The Minimum Wage and the Locations of New Business Entries in China: Estimates Based on a Refined Border Approach

Xiaoying Li[1], Dongbo Shi[2], Sifan Zhou[3]

January, 2023.

Abstract: This paper studies how the local adjustments of minimum wage levels in China affect the locations of new business entries. We use a refined border approach to address the endogeneity concerns regarding local minimum wage levels and examine whether differential changes in minimum wage levels on both sides of a county border result in abrupt changes in business entries within short distances from the border. Our results suggest that a 10% increase in the minimum wage levels decreases business entries by 2.69%. This effect is magnified for industries that pay lower average salaries or employ a larger share of unskilled workers. The entry-discouraging effects of high minimum wage levels are stronger when closer to the border where the identification assumption of the border approach is the most likely to hold and gradually decrease as we expand the widths of the border areas. Moreover, although we expect businesses could move across county borders at relatively low costs to avoid high minimum wage levels, we find that business relocation is rare and does not significantly respond to changes in the cross-county difference in minimum wage levels.

Key Words: minimum wage; new business entry; county border; China

JEL Classification: R30, J38, O18

[1] Institute of Guangdong, Hong Kong and Macao Development Studies, Center for Studies of Hong Kong, Macao and Pearl River Delta, Sun Yat-sen University. Email: lixy36@mail.sysu.edu.cn.

[2] School of International and Public Affairs, SJTU. Email: shidongbo@sjtu.edu.cn.

[3] Department of Public Finance, School of Economics, Xiamen University, China; Wangyanan Institute for Economic Studies, Xiamen University, China. 422 South Siming Road, Xiamen, Fujian 361005, China. Email: zhou_sifan@xmu.edu.cn. Corresponding Author.

1. Introduction

Local variations in policies will affect the location of economic activities (Agrawal, Hoyt, and Wilson 2020), and local variations in minimum wage levels are no exception. In this paper, we study the effects of the local adjustments of minimum wage levels in China on the locations of new business entries. While raising minimum wage levels helps the most disadvantaged workers (Ahlfeldt, Roth, and Seidel 2018) and as a result may attract workers (McKinnish 2017), it may also reduce firms' profits (Fan, Lin, and Tang 2018) and influence firms' location choices (Méjean and Patureau 2010). Startups and young businesses are powerful drivers in creating new jobs and economic growth (Haltiwanger, Jarmin, and Miranda 2013; Li et al. 2012). The locations of new business entries thus play an important role in shaping the spatial distribution of economic prosperity.

The vast literature on minimum wage policies has focused on policy environments where minimum wage levels vary macro-geographically, for example at the state level in the United States (Card and Krueger 1994, 2000; Neumark and Wascher 1992; McKinnish 2017). Local minimum wage policies tailored to local economic environments had in the past been implemented only rarely but have become increasingly common in the recent decade in both the U.S. and other developed or developing countries (Tijdens and van Klaveren 2019; Dube and Lindner 2020). With county borders being potentially more porous than state borders in terms of easier worker mobility and firm relocation, the effects of these local variations in the minimum wage rates cannot be easily extrapolated based on the prior literature that studies variations in the minimum wage rates at a more macro level. To date, there has been surprisingly little research devoted to these unique aspects of local minimum wages.

Since the inception of a minimum wage policy in China, minimum wage rates have been set to vary at the county-level administrations[4] tailored to local economic conditions (Hau, Huang, and Wang 2020). Existing studies on minimum wage policies in China, nevertheless, have mostly taken prefectural cities as units of observation and ignored the rich within-city variations. In this paper, we apply a refined border approach using Chinese business registration data to identify the causal impact of county-level minimum wage rates on new business entries and business relocation. The time variations in factors such as the cost of living, the access to markets and natural resources, and the distance to industrial clusters are likely to be distributed continuously and smoothly in space, and are thus comparable between areas within short distances from one another. By restricting the area for comparison to two-kilometer bands along county borders, with one-kilometer bands on each side of the borders, we find that a 10% increase in the minimum wage decreases new business entries by 2.69%. This effect is magnified in industries that employ large shares of low-skilled workers or pay lower average salaries, as these industries face greater exposure to minimum wage policies. The entry-discouraging effects of high minimum wage levels are stronger when closer to the border, where the identification assumption of the border approach is the most likely to hold, and gradually decrease as we expand the widths of the bands. Moreover, entries relocated from neighboring counties only account for a small proportion of the new entries near the border and do not significantly respond to changes in local minimum wage levels.

[4] The top three levels of administrative divisions in China are provinces, prefectural cities, and county-level administrations. County-level administrations include counties, county-level cities, and districts. Districts are usually more urbanized and smaller in geographical areas compared to counties, but they are equivalent to counties in China's hierarchical administrative divisions. Some sufficiently urbanized counties could convert to districts or (county-level) cities. In the rest of this paper, we refer to all these types of county-level administrations as counties unless otherwise specified.

Any attempt at causal identification of the effects of the minimum wage on new business entries faces three primary challenges. First, it is important to account for unobserved time-varying area characteristics at a sufficiently fine geographic scale, as the agglomeration economies literature has documented that immediate area characteristics play a critical role in business location decisions (Rosenthal and Strange 2001). The second challenge is that the minimum wage rate is usually endogenous to the state of economic development in an economy. Counties that are more economically prosperous tend to have both more entries and higher minimum wage rates leading to a positive correlation that disguises their causal relationship. Finally, governments may also implement other policies concurrently when adjusting the minimum wage, making it difficult to isolate the effects of the minimum wage on new business entries.

We tackle the first two challenges by adopting a refined border approach that exploits the differential changes in minimum wage rates between adjacent counties within the same prefecture to study the number of new business entries that appear within short distances of their county borders. By studying counties within the same prefecture, this border approach restricts the comparison to counties that are more likely to experience similar unobservable local shocks that drive new business entries (Holmes 1998; Dube, Lester, and Reich 2010; Rohlin 2011). Moreover, instead of using the county as the observational unit, we use a Geographic Information System (GIS) process to create banded areas of varying widths that straddle county borders (Rohlin 2011). Factors such as the labor pool, the cost of living, the access to markets and natural resources, and local economic vitality are all important for business entry location. Although it is difficult to fully control for changes in these factors with observable data, they are likely to vary continuously across county borders and to be similar within the narrow areas that run along the borders. Based on this assumption, we can

associate abrupt differences in new business entries on both sides of a county border with the corresponding differential changes in minimum wage rates.

This refined border approach also partly addresses the third challenge that arises when governments simultaneously enact other policies unrelated to the minimum wage at the prefecture or provincial level. We address the remaining endogeneity concerns regarding potential county-level policies by exploring a "third difference" in addition to the time differencing and the spatial differencing. Specifically, we compare the effects of the minimum wage on new business entries in industries that employ large shares of low-wage unskilled workers with the effects on industries that do not. By relying on the assumption that low-wage unskilled workers are more likely to be affected by changes in minimum wage rates, this comparison allows us to isolate the effects of the minimum wage from the effects of other government policies that may affect business entries across industries uniformly.

Using this refined border approach, we also investigate the degree of business mobility in response to changes in local minimum wage levels. We identify entries in one county with at least one shareholder who is also listed as shareholder of one or more pre-existing establishments on the other side of the county border. We find that the number of entries with ownership ties to establishments in neighboring counties is small and does not respond to variations in minimum wage rates in a statistically significant way. In summary, the substantive part of the entry-discouraging effects of an increased minimum wage rate come from discouraging "fresh" entries.

The remainder of this article is organized as follows. In Section 2 we discuss the relevant literature. In Section 3 we discuss our identification strategy. In Section 4 we introduce the evolution of the minimum wage system in China and the Chinese business

registration data that we use in our analysis. We report the results in Section 5 and conclude in Section 6.

2. Related Literature

This paper contributes to three strands of literature: studies of the economic effects of local minimum wage policies, studies of the locations of new business entries in China, and studies that use a border approach in evaluating policies.

The early literature on the minimum wage focused on developed countries such as the United States, with an emphasis on its employment effects. A simple economic model of a price floor predicts that, with a downward-sloping labor demand curve, an increase in a binding minimum wage will reduce employment. Consistent with this theoretical prediction, early empirical work using national-level time-series variations or cross-state variations in minimum wage rates in the U.S. found moderate negative effects of minimum wage hikes on employment (Neumark and Wascher 1992). Later case studies, however, which compared neighboring areas with differing minimum wage rates around policy changes found no such negative employment effects (Card and Krueger 1994; Dube, Naidu, and Reich 2007). This lack of effect on employment of a higher minimum wage rate is not unique to the U.S.; it has also been documented in other countries such as Britain (Dickens, Machin, and Manning 1999; Draca, Machin, and Van Reenen 2011) and Mexico (Bell 1997). These results, if taken at face value, suggest that minimum wage policy can increase the earnings of disadvantaged workers without loss of efficiency.

A focus on employment alone, however, could produce an incomplete view of the effects of minimum wage policies. More recent studies have examined the effects of minimum wage rates on capital adjustments. Consider the case of fast-food establishments, a frequent subject of studies in the minimum wage literature, which commonly use a

production technology whereby the worker-to-machine ratio is relatively fixed at least in the short run (Borjas 2013). As a result, the short-run effects of increasing the minimum wage may not show up as an instant adjustment in employment among healthy existing establishments, but instead manifest in rising marginally profitable establishment closings as well as the discouragement of new entries. Orazem and Mattila (2002) studied minimum wage policy changes in Iowa in the United States and found that a 10% increase in the minimum wage led on average to a 2.5% decline in the number of firms per year. Rohlin (2011) also studied the U.S. market and found that a higher minimum wage decreased new entries in industries that rely heavily on minimum-wage-earning workers.

Regarding China, the literature has extensively studied the impact of minimum wage laws on employment and various forms of capital adjustments. Mayneris, Poncet, and Zhang (2018) found that, while the minimum wage had nonsignificant effects on firm-level employment, it significantly increased wage costs and made it more difficult for firms to survive. Surviving firms respond to a higher minimum wage by increasing investment in capital to increase labor productivity and maintain profitability. Fan, Hu, and Tang (2020) found that a higher minimum wage increased manufacturing firms' adoption of robots. Hau, Huang, and Wang (2020) found that a higher minimum wage accelerated input substitution from labor to capital and total factor productivity growth. The capital adjustments resulting from higher minimum wage rates can also spread beyond a country's border. Fan, Lin, and Tang (2018) found that increases in minimum wage rates drove Chinese manufacturing firms to conduct outward foreign direct investment in countries with lower labor costs. All these papers discussed *existing* firms' responses to hikes in the minimum wage, yet none has studied the impact of the minimum wage on new business *entries* in China. Our paper fills this gap.

