Minimum Wage and Outward FDI from China *

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Abstract

We construct a comprehensive manufacturing firm-level dataset to study the effects of minimum wage increase in China on firms' probability of conducting outward foreign direct investment (outward FDI). Our baseline results show that the increase in minimum wage can explain about 32.3% of the growth in outward FDI from China over 2001-2012. We use three different strategies to address potential endogeneity concerns. First, we control for a number of local macroeconomic variables. Second, to rule out spatially-correlated confounding factors, we employ a regression design based on bordering cities across provincial borders. Lastly, we conduct a placebo test by studying the effects of minimum wage increase on FDI to tax-haven destinations. We then examine the heterogeneous effects of minimum wage increase. We find the effects on outward FDI to be stronger for more productive firms, those with foreign ownership, those in the more labor-intensive sectors, those located in the coastal region, for the years after 2004 and for production-oriented FDI projects.

Key words: Outward FDI, minimum wage, manufacturing, China
JEL Classification: J3, F23

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1 Introduction

Labor costs in China have increased dramatically over the past 20 years. An important contributing factor is the rising minimum wage in China. From 2001 to 2012, average monthly minimum wage across China increased by about 165% from 271 yuan to 717 yuan. This dramatic increase of the minimum wage in China has serious implications for the firm's overall costs and profitability. Existing literature has examined firms' response in terms of employment, management practices and export decisions.[1] The effects of minimum wage on firms' outward foreign direct investment (outward FDI) decisions have not been studied.

According to the 2016 World Investment Report, outward FDI from developing countries accounted for 21.1% of total FDI stocks in 2015, up from 9.9% in 2000 (UNCTAD, 2016). FDI outward stock from China increased from 27.8 billion US dollars in 2000 to 1.01 trillion US dollars in 2015. China has become the third largest home country of FDI flows (after the USA and Japan) by 2015, accounting for 8.6% of the world's total FDI flows (UNCTAD, 2016).

Does the increase in minimum wage lead to more outward FDI from China? According to the concentration-proximity trade-off hypothesis (Markusen, 1984; Helpman, Melitz and Yeaple, 2004), the basic trade-off in firm's decision to conduct FDI lies between the relative variable costs of producing abroad and the fixed cost of setting up an additional plant. An increase in operation costs associated with the employment of labor in the home country implies a decrease of the *relative* variable costs abroad, leading to larger cost savings and stronger incentive to conduct outward FDI. Indeed, anecdotal evidence supports a link between the increase in minimum wage and firms' decisions to set up operations abroad. For example, Ever-Glory International, a sportswear manufacturer based in the city of Nanjing that sells to Wal-Mart and Kohl's, built a factory in Vietnam in 2008 to reduce its cost of production (Bradsher, 2008). Huajian, one of the largest shoe exporters in China started a factory expansion in Ethiopia to benefit from lower labour costs there (Wallis, 2013). In 2016, Fuyao Glass Industry Group, China's largest auto glass manufacturer based in Fujian Province, opened a new factory worth about $500 million in Moraine, Ohio, and rising labor costs in China were cited as one of the driving forces behind the investment (Lui, 2016). These anecdotes call for a formal empirical study using comprehensive data.

In this paper, we study the effects of minimum wage on outward FDI from China. We build on the Helpman, Melitz and Yeaple (2004) model in which only the most productive

[1] See for example Fang and Lin (2015), Long and Yang (2016), Mayneris et al. (2017) and Gan et al. (2016).

firms conduct FDI. We derive two testable hypotheses from the extended model. First, an increase of the wage in the home country raises firms' probability of conducting outward FDI. Second, the effects of the home wage on the probability of FDI are larger for firms with higher productivity and for firms with lower fixed cost of conducting FDI relative to exporting.

