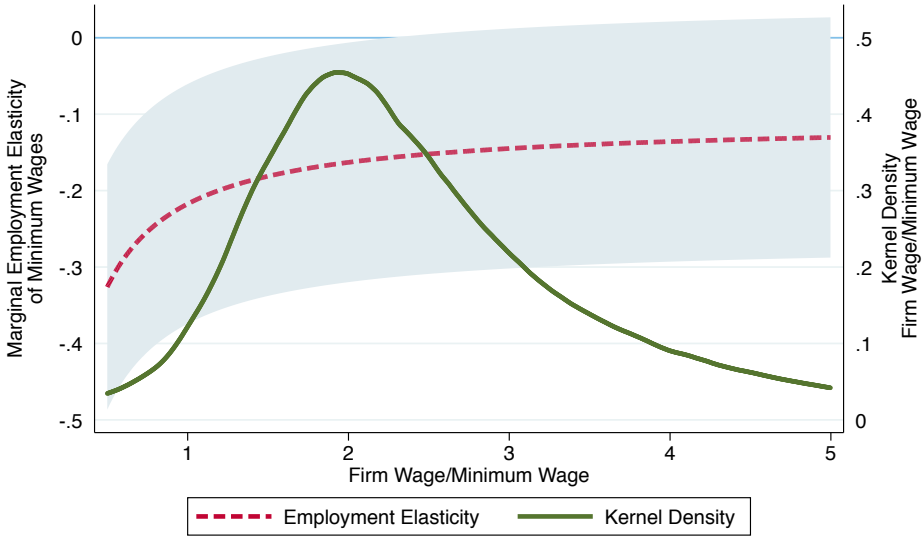


Figure XI: Heterogeneous Employment and Wage Elasticities of the Minimum Wage in Terms of Firm Exposure to Minimum Wage Hikes

The following figures show how firm employment and wage elasticity vary according to a firm's exposure to minimum wage hikes, depicted by the dash line in cranberry color. The shadow area in bluish gray shows the confidence interval of the elasticities at the 95% level. The size of elasticities is shown on the left axis. Firm exposure is measured by the ratio of firm wage to minimum wage. The green curve is the kernel density of firm exposure distribution. The density is shown on the right axis. The results are based on the baseline regression over the period 2000–07.

A. Firm Employment Elasticitiy



B. Firm Wage Elasticitiy

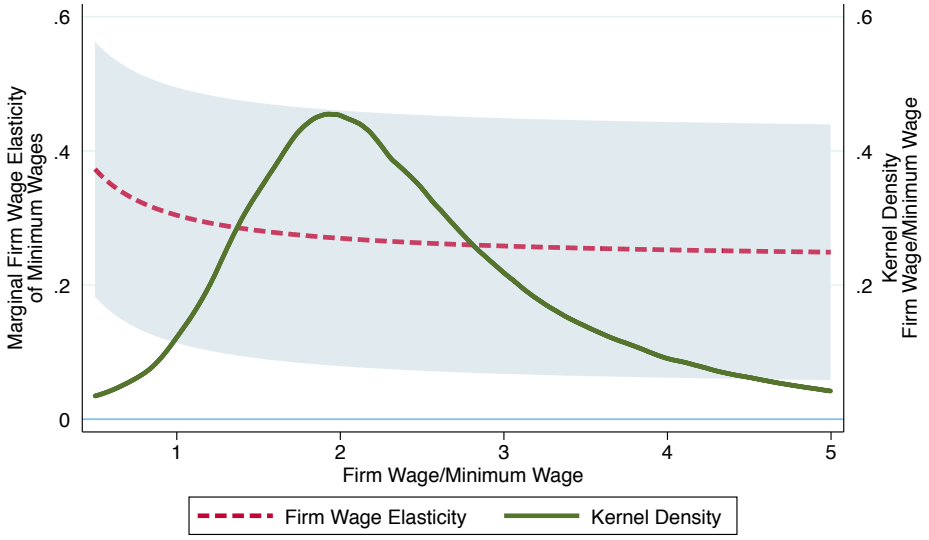
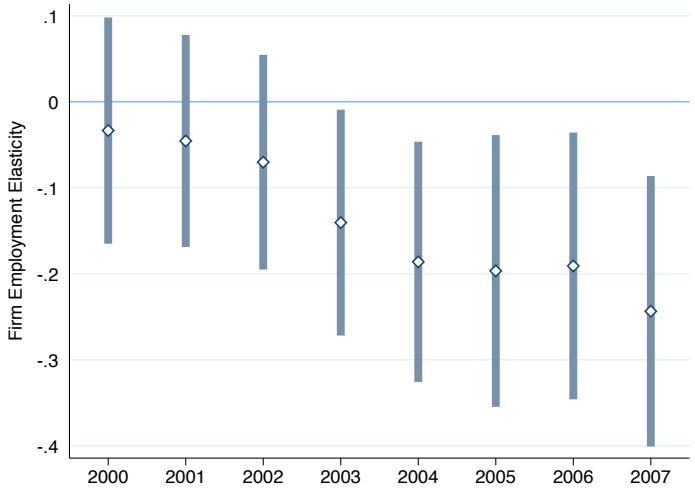


Figure XII: Elasticities of the Minimum Wage by Year

The figure shows employment and wage elasticities of the minimum wage by year over the period 2000–07. Dots in the shapes of blue diamond or red circle are point estimates of employment or wage elasticities. The bars with each dot at the center show the confidence intervals at the 95% level. The results are based on the baseline regression over the period 2000–07.

A. Firm Employment Elasticitiy



B. Firm Wage Elasticitiy