Note that the existing literature on minimum wage policies in China has mainly focused on cross-city variations in minimum wages and neglected within-city cross-county variations. This has resulted in part from data limitations, as systematic county-level minimum wage data were made available only recently (Hau, Huang, and Wang 2020). The existence of local variations in minimum wage rates is not unique to China. According to a thorough review by Tijdens and van Klaveren (2019), variations in minimum wage rates across cities or locally are also present in fifteen other countries, including Japan, Switzerland, Canada, India, Bangladesh, and Indonesia. Over the past decade, more cities in the United States are beginning to set their own minimum wage rates. In fact, the number of cities with minimum wage rates that exceed either state or federal standards has increased from a mere three in 2010 to 42 in 2020 (Dube and Lindner 2020).

The effects of local policy variations cannot be easily extrapolated based on the effects of corresponding policy variations at a more aggregate level. Firms could be more mobile within smaller geographic areas to take advantage of beneficial local policies. Studies on local development programs that use fiscal tools including tax exemptions and subsidies to attract new businesses to targeted areas such as the Enterprise Zones or their equivalents in the U.S. (Hanson and Rohlin 2013), U.K. (Einiö and Overman 2020), and France (Givord, Rathelot, and Sillard 2013; Mayer, Mayneris, and Py 2017) have found that their negative spillover effects on neighboring areas to be sizeable enough to offset their positive effects inside the targeted areas, thus generating small (if any) effects on overall economic activities. To the best of our knowledge, the literature has not assessed the effects of local minimum wages on business mobility. Our paper begins this undertaking by studying these effects in China.

This paper also contributes to the empirical literature on new business entry location decisions in China. It is among the first to use Chinese business registration data. Existing studies on business entry location decisions in China have relied mainly on China's *Annual Survey of Industrial Firms* (ASIF).[5] Although that source provides rich firm-level accounting measures, the ASIF covers only firms in the manufacturing sector with revenue of more than five million yuan. As a result, firms may appear in the ASIF because of business expansion rather than as new entrants, making the data extremely noisy for studying entry behavior. In this paper, we overcome this challenge by using Chinese business registration data, which offers complete coverage of new business entries since 1985. Along with detailed descriptions of firms' main business activities, this data source also enables us to go beyond the manufacturing sector and compare the effects of minimum wage rates on new business entries across sectors. While business registration data have been used extensively to study firm dynamics in developed countries (Guzman and Stern 2015, 2016), it has been largely under-utilized in China. Our paper is one of the first studies using administrative registration data to study business dynamics in China, in which we hope will lead to a new stream of research that does so as well.

This paper builds on the literature that uses a border approach to control for local time-varying heterogeneities. The border approach was pioneered by Holmes (1998), who compared manufacturing employment in counties on the "antibusiness" side of state borders with manufacturing employment in neighboring counties on the "probusiness" side and found that "probusiness" policies promoted the manufacturing sector. This border approach was later extended by Dube, Lester, and Reich (2010) to study the effects of minimum wage laws on restaurant employment. Dube and colleagues collected county-level employment data for

[5] For example, consider studies on business entry location decisions in connection with tax treatments (Zhang and Shen 2020) and administrative approval reforms (Bi et al. 2018).

county pairs that straddle borders of states with differing minimum wage rates and found no significant effects of the minimum wage on employment. Rohlin (2011) applied this method to study the effects of the minimum wage on new establishment location decisions in the United States. Mindful that immediate area characteristics are important to business location decisions, Rohlin (2011) did not use the county as the unit of analysis, but rather constructed narrow pairs of adjacent areas on either side of a state border that were within one, five, and ten miles of the border. Rohlin found that a higher minimum wage did deter new business entries in these areas. Note that in all three of these papers that apply the border approach, the policy variables differ at the state level and the borders at issue are state borders. As it comes to policies varying across more refined geographical units, Duranton, Gobillon, and Overman (2011) used neighboring establishments within 1km from each other for spatial differencing to study the property tax varying at the Local Authority level in the UK. Since minimum wage policies in China vary at the county level, using the entire county as the unit of analysis will incur endogeneity issues. Instead, we examine whether changes in the minimum wage on two sides of a county border result in abrupt changes in business entries within one kilometer to up to four kilometers from the county borders.

3. Empirical Strategy

Our identification strategy exploits how varying changes in minimum wage rates between adjacent counties within the same prefecture affect the number of new business entries that appear within a short distance of their county borders.

To see how this strategy works, we first express the determinants of the number of new business entries in the following form:

$$y_{it} = \alpha + \beta ln\,(MW_{c_i t}) + \Phi X_{it} + \gamma_i + \mu_t + \theta_{it} + \epsilon_{it} \qquad (1)$$

where i indexes areas, t indexes years, and c_i indexes the county that area i belongs to. Minimum wage rates are set to vary at county level. In this equation, we group factors other than the minimum wage rate that also affect new business entries into three categories. First, area fixed effects, γ_i, account for all observable and unobservable time-invariant area-specific characteristics. Second, time fixed effects, μ_t, account for observable and unobservable time-varying factors that affect all areas in the same way. Lastly, time-varying area-dependent factors are separated into observable variables X_{it} and an unobservable θ_{it}. The structural error term is denoted as ϵ_{it}.

When the unobservable time-varying area-dependent factor correlates with the minimum wage level, i.e., $cov(\ln(MW_{c_it}), \theta_{it}) \neq 0$, a two-way fixed effects estimation with area fixed effects, year fixed effects, and X_{it} controlled for will produce biased estimate for β. For example, sudden economic booms at the local level increase new business entries but also raise the cost of living, sometimes resulting in minimum wage hikes. In this case, unobserved common confounding factors affect both the dependent variable and the key independent variable, resulting in a biased estimate. Alternatively, local policymakers may have information unrevealed to outsiders and expect growths of entries that would sustain even if local minimum wage rate is to be raised. A reversed causality issue arises as local policymakers adjust minimum wage rate upwards out of such expectation. In both scenarios, there exist unobserved local shocks θ_{it} that are correlated with $\ln(MW_{c_it})$ but are not accounted for by X_{it}. With $cov(\ln(MW_{c_it}), \theta_{it}) > 0$, running the two-way fixed effects regression will result in a downward bias for the estimated size of the negative causal effects of $\ln(MW_{c_it})$ on y_{it}. When such bias is large enough, the sign of the coefficient of $\ln(MW_{c_it})$ could even be flipped to be positive.

To address this endogeneity issue, we explore variations between neighboring counties within the same prefecture that have different changes in minimum wage levels and we restrict the areas for comparison to areas within short distances from the county borders. Define Δ_d as the spatial difference operator which takes the difference between each area of width d along one side of a county border and its neighboring area also of width d on the other side of the border. Applying this spatial difference operator to (1) gives:

$$\Delta_d y_{it} = \beta \Delta_d ln\,(MW_{c_i t}) + \Phi \Delta_d X_{it} + \Delta_{\mathrm{d}} \gamma_i + \Delta_d \theta_{it} + \epsilon_{it} \qquad (2)$$

We then use the panel dimension of our data to perform *within* transformation to eliminate the spatial difference of area fixed effects, $\Delta_{\mathrm{d}} \gamma_i$. For any variable x that is already spatially differenced as $\Delta_d x$, for area i, let $\overline{\Delta_d x_i}$denote the time average of the spatial difference, and define $\widetilde{\Delta_d x_{it}} \equiv \Delta_d x_{it} - \overline{\Delta_d x_i}$. We perform *within* transformation for (2) and get:

$$\widetilde{\Delta_d y_{it}} = \beta \Delta_d ln\,\widetilde{(MW}_{c_i t}) + \Phi \widetilde{\Delta_d X_{it}} + \widetilde{\Delta_d \theta_{it}} + \widetilde{\epsilon_{it}}. \qquad (3)$$

Estimating (3) will give consistent estimates of β if $cov(\Delta_d \ln\widetilde{(MW}_{c_i t}), \widetilde{\Delta_d \theta_{it}})$=0. The identification assumption is that the differences of local shocks between narrow neighboring areas on two sides of the county borders are uncorrelated with the time variations in the differences of minimum wage rates between neighboring counties.

This identification assumption is likely to be satisfied for a small enough d. First, factors such as the cost of living, the access to input and output markets, and the distance to industrial clusters are likely to be distributed continuously and smoothly in space, making them comparable contemporaneously between areas within short distances from one another. Thus, their time variations are also likely to be spatially smooth. Second, although the county-level minimum wage rate is often endogenous to (the expectation of) the county-level overall economic conditions, when the border area is small enough relative to the whole

county in terms of its share of economic activities, the time variations of the between-county difference in minimum wage rates are likely to be exogenous to that in economic conditions within the narrow border areas. For both reasons, $\widetilde{\Delta_d \theta_{\iota t}}$ is likely to be uncorrelated with $\Delta_d \ln\widetilde{(MW_{c_\iota t})}$ for a small enough d.

The validity of the identification assumption critically depends on the size of d. We face a tradeoff regarding the choice of d. The smaller the d, the more likely that this identification assumption is satisfied. Meanwhile, the smaller the d, the smaller the amount of business activities that the border areas cover. For our baseline analysis, we choose d to be one kilometer. Specifically, we restrict the areas for comparison to two-kilometer bands along county borders, with one-kilometer bands on each side of the borders. The one-kilometer border areas are small for the majority of counties in China in terms of both the sizes of geographic areas and the shares of economic activities. In our sample, the median size of a county is 1492 km^2, about 38km*38km for an imaginary square-shaped county with four neighboring counties. Each one-kilometer band near a neighbor of the county accounts for 2.59%[6] of the county's area[7]. The entries within the one-kilometer border area next to one of a county's neighbor on average only accounts for 3.6% of the total entries in the county. The 90th percentile of this share is 4.5% and the 95th percentile is 13.8%. Beside the one-kilometer band, we also report results as we relax this d to be two, three, and four kilometers, as well as when we use the entire county instead of the narrow area running along the border for spatial differencing. In robustness checks, we further examine how the percentage of the economic activities that the one-kilometer border areas account for relative to the whole counties affects the identification assumption and the estimates.

[6] (1km*38km)/(38km*38km) =2.59%

[7] The 10th percentile of the size distribution of counties in China is 231 km^2 (about 15km*15km). For an imaginary square-shaped county, each one-kilometer band accounts for only 6.67% (231 km^2 ≈ 15km*15km; (1km*15km)/(15km*15km) =6.67%) of the area of a county.