To test these predictions, we construct a rich firm-level panel dataset. We draw from multiple sources: firm-level data from Annual Survey of Industrial Firms (ASIF), data on outward FDI projects from the Chinese Ministry of Commerce, city-level data on minimum wage from government websites and statistical bulletins, and city-level socio-economic data from the commercial data provider CEIC. Our merged dataset contains rich information on firm-level and city-level variables, including local minimum wage and firms' outward FDI decisions.[2]

We then employ a linear probability model to study the effects of minimum wage increase on firms' probability of conducting outward FDI. We find that higher minimum wage faced by firms is positively associated with greater probability of conducting outward FDI. Our baseline results show that a 10% increase in minimum wage raises the outward FDI probability by 0.0289 percentage points. This is a large effect considering that only 0.222% of firms in our sample conduct any outward FDI. Using a back-of-envelop calculation, we find that the increase in minimum wage can explain about 32.3% of the increase in outward FDI from China over 2001-2012. We conduct additional tests to address potential endogeneity issue. First, we show our baseline estimates to be unaffected by including additional local macroeconomic controls. Second, we follow the approach of Dube, Lester and Reich (2010) who use contiguous county pairs across state borders in the US to identify the employment effects of minimum wage. We construct a dataset of all city pairs in China that straddle a province border. We continue to find that minimum wage increase has a large and statistically significant effect on firms' outward FDI probability under the approach of Dube et al. (2010). Third, we develop a placebo test. Since FDI to tax-haven destinations does not involve the relocation of actual production activities, the mechanism considered in the theoretical model does not apply to FDI to tax-haven destinations. We examine the effects of minimum wage increase on FDI to tax-haven countries in our placebo test. Reassuringly, we do not find a positive association between the minimum wage and FDI to tax haven countries.

We then study the heterogeneous effects across different types of firms. We find that firms with foreign ownership are the most sensitive to increase in the minimum wage,

[2]We have information on the year and destination of each outward FDI project (the extensive margin). We do not have information on the investment value (the intensive margin) of each outward FDI project.

while state-owned enterprises (SOEs) are the least sensitive. We also find the effects of minimum wage increase on outward FDI to be stronger for more productive firms, those in the more labor-intensive sectors and those located in the prosperous east coastal region. Moreover, we study the effects by the primary activity type (production versus distribution) and the destinations of the FDI projects, and find the effects to be more significant for production-oriented FDIs and those to developing countries. Lastly, we examine the effects across time and find the effects to be stronger after 2004.

This paper belongs to the vast literature on the economic effects of minimum wage regulations. The literature is primarily based on developed countries (in particular the US) with an emphasis on employment effects (Brown, Gilroy and Kohen, 1982; Card and Krueger, 1994; Neumark and Wascher, 2000; Dube, Lester and Reich, 2010; Autor, Manning and Smith, 2016, among others). A growing number of papers in recent years have examined the effects of minimum wage increase in China on the performance of firms there. Long and Yang (2016) find a negative effect of minimum wages on profitability while Mayneris, Poncet and Zhang (2017) find that the survival probability of the most exposed firms decreased after strengthening the minimum wage system in 2004. Wang and Gunderson (2011), Fang and Lin (2015), Long and Yang (2016) and Huang, Loungani and Wang (2014) study the effects of minimum wages on employment. These papers find that minimum wages have significant adverse employment effects, especially after 2004 and for low-skilled workers.[3] Hau, Huang and Wang (2016) and Mayneris, Poncet and Zhang (2017) examine how firms' respond to the increase in minimum wages in terms of input-substitution, management practice, and productivity and find significant effects. Lastly, Gan, Hernandez and Ma (2016) study the relationship between changes in the minimum wage and firms' export behaviors in China and find that minimum wage increase has negative effects on both the probability of exporting (the extensive margin) and total export sales (the intensive margin). Our paper complements these earlier studies by focusing on outward FDI which is becoming increasingly prevalent among firms in China. To summarize, our paper is in line with the literature that finds wide-ranging impacts of minimum wage increases in China, but differs from the literature by examining a previously overlooked dimension.

This paper belongs to the large theoretical and empirical literature on FDI. Seminal contributions include Markusen (1984), Brainard et al. (1997), Carr, Markusen and Maskus (2001), and Helpman, Melitz and Yeaple (2004). Our paper is related to the em-

[3] Dautović et al. (2017) examine the effects of minimum wage on the consumption of low-income households in China.

pirical studies on the determinants of FDI.[4] These papers have studied the role of internal factors such as firm productivity (Tomiura, 2007; Yeaple, 2009) and external factors such as exchange rate shocks (Cushman, 1985; Russ, 2007) and home country financial development (Di Giovanni, 2005). However, none of these papers analyzes the effect of minimum wage on outward FDI.[5] We aim to fill this gap in the literature.