In our implementation, we organize the data at the county-pair-year level, take spatial difference for the dependent variable, the log (minimum wage), and all control variables. We then estimate (3) by regressing (2) with $\Delta_{\mathrm{d}}\gamma_i$ controlled for using the county-pair fixed effects. We use the log plus one transformation of the number of entries as the dependent variable y_{it} to handle cases of zero entries. For control variable X_{it}, we include the log (number of pre-existing establishments by sector+1) in the primary, secondary, and tertiary sector, separately, to account for both the size and the sectoral composition of economic activities. We use robust standard errors clustered at the county level to allow for arbitrary forms of heteroskedasticity, spatial correlation across a given county's neighboring counties, and serial correlation across years.

Using areas that are contiguous to a treated area as the control group is not new to the minimum wage literature. For example, Card and Krueger (1994, 2000) studied minimum wage effects in New Jersey and Pennsylvania by comparing employment figures in these two neighboring states before and after New Jersey raised its minimum wage. Dube, Naidu, and Reich (2007) used San Francisco and the adjacent East Bay to make a similar comparison. Compared to the case-study-style difference-in-differences approach, our approach is more similar to Dube, Lester, and Reich (2010), which took full advantage of all minimum wage differences between pairs of neighboring counties. In their setting, the minimum wage rates varied at the state level and the areas under study were the contiguous counties along the state borders. In our paper, the minimum wage rates vary at the county level and the areas under study are the areas of narrow widths running along the county borders.

What is more, following Fan, Lin, and Tang (2018), we strengthen our identification by showing that the new-business-discouraging effects of minimum wage rates are stronger in industries that are exposed to minimum wages more directly. We compare the effects of

the minimum wage on new business entries in industries that employ large shares of low-wage unskilled workers with the effects on industries that do not. This cross-industry comparison provides a third differencing in addition to the spatial differencing and time differencing, which helps isolate the effects of the minimum wage from other government policies that may affect business entries across industries uniformly.

4. Data and Sample

4.1 Minimum wage policies in China

The evolution of minimum wage policies in China played out over three stages marked by increasingly strict enforcement. These three policy stages occurred from 1994 to 2004, 2004 to 2008, and in a post-2008 stage. Early implementation of minimum wage policies began in 1989 in Zhuhai in Guangdong province, followed by Guangzhou, Jiangmen, and Shenzhen in the same year. These coastal cities, which are located in southeastern China, were at the frontier of China's market transition and were among the first to experience labor–capital conflicts. In 1993, the first national Minimum Wage Regulations in China were introduced and were later written into the 1994 version of the Chinese Labor Law (Lin and Yun 2016). According to the 1994 legislation, each province, municipality, and autonomous region is required to set and adjust its own minimum wage based on comprehensive consideration of the following five factors: (1) the minimum cost of living and the number of dependents an average worker supports, (2) average local wages, (3) labor productivity, (4) local employment conditions, and (5) economic development at the local level.[8] These requirements reflect the inherent tradeoff that governments face, where a minimum wage rate that is too low relative to the local cost of living will be insufficient, while a minimum wage

[8] http://www.lawinfochina.com/display.aspx?id=705&lib=law#menu4

rate that is too high relative to the local stage of economic development may deter domestic and foreign investment (Frost 2002).

In 2004, concerns grew that minimum wage rates were rising too slowly and inequality both within and across cities in tandem was worsening in the midst of China's rapid economic growth. In response to these concerns, the Ministry of Labor and Social Security of China reformed the "Minimum Wage Regulations" by introducing an hourly minimum wage for part-time workers, requiring the minimum wage rate to be updated at least once every two years, and increasing penalties for violators fivefold, from an interval ranging between 20% and 100% of wages to an interval ranging between 100% and 500% of wages. In addition, the 2004 Regulations clarified that minimum wage policies also cover workers in privately owned entities and sole proprietorships. Moreover, firms cannot use overtime pay and legally required supplementary income to meet the minimum wage requirements. Later in the same year, the State Council of China promulgated the Decree of Labor Inspection, which also strengthened the enforcement of minimum-wage rules (Mayneris, Poncet, and Zhang 2018).

In 2008, China's Labor Contract Law came into effect, significantly increasing the percentage of workers with formal labor contracts (Freeman and Li 2015; Gallagher et al. 2015) and contributing to a more consistent enforcement of labor regulations across Chinese cities (Huang, Loungani, and Wang 2014). In the absence of a mature mechanism for negotiations between labor and capital, many firms use the local minimum wage rate as their reference point in setting wage levels. According to a survey administered in Guangdong province, about 28.5% of firms and 37% of workers have the local minimum wage rate written directly into their labor contracts as their base pay (Sun, Liu, and Fan 2019).

We obtain minimum wage data from the Ministry of Human Resources and Social Security (MOHRSS) and the China Academy of Labor and Social Security. The data cover all adjustments of minimum wage rates at the county level between 1992 and 2012. Among the 2,858 county-level units in mainland China, 2,670 maintain minimum wage data for every year between 1997 and 2012.[9] In Figure 1, Panels (A) and (B), we display the county-level monthly nominal minimum wage rate in China in 1997 and 2012, respectively. We use the monthly minimum wage rate in this paper, as the hourly minimum wage rate is usually set as a monthly minimum wage rate divided by the monthly working hours of full-time workers (Hau, Huang, and Wang 2020). In Figure 2, we show that the average nominal minimum wage rate rose from 190 yuan in 1997 to 936 yuan in 2012. The minimum wage rate was more than 42% of the provincial average manufacturing salaries in 1997. This ratio dropped to about 30% by 2012. The ratio may appear low relative to that in developed countries. Note, however, that overtime pay and other legally required income supplements are calculated as multiples of base pay in China, especially after the 2008 Labor Contract Law. With base pay often set at the local minimum wage rate, the monthly payments of a large portion of workers are tied to the local minimum wage rate, even if the actual monthly pay is higher than the minimum wage rate (Ye, Li, and Yang 2016).

[9] The number of county-level units that maintain minimum wage data throughout the sample period falls slightly short of the number of county-level units in the 2014 version of administrative divisions for two reasons. First, there are minor changes across distinct versions of administrative divisions as a result of (1) the upgrading of some counties to county-level cities or municipal districts, (2) the merging of two districts or two counties into one, and (3) dividing prefectural cities into county-level subdivisions. The first scenario is associated with county name changes while the latter two scenarios decrease or increase the number of counties. From the sample we used for our analysis, we drop counties or districts related to the latter two scenarios. For the remaining the counties, county borders remain stable over time. Second, among counties that exist in all versions of administrative divisions, some did not impose a county-level minimum wage in the early years of the sample period. These counties are mostly rural and agricultural, with few employed workers during the early years, becoming urbanized only later. We keep the sample balanced by not including those counties in our analysis.

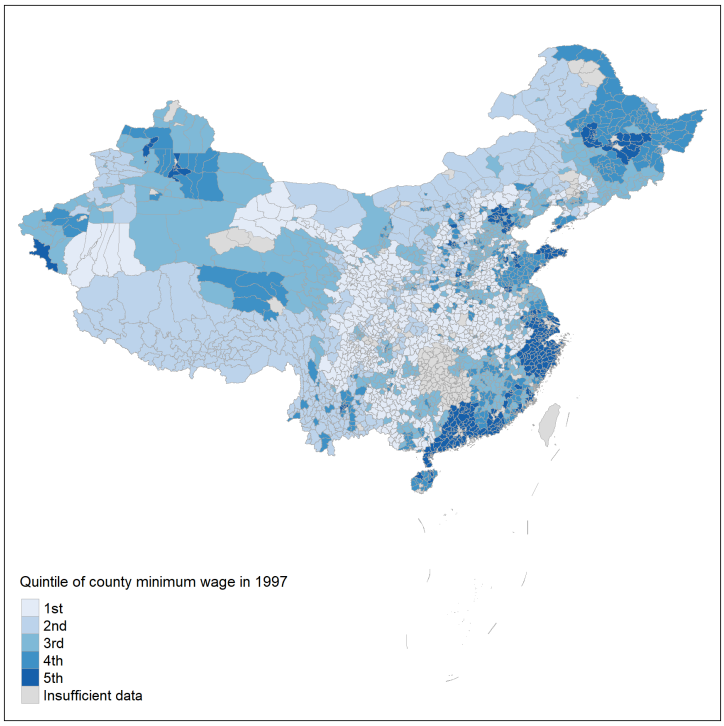

Figure 1(A): County-Level Monthly Nominal Minimum Wage in 1997

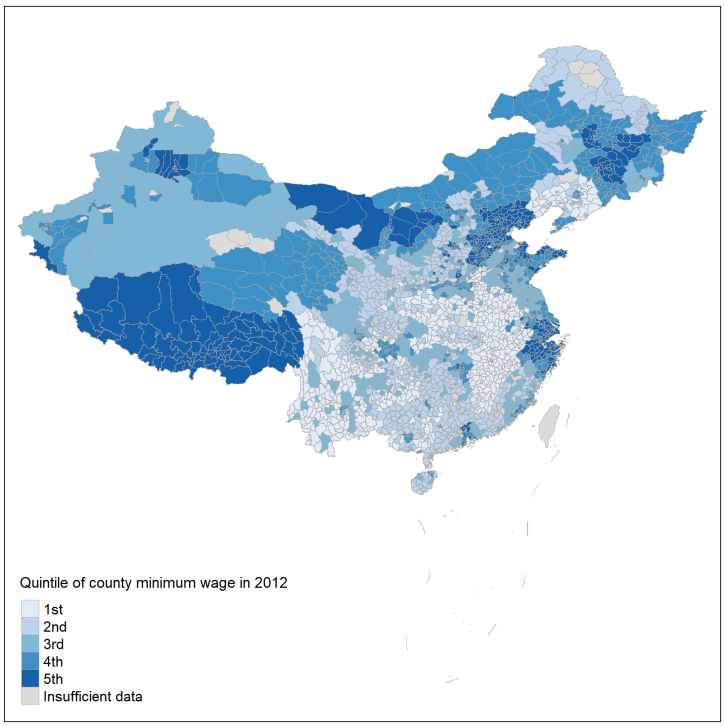

Figure 1(B): County-Level Monthly Nominal Minimum Wage in 2012

Notes: The sample is limited to the 2,670 counties for which minimum wage information for every year from 1997 through 2012 is available.

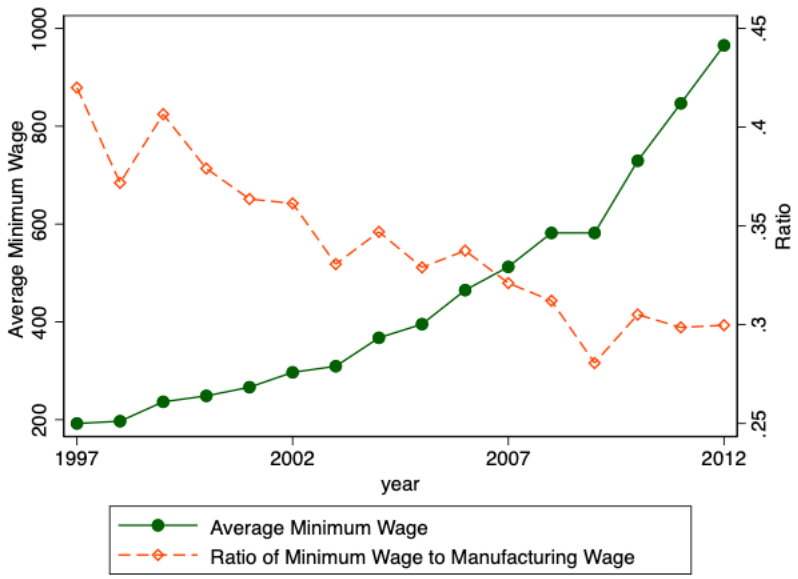

Figure 2: Minimum Wage Trends

Notes: We obtain average wages in the manufacturing sector by province from 1997 through 2012 from the China Statistical Year Book. We then calculate the ratio of the county-level minimum wage to the provincial average manufacturing wage and take average of this ratio across counties by year. The lack of any change in the minimum wage level and the dip in the minimum wage–to–manufacturing wage ratio between 2008 and 2009 was the result of an announcement made by China's Ministry of Human Resources and Social Security to temporarily freeze adjustments in the minimum wage in response to the international financial crisis.

Since the inception of a minimum wage policy in China, minimum wage rates have been set to vary across county-level administrations. On average, a province administers twelve prefectural cities and a prefectural city administers eight counties or municipal districts.[10] Provincial governments typically establish three to five levels of minimum wage rates and allow each municipal district and county to choose the appropriate level for its minimum wage rate based on local conditions. The adjustment date of a county's minimum wage rate can differ from the dates on which its neighboring counties within the same province adjust their rates (Fang and Lin 2020). What is more, both the range of minimum wage rates and the number of separate minimum wage rates within a prefectural city can vary

[10] We use the 2014 version of the administrative divisions of the People's Republic of China as our benchmark list of counties in China. As of 2014, mainland China was to be divided into four municipalities (Beijing, Tianjin, Shanghai, and Chongqing) and 27 provinces, the latter of which are divided into 333 prefectures. Municipalities and prefectures are further divided into 2,858 county-level units, including both municipal districts and counties. In the remainder of this paper, we treat urban districts and counties equivalently and refer to both as counties, except when these distinctions are explicitly investigated in the robustness section.

over time.[11] As a result, there are rich variations in minimum wage rates across counties and districts within the same prefecture.

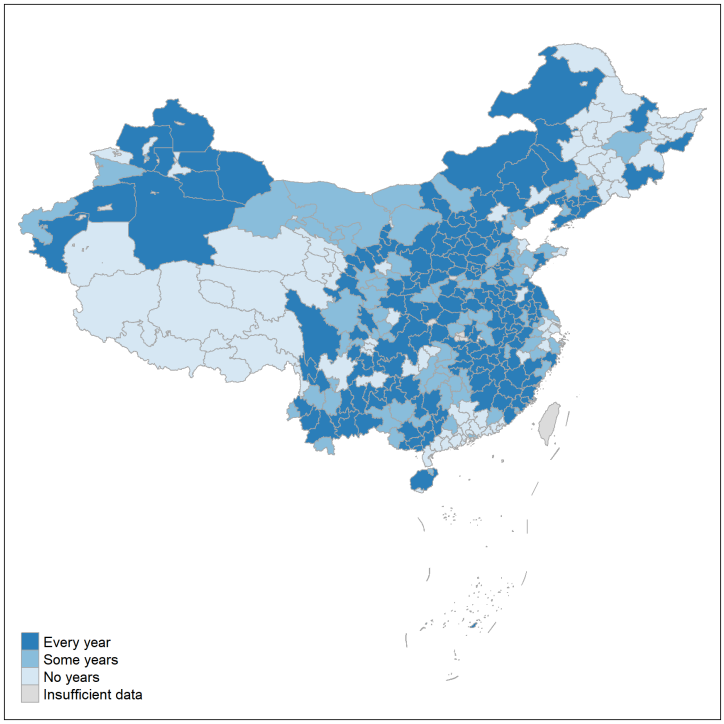

Figure 3: Frequency of Cross-County Variation in the Minimum Wage

Notes: Each delineated area in mainland China indicates a prefecture. Chongqing and 172 prefectures exhibit cross-county variation every year over our sample period. Tianjin and 80 prefectures exhibit cross-county variation in at least one year over our sample period. Beijing, Shanghai, and 81 prefectures have kept the same minimum wage level across counties.

Our identification strategy relies on within-prefecture cross-county variations in minimum wage rates. In Figure 3, we show that Chongqing and 173 prefectures exhibit cross-county variation every year over our sample period. Tianjin and 81 prefectures exhibit cross-county variation in at least one year over our sample period. Beijing, Shanghai, and the remaining 78 prefectures have maintained uniform minimum wage rates across counties. These prefectures are concentrated in four provinces: Tibet, Qinghai, Heilongjiang, and Jilin.

[11] An example of this time variation can be found in Chongqing. In 1997, there were four minimum wage rates: 210 yuan per month in seven counties, 190 yuan in seven counties, 170 yuan in 17 counties, and 150 yuan in five counties. Two counties were excluded from the 1997 Chongqing minimum wage policy document because they were dominated by agriculture and minimum-wage-eligible employment was too low to be relevant. In 2012, there were three minimum wage rates: 1,050 yuan per month in 21 counties, 950 yuan per month in 15 counties, and 750 yuan per month in two counties.

The former two are located in western China and feature low population density, while the latter two are located in northeastern China.

In Figure 4 we show that there were more than two thousand contiguous county pairs within the same prefecture that imposed varying minimum wage rates. Among these county pairs, the average difference in their nominal minimum wage rates increased from 30 yuan in 1997 to 126 yuan in 2012. The percentage difference, calculated as the difference divided by the lower of the minimum wage rates between the two counties, fluctuated between 14% and 18%. These rich within-prefecture cross-county variations in minimum wage rates makes our refined border approach feasible.

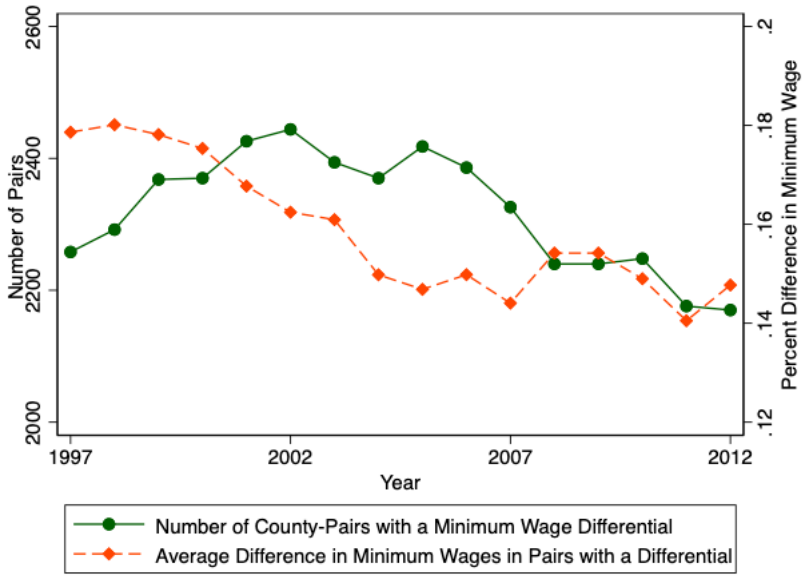

Figure 4: Number of Same-Prefecture Neighboring County Pairs with Minimum Wage Differentials and Average Minimum Wage Differentials.

4.2 China's Business Registration Database

We obtain business entry data from the National Enterprise Credit Information Publicity System (NECIPS).[12] In China, all firms are required by the Company Law and the

[12] http://gsxt.gdgs.gov.cn

Partnership Law to register annually with the State Administration of Market Regulation (SAMR) to renew their business licenses and update any business or ownership changes. SAMR releases these business registration records through the NECIPS for the convenience of law enforcement and to enable the public to search and verify firms' legal status.

As a result of their administrative origin, the registration data cover the entire population of business entries that have occurred in China since 1985. These data include each firm's name, legal status (active, deceased, or merged), ownership type (e.g., individual proprietorship, privately owned firm, state- or collectively owned enterprise, foreign-invested enterprise), one-digit industry category, detailed descriptions of the scope of business activities, amount of registered capital, incorporation date, address, and shareholder list. Using registration addresses, we are able to obtain firms' latitude and longitude coordinates, which we use to geolocate firms in relation to counties and county boundaries. Using the shareholder list, we measure business relocation as entries in one county with at least one shareholder who also owns some pre-existing establishment on the other side of the county border.

4.3 Sample and Summary Statistics

We organize our sample at the county-pair-year level. We impose three restrictions on the baseline sample of neighboring county pairs: (1) each of the two counties must have implemented a minimum wage over the entire sample period, (2) each of the two counties must include at least one business entry over the sample period, and (3) both counties must be located in the same prefecture. In this baseline sample, we treat municipal districts and counties equivalently and refer to all county-level administrative units as counties. For counties that experience entries in some years but no entries in others, we fill the rare no-entry observations with zeroes. This procedure results in a balanced panel of 7,384 distinct

Table 1: Summary Statistics

Sample Period: 1997-2012

Panel (A) Summary Statistics at the City-Year Level

Number of Cities: 317; Number of City-Year Cells: 5,072.

Share of city-year cells with uniform minimum wage: 34.7%

Variable:	Mean	Std. Dev.	Min	Max
Number of Counties per City	8	4	2	35
Minimum Wage Range	47.9	53.3	0	370

Panel (B) Summary Statistics at the County-Year Level

Number of Counties: 2,526; Number of County-Year Cells: 40,416.