Within the literature on FDI, our paper most closely relates to the recent but expanding strand of literature that use firm-level data to analyze the determinants of outward FDI from China, including Chen and Tang (2014) and Chen, Tian and Yu (2016).[6] These papers employ data merged from the OFDI dataset from Chinese Ministry of Commerce (MOFCOM) and the Annual Surveys of Industrial Firms (ASIF) from National Bureau of Statistics. Chen and Tang (2014) find that larger, more productive, and more export-intensive firms in China are more likely to conduct outward FDI. Chen, Tian and Yu (2016) find that, as a result of factor market distortions favoring state-owned enterprises (SOE) in China, private firms are more likely to conduct outward FDI than comparable SOEs. While the above studies are informative on the patterns of outward FDI from China, they are silent on the reasons behind the *growing trend*. By contrast, we make use of the firm-level panel data to study the extent to which minimum wage increase in China can explain the rise in FDI originating from there.

The rest of the paper is organized as follows: Section 2 presents the theoretical model and discusses the testable implications; Section 3 describes our data while Section 4 discusses the relevant institutional background; the main empirical specification and results are presented in Section 5; Section 6 discusses heterogeneous effects; Section 7 concludes.

2 Model

There are N countries, indexed by $i, j, \cdots \in \{1, 2, \cdots, N\}$ and each endowed with population L_i. Each worker in country i supplies one unit of labor inelastically. There are two sectors, one sector with a numeraire good and the other with differential goods. In the numeraire sector, output is freely traded between countries. The productivity of country i in the sector is given by w_i, which then pins down the wage of the country.

[4] See Blonigen (2005) for a review of the relevant literature.

[5] Buckley (1988) points to the importance of labor costs for the location decision for multinationals but does not conduct any formal empirical test.

[6] A few papers study the determinants of outward FDI from China from the perspective of international business (Luo, Xue and Han, 2010; Kolstad and Wiig, 2012; Buckley, Clegg, Cross, Liu, Voss and Zheng, 2007; Wang, Hong, Kafouros and Boateng, 2012). In particular, Buckley et al. (2007) find outward FDI from China to be associated with cultural and geographic proximity to host countries, and other host country characteristics including political risk, market size, and natural resources endowment.

2.1 Preference

The preference of the representative consumer in country j is given by

$$U_j = q_o^{\alpha}\left(\left(\int_{\Omega_j} q_j(w)^{(\sigma-1)/\sigma} dw\right)^{\sigma/(\sigma-1)}\right)^{1-\alpha}$$

where q_o is the numeraire good, $q_j(w)$ is a variety of the differentiated good, $\alpha \in (0,1)$ governs the relative share of expenditure on the numeraire good, Ω_j denotes the set of all varieties sold in country j, and σ is the elasticity of substitution between goods varieties. Each firm in the differentiated sector produces a unique variety. As is well known, the quantity demanded in country j for the variety produced by firm w is given by

$$q_j(w) = \frac{E_j p_j(w)^{-\sigma}}{(P_j)^{1-\sigma}},$$

where E_j is the aggregate expenditure in country j on differentiated goods and P_j is the aggregate price index of differentiated goods for country j with

$$P_j = \left[\int_{\Omega_j} p_j(w)^{1-\sigma}\right]^{1/(1-\sigma)}.$$

2.2 Firms' Behavior

Each firm is characterized by its country of origin i and a productivity parameter ϕ. Each firm receives a productivity draw ϕ from a common cumulative distribution function (CDF) $F(\phi)$. The production function of the firm with productivity ϕ is $f(l) = \phi l$ where l is the labor input.

Firms can sell directly to the consumers in the home country without any fixed costs. In contrast, to export to country j, a firm in country i has to pay a fixed cost F_E, which is a stochastic shock with a mean of f_E and measured in units of destination labor. In addition, to sell one unit of the product to country j, a firm in country i has to ship $\tau_{ij} \geq 1$ units of the good, where $\tau_{ij} \geq 1$ is an iceberg trade cost commonly assumed in the literature. Consequently, the marginal cost of selling a unit of the good to consumers in country j through exporting is $\frac{w_i \tau_{ij}}{\phi}$.