Share of County-Year Cells with zero entries: 1.87%

Variable:	Mean	Std. Dev.	Min	Max
Nominal Minimum Wage	448	249	130	1,500
Number of New Entry	682	1,411	0	44,074
Number of Same-Prefecture Neighboring Counties	3	1.4	1	10
Number of Preexisting Establishments by Sector[1]				
Primary Sector	87	176	0	4,383
Secondary Sector	591	1,485	0	51,601
Tertiary Sector	1,973	4,779	0	130,263

Panel (C) Summary Statistics at the County-Pair-Year Level,
Neighboring *County Pairs within Same Prefecture.*

Number of County Pairs: 7,384; Number of County-Pair-Year Cell: 118,144.

Share of County-Pair-Year Cells with Different Minimum Wages: 31.4%

Variable:	Mean	Std. Dev.	Min	Max
Cross-Border Difference in Minimum Wage[2]	19	37	0	370
Cross-Border Difference in Entries[2]				
within a ***1km*** band on each side of the border	41	354	0	17,241
within a ***2km*** band on each side of the border	76	432	0	17,887
within a ***3km*** band on each side of the border	114	550	0	18,570
within a ***4km*** band on each side of the border	150	654	0	19,246
county total	615	1,502	0	44,063
Share of New Entries Near Border[3]				
within a ***1km*** band near the border	0.036	0.103	0	1
within a ***2km*** band near the border	0.076	0.175	0	1
within a ***3km*** band near the border	0.112	0.222	0	1
within a ***4km*** band near the border	0.146	0.257	0	1

Notes: [1] The primary sector includes "Agriculture, Forestry, and Fishing" and "Mining", the secondary sector includes "Manufacturing" and "Construction", and the tertiary sector includes "Transportation and Warehousing", "Accommodation & Food Services", "Wholesale and Retail", "Real Estate ", "Education", "Arts, Entertainment and Recreation", "Scientific Research and Technical Services", "Leasing and Business Services", "Finance", "Information", "Health Care and Social Assistance", and "Other Services". [2] In absolute values. [3] There are 1,990 pair-year observations with zero county total entries and these observations were not used to calculate the share of new entries.

same-prefecture neighboring county pairs consisting of 2,526 counties observed every year between 1997 and 2012.[13]

We report summary statistics in Table 1. Among the 2,526 counties that comprise our sample, a county experiences on average about 682 new entries per year and have three neighboring counties within the same prefecture. The one-kilometer band near a county's border with a neighboring county within the same prefecture accounts for 3.6% of the county's new entries. This ratio increases to 7.6%, 11.2%, and 14.6% when we expand the band widths to 2 km, 3 km, and 4 km respectively. The cross-border differences in new entries within 1 km of a border ranges between 0 and 17,241, with an average of 42 new entries. Some 31.4% of the county-pair-year cells impose different minimum wage rates. Among these county-pair-year cells that impose different minimum wage rates, the cross-border difference in minimum wage rates is on average 61 yuan, which is about 14.5% relative to the mean of the minimum wage rates on both sides of a county border. When all county-pair-year cells in the sample are included, the average cross-border difference in minimum wage rates is 19 yuan.

5. Results

5.1 Baseline

In Table 2 we report the baseline results as specified in estimation equation (3). For column (1) we restrict the sample area to the one-kilometer band on each side of a county border among neighboring counties within the same prefecture. The narrowness of the bands

[13] There are 11 prefectural cities in Hunan Province together with Shenyang (in Liaoning Province) that did not maintain minimum wage information before 2000. Ziyang (in Sichuan Province) began imposing a minimum wage in 2002. As of 2014, four prefectural cities had not been further divided into counties or districts and thus do not form within-city neighboring county pairs (Dongguan, Zhongshan, Jiayuguan, and Sanya). Foshan maintains minimum wage information for only one of its five districts. Suqian (in Jiangsu Province) includes five county-level units, among which four imposed a minimum wage only in 2006. These prefectures are thus dropped from the dataset to construct the balanced panel.

ensures that the cost of living, local market access, and local supply chains are similar on both sides of a county border. We find that raising the minimum wage rate by 10% decreases the entry of new business establishments by 2.69% and that this effect is statistically significant at the 1% level.

Table 2: Effects of Minimum Wage on Entry

Dep. Var.	Cross-Border Differences in Log (number of entries + 1)				
	1km	2km	3km	4km	County Total
	(1)	(2)	(3)	(4)	(5)
Cross-Border Differences in Log (Min. Wage)	-0.269***	-0.233***	-0.080	-0.103	0.331***
	(0.079)	(0.085)	(0.092)	(0.091)	(0.076)
Cross-Border Differences in Log (Number of Pre-existing Establishment by Sector+1)					
Primary Sector	0.029***	0.059***	0.061***	0.064***	0.096***
	(0.007)	(0.008)	(0.008)	(0.008)	(0.007)
Secondary Sector	0.020*	0.024*	0.037***	0.050***	0.080***
	(0.011)	(0.012)	(0.014)	(0.014)	(0.014)
Tertiary Sector	0.049***	0.072***	0.096***	0.116***	0.290***
	(0.009)	(0.010)	(0.011)	(0.011)	(0.011)
County-Pair FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
Observations	118,144	118,144	118,144	118,144	118,144
R-squared	0.754	0.771	0.790	0.809	0.854

Notes: Robust standard errors clustered at the county level are shown in parentheses: *** p<0.01, ** p<0.05, *p<0.1. The sample includes all the same-prefecture neighboring county pairs that satisfy the following two requirements: (1) minimum wage information is available for both counties throughout the period running from 1997 through 2012; (2) there is at least one business entry in either county of the county pair over the sample period from running 1997 through 2012. Note that we treat municipal districts as equivalent to counties. Therefore, pairs of geographic units that consist of two neighboring municipal districts and those that consist of one municipal district and one neighboring county are also included. The dependent variable for column (1) is the cross-border difference in logged one plus the number of entries within one kilometer of the county border. The dependent variables used to obtain the results reported in columns (2), (3), and (4) are constructed similarly, except we enlarge the sample area from a two-kilometer band to a four-kilometer band on each side of a county border. The dependent variable for column (5) is constructed using total entries in the entire county instead of entries near the border.

Minimum wage rates are higher in counties that are more economically developed and active. When it is infeasible to control for these local prosperity dynamics, an endogeneity issue arises that produces an underestimation of the negative effects of a

minimum wage on new business entry and, in some cases, a positive coefficient. To obtain the results reported in columns (2) through (4) we gradually enlarge the sample areas from two-kilometer bands to four-kilometer bands on each side of the county borders. We find that, as the comparability in local prosperity on two sides of the county borders decreases, both the size and statistical significance of the minimum wage coefficient decreases, although the sign remains negative.

In column (5), we report results obtained using total entries in an entire county instead of entries near the border as our dependent variable. The results suggest that counties that impose higher minimum wage rates attract more new business entries. The differences between the results reported in column (5) and those reported in column (1) confirm that ignoring the endogeneity issue associated with minimum wage rates will lead to a biased estimate of the minimum wage effects on business entries.

5.2 By Exposure to the Minimum Wage

In this subsection, we examine how the effects of increasing minimum wage rates on new business entries vary across industries with differential exposure to a minimum wage. Because our identification strategy relies on comparisons between counties within the same prefecture, policies varying at the prefecture or provincial level do not affect our baseline identification. We address the remaining concerns regarding policies that may vary at the county level by comparing the effects of a minimum wage on new entries of businesses that operate in industries that employ large shares of low-wage unskilled workers with the effects of a minimum wage on industries that do not. Given that low-wage and unskilled workers are more likely to be affected by minimum wage policies, this comparison enables us to isolate the effects of the minimum wage from the effects of other government policies.

To show the heterogenous influence of the minimum wage rates on entries of different industries, in this section we organize the data at county-pair-industry-year level. We obtain the industry-level average salary data from CEIC[14], and the workers' educational achievement and job industries from the Fifth National Population Census of China[15]. In Table 3 Column (1) we report the regression results based on this sample and control for county-pair fixed effects *by industry* as well as year fixed effects. The coefficient of the cross-border difference in log (minimum wage) is -0.037, statistically significant at the 1% level. Since for this regression we count the number of entries by industry, this coefficient is smaller than that in our baseline result where the number of entries of all industries are pooled together. In Column (2), we add the interaction term between the cross-border difference in log (minimum wage) and log (industry level average salary in 2004). The coefficient of this interaction term is 0.036, significant at the 10% level. Meanwhile, the coefficient of the cross-border difference in log (minimum wage) remains negative with a bigger size, and is still significant at the 5% level. The two coefficients taken together suggest that the entry-discouraging effect of increasing minimum wage rates is stronger for low-salary industries and weaker for high-salary industries[16].

In column (3), we add the interaction term between the cross-border difference in log (minimum wage) and the industry-level share of workers with no more than primary school education. The coefficient of the interaction term is -0.050, significant at the 10% level. The coefficient of the cross-border difference in log (minimum wage) is -0.013. The lack of

[14] www.ceicdata.com
[15] Downloaded from international.ipums.org.
[16] For example, the Information industry was the industry with the highest average salary in 2004 at 33,449 yuan, the natural logarithm of which is 10.42. Thus, the effects of minimum wage on entries in the Information industry is: -0.384+0.036*10.42=-0.0089. In contrast, the manufacturing industry had an average salary of 14,251 yuan in 2004, the natural logarithm of which is 9.56. Thus, the effects of minimum wage on entries in the manufacturing industry is: -0.384+0.036*9.56=-0.040, about four-fold the size of that in Information industry.

statistical significance of this coefficient is as expected. It indicates that, for an industry with all of its workers finishing primary education, the number of entries is not responsive to changes in minimum wage rates. As the industry-level share of low-education workers increases, the industry-level entries are more responsive to minimum wage rates.

Table 3: Entries in Industries More Exposed to Minimum Wages are More Affected

Dep. Var.: Cross-Border Differences in Log (number of entries + 1), 1km to border	(1)	(2)	(3)
Cross-Border Differences in Log (Min. Wage)	-0.037***	-0.384**	-0.013
	(0.018)	(0.183)	(0.013)
Cross-Border Differences in Log (Min. Wage) *X* Industry Level Characteristics			
Log (Average Salary in 2004)		0.036*	
		(0.019)	
% Workers with no more than Primary School Education			-0.050**
			(0.024)
Cross-Border Differences in Log (Number of Pre-existing Establishment by Sector+1)			
Primary Sector	0.001**	0.001**	0.001**
	(0.000)	(0.000)	(0.000)
Secondary Sector	0.007***	0.007***	0.007***
	(0.001)	(0.001)	(0.001)
Tertiary Sector	0.011***	0.011***	0.011***
	(0.001)	(0.001)	(0.001)
County-Pair-Industry FE	Y	Y	Y
Year FE	Y	Y	Y
Observations	2,180,576	2,180,576	2,180,576
R-squared	0.589	0.589	0.589

Notes: Robust standard errors clustered at the county level are shown in parentheses: *** p<0.01, ** p<0.05, *p<0.1. Data on industry-level average salaries in 2004 are obtained from www.ceicdata.com. Data on industry-level education are aggregated from the 2000 Population Census, available for download at international.ipums.org. In all specifications, we control for the Cross-Border Differences in Log (Number of Pre-existing Establishment by Sector+1) for the primary sector, the secondary sector, and the tertiary sector.

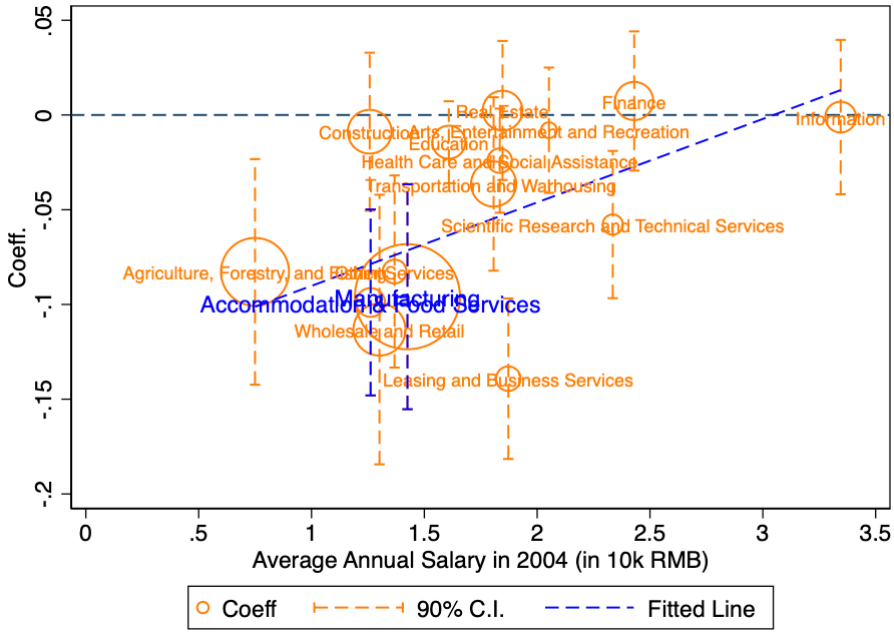

Figure 5(A): Effects of Minimum Wage Decreases in Industry Average Salaries

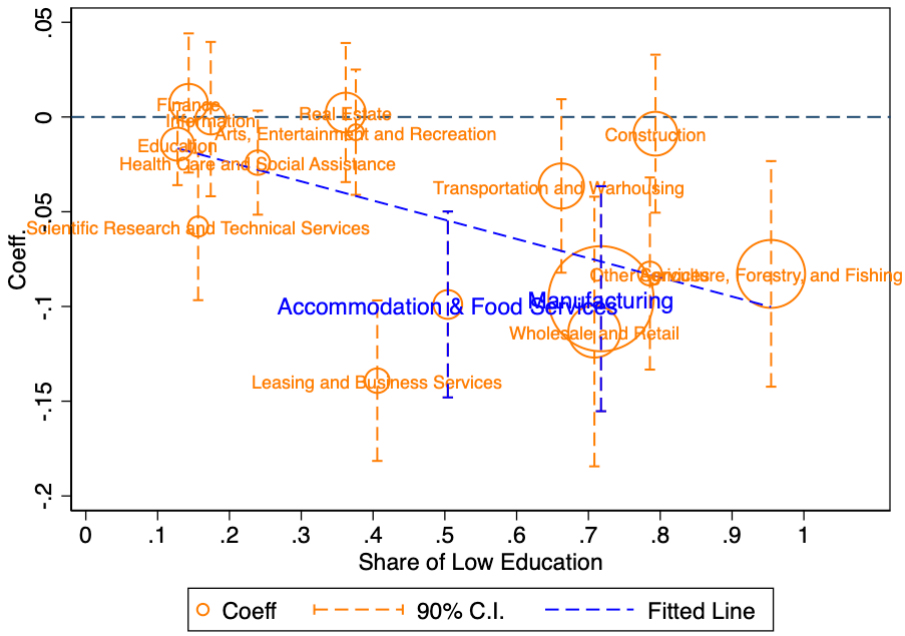

Figure 5(B): Effects of Minimum Wage Increases in Share of Unskilled Workers

Notes: The centroid of each circle corresponds to a separate regression, specified from equation (3) with the dependent variable constructed using the number of industry-specific entries within a one-kilometer band near a county border. Data on industry-level GDP and average salaries in 2004 are obtained from www.ceicdata.com. Data on industry-level education is aggregated from the 2000 Population Census and is obtained from international.ipums.org. We define "low education" as having not completed higher than a primary-school-level education. The size of each circle indicates the relative GDP of the labeled industry in 2004, in reference to which the linear fitted lines are weighted. The slope of the fitted line in Figure 5(A) is 0.044, with a p-value of 0.034. The slope of the fitted line in Figure 5(B) is -0.101, with a p-value of 0.020.

To provide more transparency about the effect of minimum wage on entries in each industry, we also run the specification that corresponds to column (1) of Table 2 by industry. The industry-level results are consistent with what has been previously documented in the literature. Minimum wage changes significantly influence the manufacturing sector as well as the food and accommodations service industries. Such changes do not, however, matter as much for highly paid service industries such as the finance, information, and real estate industries. We plot these regression coefficients against industry-level characteristics in Figure 5. In both Figure 5 (A) and (B), the vertical axis indicates the effects of increasing minimum wage rates on industry-specific entries located within one kilometer of a county border from our baseline specification. In Figure 5(A), the horizontal axis indicates the industry average annual salaries in 2004. In Figure 5(B), the horizontal axis indicates the share of workers who advanced educationally no further than primary school. Both the upward sloped linear fitted line in Figure 5(A) and the downward sloped linear fitted line in Figure 5(B) are consistent with the regressions using interaction terms in Table 3. To the extent that the effects of other county-level policies do not vary systematically with the industry-level share of low-wage and unskilled workers, it is the difference in minimum wage rates that cause the abrupt changes in the number of new entries across the county borders.

5.3 By Policy Period

We now consider the effects of minimum wage rates on new business entries across varying policy periods. As discussed in Section 3, the Ministry of Labor and Social Security reformed China's national minimum wage system in 2004 (Mayneris, Poncet, and Zhang 2018) and a new Labor Contract Law was introduced in 2008 (Du et al. 2016, Gallaghre et al. 2015). We expect the effects of minimum wage rates on business entries to be progressively

larger after the 2004 and 2008 policy changes because of the increasingly strict enforcement of minimum wage policies.

Table 4: Effects of Minimum Wage by Policy Period

Dep. Var.:	Dep. Var.: Cross-Border Differences in Log (number of entries + 1), 1km to border	
	(1)	(2)
Cross-Border Differences in Log (Min. Wage) *X*		
1997–2003	-0.239***	-0.237***
	(0.0879)	(0.0882)
2004–2012	-0.318***	
	(0.0860)	
2004–2008		-0.292***
		(0.0829)
2009–2012		-0.352***
		(0.109)
Cross-Border Differences in Log (Number of Pre-existing Establishment by Sector+1)		
Primary Sector	0.0277***	0.0273***
	(0.00708)	(0.00715)
Secondary Sector	0.0191*	0.0190*
	(0.0109)	(0.0109)
Tertiary Sector	0.0493***	0.0494***
	(0.00896)	(0.00896)
County Pair FE	Y	Y
Year FE	Y	Y
Observations	118,144	118,144
R-squared	0.754	0.754

Notes: Robust standard errors clustered at the county level shown in parentheses: *** p<0.01, ** p<0.05, *p<0.1. The sample includes all the same-prefecture neighboring county pairs that satisfy the following two requirements: (1) minimum wage information is available for both counties throughout the period running from 1997 through 2012; (2) there is at least one business entry in either county of the county pair over the sample period running from 1997 through 2012. Note that municipal districts are treated as equivalent to counties. Therefore, pairs of geographic units that consist of two neighboring municipal districts and those that consist of one municipal district and one neighboring county are also included.

We examine the effects of minimum wage rates across policy periods and report the results in Table 4. For column (1), we interact the cross-border difference in the log (minimum wage) with a "pre-2004" dummy and a "post-2004" dummy. We find that the effects of minimum wage rates on new entries are negative in both periods. The coefficient, however, is larger in size with a larger t-statistic after 2004 than before, although the

difference between the two coefficients is not statistically significant. A 10% increase in a county's minimum wage is associated with a decline in new business entries of 2.39% before 2004. After 2004, this coefficient increases to 3.18%. The coefficients for both periods are significant at the 1% level. For column (2), we further decompose the post-2004 period into two sub-periods, 2004–2008, and 2009–2012, and interact the cross-border difference in the log (minimum wage) with all three period-indicating dummies. The effect of a minimum wage is significant at the 1% level for all the three periods. Although the differences between these period-specific coefficients are statistically insignificant, the sizes of these coefficients are magnified in later periods as the enforcement of minimum wage policies becomes stricter.

5.4 Business Relocation Effects

In this section, we estimate the size and the significance of the business relocation effects of increasing local minimum wage rates. Local changes in policies that reduce the local costs of running businesses relative to neighboring areas could attract businesses from those neighboring areas. We make use of the identity information of shareholders of registered firms to measure business relocation[17]. Specifically, we identify the number of entries in one county with at least one shareholder who is also listed as a shareholder of one or more pre-existing establishments on the other side of the county border. Our measure thus includes three types of business relocation. First, our measure includes the cases of business relocation in a strict sense that involves an entry and a paired exit of the same business, based on the assumption that "the same business" involves at least some same business owners. Second, our measure also includes the scenarios when a business owner reduces production

[17] In the practice of Chinese business registration, there is no readily available indicator for business relocation. An establishment may stop production and dismiss all workers without formally deregistering with the State Administration of Market Regulation (SAMR) in a timely manner, as the local Administration of Industry and Commerce has incentives to delay or discourage deregistering to avoid appearing incompetent. As a result, matching based on business names between contemporaneous entries and exits in neighboring counties provides limited information for identifying business relocation.

and dismisses some workers from a pre-existing establishment on the higher-minimum-wage side of a county border, starts a new establishment on the lower-minimum-wage side of a county border, and transfers part of its labor-intensive activities from the former to the latter. In this case, even though the total number of establishments in the pair of counties increases, the overall economic activities may remain the same. Lastly, our measure includes the cases when a business owner of a pre-existing establishment starts a new business without reducing the activities in his or her original establishment. This is not the relocation of pre-existing economic activities, but the "relocation" of *potential* economic activities that could have occurred near the original plant as proximity facilitates communication and management (Giroud 2013) but ends up located on the other side of the county border to benefit from the lower labor costs.

With this measure, we find that the number of entries relocated from neighboring counties is small. At the county-pair-year level, among the 682 new entries in a county, on average only 0.610 have shareholders ever appeared also as shareholders in its neighboring county, a percentage of 0.09%. This percentage is slightly higher though still small when we restrict our observation to the border areas. At the county-pair-year level, among the average of 31 new entries within the one-kilometer band adjacent to another county, on average only 0.117 entries have shareholders ever appeared as shareholders in the paired neighboring county, a percentage of 0.38%.

In Table 5, we provide regression results to show that changes in the minimum wage rates have statistically insignificant effects on the relocation of establishments. In Panel A, we take the pairwise difference of the log plus one transformation of the number of "relocated entries" as the dependent variable. To obtain the results reported in columns (1) through (4) we gradually enlarge the sample area from a one-kilometer band to a four-

kilometer band on each side of a county border. The coefficient in column (1) is negative, consistent with the prediction that a lower minimum wage attracts more entries relocated from a neighboring county. Nevertheless, this coefficient is statistically insignificant. The coefficients in column (2), (3), and (4) are also statistically insignificant. In column (5), we report results obtained using total entries in an entire county relocated from its paired neighboring county to construct our dependent variable. Note that since we do not apply the border approach in column (5), the result shows correlation rather than causality. The positive and significant coefficient in column (5) thus indicates that counties with higher minimum wage levels tend to have more entries relocated from neighboring counties, possibly because these counties are more economically prosperous to begin with.

Table 5: "Relocated" Entries and "Fresh" Entries.

Panel A					
Dep. Var.	Cross-Border Differences in Log (number of "*relocated*" entries + 1)				
	1km	2km	3km	4km	County Total
	(1)	(2)	(3)	(4)	(5)
Cross-Border Differences in Log (Min. Wage)	-0.006	0.001	0.013	-0.025	0.161***
	(0.015)	(0.021)	(0.024)	(0.026)	(0.046)
Observations	118,144	118,144	118,144	118,144	118,144
R-squared	0.306	0.337	0.365	0.372	0.300
Panel B					
Dep. Var.	Cross-Border Differences in Log (number of "*fresh*" entries + 1)				
	1km	2km	3km	4km	County Total
	(1)	(2)	(3)	(4)	(5)
Cross-Border Differences in Log (Min. Wage)	-0.259***	-0.226***	-0.072	-0.096	0.331***
	(0.079)	(0.085)	(0.092)	(0.091)	(0.076)
Observations	118,144	118,144	118,144	118,144	118,144
R-squared	0.753	0.771	0.790	0.809	0.854

Notes: In Panel A, we define "relocated" entries as the new entries with at least one shareholder who also owns shares of at least one pre-existing establishment on the other side of the county border. In Panel B, we define "fresh" entries as those without any shareholder who owns shares of any pre-existing establishment on the other side of the county border. In all specifications, we control for the cross-border differences in the log (number of pre-existing establishments by sector+1) in the primary, secondary, and tertiary sector, county-pair fixed effects, and year fixed effects.

In Panel B, we subtract the "relocated entries" from the new entries, and take the cross-border difference of the log plus one transformation of these "fresh" entries as the dependent variable. We find a pattern that is close to what we uncovered in our main results (Table 2). Although the sizes of the coefficients are smaller than those in Table 2, these differences are insignificant. In other words, while "relocation" accounts for part of the entry-discouraging effects of higher minimum wages, the bulk of the effects comes from discouraging "fresh" new entries that have no prior ownership ties to establishments in neighboring counties.

In summary, with our measure of business relocation, these results show that increasing county-level minimum wage rate does not have significant displacement effects on existing establishments. Note that, nevertheless, our measure does not capture the potential displacement (or the reorientation) effects on new businesses without any prior ownership tie. Thus, our results do not address whether the cross-border difference in minimum wage rates alter the total number of entries on both sides of the county borders. Though beyond the scope of this current paper, it could be an interesting policy question that policymakers at a higher level, such as those at the prefectural or provincial level, may care about when considering whether to require a uniform minimum wage rates across counties instead of allowing the rates to vary by county.

5.5 Robustness Checks

In this section, we provide additional robustness checks. First, the validity of our identification assumption requires the (time variations in the) areas on two sides of county borders to be highly comparable. In all the results above, we treated municipal districts and counties equivalently. Although counties and districts both are at the third level in China's administration hierarchy and can choose their own minimum wage rates, counties are

typically less economically developed than municipal districts. In appendix table A1, we split the baseline sample into three subsamples: (1) one where one side of a border is a municipal district and the other side is a county, (2) one where both sides of a border are municipal districts, and (3) one where both sides of a border are counties. In the first subsample, where the two sides of the border are less comparable, increases in minimum wage rates do not significantly decrease entries. In the next two subsamples, where both sides of a border are administrative divisions of the same type and our identification assumption is more likely to be satisfied, the coefficients indicate strong entry-discouraging effects of a higher minimum wage.

Second, our identification assumption is more likely to be valid when the economic activities occurring in the border areas are small enough relative to those in the county as a whole. With the dispersion of the county sizes, there are small counties and there could also be counties for which economic activities happen to cluster near the county borders. When the border areas account for a significant amount of the county's overall economic activities, the county-level minimum wage rates are likely to be endogenous to the conditions near the border, which will invalidate the identification and lead to an underestimate of the negative effect of minimum wage rates on entries.

To address this concern, we split the full sample according to the percentage of economic activities accounted for by the one-kilometer border areas and run our baseline specification for each of these subsamples in Table 6. In column (1), we reproduce our baseline results with the full sample for ease of comparison. In column (2)-(4), we use the subsamples where the border areas only account for a small portion of the county's economic activities. Specifically, in column (2), we restrict the sample to the county pairs where the one-kilometer bands on both sides of the borders account for less than 5% of the

corresponding counties' total number of incumbent establishments every year throughout our sample period. The coefficient of the cross-border difference in log (minimum wage) remains negative and significant, with a size slightly bigger than that in column (1). The difference between the two coefficients is not statistically significant. We construct the subsamples in column (3) and (4) similarly, other than that we change the threshold percentage to 10% and 20%, respectively. The estimated coefficients are similar. In column (5)-(7), we use the subsamples where the one-kilometer border areas account for a significant share of the county's economic activities. Specifically, in column (5) we restrict the sample to county-pairs where the one-kilometer bands on both sides of the border account for more than 30% of the corresponding county's total number of establishments in at least one year[18] during the sample period. The amount of the economic activities near the border could be significant enough to drive the county-level minimum wage rates. As expected, the coefficient of the cross-border difference in log (minimum wage), though still negative, is smaller in size and statistically insignificant. The subsamples in column (6) and (7) are constructed similarly to that in column (5), other than that we change the threshold percentage to 40% and 50%, respectively. For these subsamples, we obtain positive and significant coefficients for cross-border differences in log (minimum wage). These coefficients are similar to those we obtain using the pairs of entire counties instead of using pairs of border areas as units for analysis. Note that the sample sizes in (5)-(7) are small relative to our full sample. And as a result, keeping them in the sample did not significantly affect our estimates.

[18] We construct the subsamples in this way to make sure that each of them is balanced at county-pair level. For a county pair to be in a subsample in any given year, it is in the subsample throughout the sample period.

Table 6: Split-sample analysis by the percentage of activities in the one-kilometer band to border

Dep. Var.: Log (number of entries within 1km band to border + 1)							
Sample	Baseline	In both counties, $\frac{Number\ of\ Establishments\ in\ 1km\ band\ to\ border}{Number\ of\ Establishments\ in\ the\ whole\ county}$					
		<5%	<10%	<20%	≥30%	≥40%	≥50%
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Cross-Border Differences in Log (Min. Wage)	-0.269***	-0.277***	-0.259***	-0.263***	-0.194	0.612***	0.434***
	(0.079)	(0.084)	(0.080)	(0.083)	(0.421)	(0.150)	(0.073)
Cross-Border Differences in Log (Number of Pre-existing Establishment by Sector+1)							
Primary Sector	0.029***	0.035***	0.037***	0.029***	0.002	-0.048	-0.021
	(0.007)	(0.007)	(0.007)	(0.007)	(0.026)	(0.039)	(0.033)
Secondary Sector	0.020*	-0.003	-0.007	-0.001	0.002	0.014	-0.083
	(0.011)	(0.010)	(0.010)	(0.011)	(0.081)	(0.172)	(0.160)
Tertiary Sector	0.049***	0.034***	0.039***	0.045***	0.621***	0.656***	0.395***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.102)	(0.123)	(0.127)
County-Pair FE	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y
Observations	118,144	90,272	100,544	106,528	3,040	1,568	800
R-squared	0.754	0.578	0.616	0.661	0.953	0.946	0.931

Notes: Robust standard errors clustered at the county level are shown in parentheses: *** p<0.01, ** p<0.05, *p<0.1. In column (1) we reproduce our baseline results with full sample for ease of comparison. In column (2), we restrict the sample to the county pairs where the one-km band near the border on both sides of the border account for less than 5% of the corresponding county's total number of establishments throughout our sample period. The subsamples in column (3) and (4) are constructed similarly to that in column (2), other than that we change the threshold percentage to 10% and 20%, respectively. In column (5) we restrict the sample to county pairs where the one-km band near the border on both sides of the border account for more than 30% of the corresponding county's total number of establishments at some point in our sample period. The subsamples in column (6) and (7) are constructed similarly to that in column (5), other than that we change the threshold percentage to 40% and 50%, respectively. Note that each of these subsamples is balanced at county-pair level. For a county-pair to be in a subsample in any given year, it is in the subsample throughout the sample period.

6. Conclusion

The minimum wage is a source of controversy that is rich with economic implications. In this study we focus on the minimum wage policy in China using county-level minimum wage data in combination with firm registration data and adopt a refined border approach to account for unobserved local shocks. In our core finding we show that a 10% increase in a locality's minimum wage reduces new business entries by 2.69%. To our surprise, we find that the size of this effect is closely aligned with the estimates reported by Orazem and Mattila (2002) in the U.S. context. We further show that this entry-discouraging effect is especially strong in industries that are particularly exposed to minimum wage policies and in periods during which the enforcement of minimum wage policies is stricter. Although we expect businesses could move across county borders at relatively low costs to avoid high minimum wage levels, we find that business relocation is rare and does not significantly respond to changes in minimum wage levels.

Our analysis ventures into new territory. The prior literature on minimum wage policies in China has discussed their effects on capital adjustments at the *intensive* margin, as they investigate how *existing* firms respond to hikes in the minimum wage. In this paper, we complete the evaluation regarding the effects of minimum wage policies in China by studying their impacts on capital adjustments at the *extensive* margin in the form of *new* business entries. This last piece of the puzzle is important, especially given the critical role that new businesses play in job creation and economic growth. Moreover, the business relocation effects have been largely ignored by the minimum wage literature but have become increasingly policy-relevant with the rising popularity of *local* minimum wage policies. Our paper explicitly investigates how local minimum wage affects business mobility.

Note that, although the spatial differencing within a short distance to the county border helps achieve identification, the losses of potential entries on the side with a higher minimum wage rate may show up again as gains of entries on the other side and resulting in double counting. Thus, for county policymakers in China who sets the minimum wage rate, our estimates provide an upper bound for the entry-discouraging effects of increasing the minimum wage rate. For policymakers at a more macro level, such as at the prefectural or provincial level, nevertheless, the relative sizes of the gains and losses on two sides of a county border may bear important policy implications regarding whether it is efficiency-enhancing to coordinate minimum wage levels at a more aggregate geographic level rather than allowing it to vary county by county. For example, some prefectural cities in China have reduced cross-county within-prefecture variations in minimum wage levels in recent years, whereas more cities in the U.S. are setting their own city-level minimum wage rates higher than the federal requirements. Though beyond the scope of our paper, this is an interesting research question both theoretically and empirically that awaits future research endeavor on local minimum wage policies.

References

Agrawal, David R, William H Hoyt, and John Douglas Wilson. 2020. 'Local policy choice: theory and empirics', *Available at SSRN 3545542*.

Ahlfeldt, Gabriel M, Duncan Roth, and Tobias Seidel. 2018. 'The regional effects of Germany's national minimum wage', *Economics Letters*, 172: 127-30.

Bell, Linda A. 1997. 'The Impact of Minimum Wages in Mexico and Colombia', *Journal of labor economics*, 15: S102-S35.

Bi, Qingmiao, Xilu Chen, Xianxiang Xu, and Shujuan Li. 2018. 'Administrative Approval Reform and Firm Entry', *Economic Research Journal*, 53: 140-55.

Borjas, George J. 2013. *Labor economics* (McGraw-Hill/Irwin Boston).

Card, David, and Alan B Krueger. 1994. 'Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania', *The American Economic Review*, 84: 772-93.

———. 2000. 'Minimum wages and employment: a case study of the fast-food industry in New Jersey and Pennsylvania: reply', *American Economic Review*, 90: 1397-420.

Dickens, Richard, Stephen Machin, and Alan Manning. 1999. 'The effects of minimum wages on employment: Theory and evidence from Britain', *Journal of labor economics*, 17: 1-22.

Draca, Mirko, Stephen Machin, and John Van Reenen. 2011. 'Minimum wages and firm profitability', *American economic journal: applied economics*, 3: 129-51.

Dube, Arindrajit, T William Lester, and Michael Reich. 2010. 'Minimum wage effects across state borders: Estimates using contiguous counties', *The review of economics and statistics*, 92: 945-64.

Dube, Arindrajit, and Attila S Lindner. 2020. 'City Limites: What do Local-Area Minimum Wages Do?', *National Bureau of Economic Research Working Paper Series*, No. 27928.

Dube, Arindrajit, Suresh Naidu, and Michael Reich. 2007. 'The economic effects of a citywide minimum wage', *ILR Review*, 60: 522-43.

Duranton, Gilles, Laurent Gobillon, and Henry G Overman. 2011. 'Assessing the effects of local taxation using microgeographic data', *The economic journal*, 121: 1017-46.

Einiö, Elias, and Henry G Overman. 2020. 'The effects of supporting local business: Evidence from the UK', *Regional Science and Urban Economics*, 83: 103500.

Fan, Haichao, Yichuan Hu, and Lixin Tang. 2020. 'Labor costs and the adoption of robots in China', *Journal of Economic Behavior & Organization*.

Fan, Haichao, Faqin Lin, and Lixin Tang. 2018. 'Minimum Wage and Outward FDI from China', *Journal of Development Economics*, 135.

Fang, Tony, and Carl Lin. 2020. 'Minimum wages and employment in China.' in, *Minimum Wages in China* (Springer).

Freeman, Richard B., and Xiaoying Li. 2015. 'How Does China's New Labor Contract Law Affect Floating Workers? ', *British Journal of Industrial Relations*, 53: págs. 711-35.

Frost, Stephen. 2002. 'Labour standards in China: the business and investment challenge', *Association for Sustainable and Responsible Investment in Asia*.

Gallagher, Mary, John Giles, Albert Park, and Meiyan Wang. 2015. 'China's 2008 Labor Contract Law: Implementation and implications for China's workers', *Human Relations*.

Giroud, Xavier. 2013. 'Proximity and investment: Evidence from plant-level data', *The Quarterly journal of economics*, 128: 861-915.

Givord, Pauline, Roland Rathelot, and Patrick Sillard. 2013. 'Place-based tax exemptions and displacement effects: An evaluation of the Zones Franches Urbaines program', *Regional Science and Urban Economics*, 43: 151-63.
Guzman, Jorge, and Scott Stern. 2015. 'Where is silicon valley?', *Science*, 347: 606-09.
———. 2016. "The State of American Entrepreneurship: New Estimates of the Quality and Quantity of Entrepreneurship for 32 US States, 1988-2014." In.: National Bureau of Economic Research.
Haltiwanger, John, Ron S Jarmin, and Javier Miranda. 2013. 'Who creates jobs? Small versus large versus young', *Review of Economics and Statistics*, 95: 347-61.
Hanson, Andrew, and Shawn Rohlin. 2013. 'Do spatially targeted redevelopment programs spillover?', *Regional Science and Urban Economics*, 43: 86-100.
Hau, Harald, Yi Huang, and Gewei Wang. 2020. 'Firm response to competitive shocks: Evidence from China's minimum wage policy', *The Review of Economic Studies*, 87: 2639-71.
Holmes, Thomas J. 1998. 'The effect of state policies on the location of manufacturing: Evidence from state borders', *Journal of political Economy*, 106: 667-705.
Huang, Yi, Prakash Loungani, and Gewei Wang. 2014. 'Minimum Wages and Firm Employment: Evidence from China', *Globalization Institute Working Papers*, 14.
Li, Hongbin, Zheyu Yang, Xianguo Yao, Haifeng Zhang, and Junsen Zhang. 2012. 'Entrepreneurship, private economy and growth: Evidence from China', *China Economic Review*, 23: 948-61.
Lin, Carl, and Myeong-Su Yun. 2016. 'The effects of the minimum wage on earnings inequality: Evidence from China.' in, *Income Inequality Around the World* (Emerald Group Publishing Limited).
Mayer, Thierry, Florian Mayneris, and Loriane Py. 2017. 'The impact of Urban Enterprise Zones on establishment location decisions and labor market outcomes: evidence from France', *Journal of Economic Geography*, 17: 709-52.
Mayneris, Florian, Sandra Poncet, and Tao Zhang. 2018. 'Improving or disappearing: Firm-level adjustments to minimum wages in China', *Journal of Development Economics*, 135: 20-42.
McKinnish, Terra. 2017. 'Cross-state differences in the minimum wage and out-of-state commuting by low-wage workers', *Regional Science and Urban Economics*, 64: 137-47.
Méjean, Isabelle, and Lise Patureau. 2010. 'Firms' location decisions and minimum wages', *Regional Science and Urban Economics*, 40: 45-59.
Neumark, David, and William Wascher. 1992. 'Employment effects of minimum and subminimum wages: panel data on state minimum wage laws', *ILR Review*, 46: 55-81.
Orazem, Peter F, and J Peter Mattila. 2002. 'Minimum wage effects on hours, employment, and number of firms: The Iowa case', *Journal of Labor Research*, 23: 3.
Rohlin, Shawn M. 2011. 'State minimum wages and business location: Evidence from a refined border approach', *Journal of Urban Economics*, 69: 103-17.
Rosenthal, Stuart S, and William C Strange. 2001. 'The determinants of agglomeration', *Journal of Urban Economics*, 50: 191-229.
Sun, Zhongwei, Yiwei Liu, and Changyu Fan. 2019. 'The "Floor Wage System" and its Consequences in the Implementation of theMinimum Wage: Based on Guangdong Enterprise-Employee Matching Survey Data in 2017', *China Population Science*: 114-25.
Tijdens, Kea, and Maarten van Klaveren. 2019. "Understanding the Drivers of Minimum Wage-Setting: An Analysis of 146 Countries." In *ILO's 6th RDW Conference in Geneva*, 8-10.

Ye, Linxiang, Shi Li, and Can Yang. 2016. 'Estimating the Relative Level of Minimum Wage in China', *China Population Science*: 99-107.
Zhang, Tao, and Yang Shen. 2020. 'Firm Entry, Tax and Agglomeration Economies—Empirical Study Based on Industrial Linkages', *China Economic Quarterly*, 19.

Table A1: Effects of the Minimum Wage on Entry, by Type of Border

Dep. Var.: Cross-Border Differences in Log (number of entries + 1)			
Sample	Same Prefecture		
	District-County	District-District	County-County
	(1)	(2)	(3)
Cross-Border Differences in Log (Min. Wage)	-0.0958	-0.572**	-0.402***
	(0.117)	(0.238)	(0.118)
Cross-Border Differences in Log (Number of Pre-existing Establishment by Sector+1)			
Primary Sector	0.0404***	0.0124	0.0183**
	(0.0144)	(0.0183)	(0.00801)
Secondary Sector	-0.00846	0.0518	0.0194*
	(0.0282)	(0.0532)	(0.0108)
Tertiary Sector	0.0649***	0.234***	0.0218**
	(0.0224)	(0.0366)	(0.00961)
County-Pair FE	Y	Y	Y
Year FE	Y	Y	Y
Observations	30,816	24,576	62,752
R-squared	0.685	0.909	0.551

Notes: Robust standard errors clustered at the county level are shown in parentheses: *** p<0.01, ** p<0.05, *p<0.1. For column (1) we restrict the sample to within-prefecture neighboring county pairs. For column (2) we restrict the sample to within-prefecture neighboring municipal district pairs. For column (3) we restrict the sample to neighboring geographic unit pairs consisting of one municipal district and one county within the same prefecture. The samples for these three columns pooled together are equivalent to the baseline sample used for column (1) of Table 2.