Alternatively, a firm in country i can sell to the consumers in country j by conducting FDI. To set up a plant and produce the good in country j, the firm has to pay a fixed cost of FDI F_I, which is a stochastic shock with a mean of f_I and measured in units of host-country labor. As in Helpman, Melitz and Yeaple (2004), we assume $f_{\mathrm{I}} > f_{\mathrm{E}}$. The marginal

cost of selling a unit of the good to consumers in country j through FDI is $\frac{w_j}{\phi}$. We define the fixed cost gap as $F_I - F_E = f_{gap}\epsilon = (f_{\mathrm{I}} - f_{\mathrm{E}})\epsilon$, where $\epsilon \in (0, \infty)$ is a random variable given by the CDF $G(\epsilon)$. We assume that $G(\epsilon)$ has a mean of one and is independent from $F(\phi)$.

2.3 Decision to conduct FDI

Conditional on selling any output to consumers in country j, each firm maximizes its total profits by comparing the profits from exporting versus that from conducting FDI. Specifically, we have

$$\pi_E(\phi) = \frac{1}{\sigma}\frac{E_j}{(P_j)^{1-\sigma}}(\frac{\sigma}{\sigma-1}\frac{w_i\tau_{ij}}{\phi})^{1-\sigma} - w_j F_E,$$

and

$$\pi_I(\phi) = \frac{1}{\sigma}\frac{E_j}{(P_j)^{1-\sigma}}(\frac{\sigma}{\sigma-1}\frac{w_j}{\phi})^{1-\sigma} - w_j F_I,$$

where $\pi_E(\phi)$ and $\pi_I(\phi)$ are the profits for a firm with productivity ϕ from country i from exporting to country j, or conducting FDI there, respectively. Therefore, a firm from country i decides to sell to country j through FDI if and only if

$$\frac{1}{\sigma}\frac{E_j}{(P_j)^{1-\sigma}}(\frac{\sigma}{\sigma-1}\frac{w_j}{\phi})^{1-\sigma} - \frac{1}{\sigma}\frac{E_j}{(P_j)^{1-\sigma}}(\frac{\sigma}{\sigma-1}\frac{w_i\tau_{ij}}{\phi})^{1-\sigma} > f_{gap}\cdot\epsilon\cdot w_j. \tag{1}$$

Intuitively, because of the higher fixed cost associated with conducting FDI, only the more productive firms find it profitable to do so. Rearranging the terms in Equation 1, we have

$$\epsilon < \frac{1}{f_{gap}w_j}\frac{1}{\sigma}\frac{E_j}{(P_j)^{1-\sigma}}(\frac{\sigma}{\sigma-1})^{1-\sigma}\Big((\frac{w_j}{\phi})^{1-\sigma} - (\frac{w_i\tau_{ij}}{\phi})^{1-\sigma}\Big)$$

Noting that the CDF of ϵ is given by $G(\epsilon)$, we have

$$Pr(FDI|\phi) = G\Big(\frac{1}{f_{gap}w_j}\frac{1}{\sigma}\frac{E_j}{(P_j)^{1-\sigma}}(\frac{\sigma}{\sigma-1})^{1-\sigma}\big((\frac{w_j}{\phi})^{1-\sigma} - (\frac{w_i\tau_{ij}}{\phi})^{1-\sigma}\big)\Big) \tag{2}$$

where $Pr(FDI|\phi)$ is the probability of conducting FDI conditional on firm productivity ϕ.

2.4 Comparative Statics

We use Equation 2 to study the comparative statics of the model. The effects of an increase in wage in the home country on FDI probability can be obtained by taking the derivative of $Pr(FDI|\phi)$ with respect to w_i, as given below

$$\frac{\partial Pr(FDI|\phi)}{\partial w_i} = g(\epsilon) \cdot \frac{1}{f_{gap} w_j} \frac{E_j}{(P_j)^{1-\sigma}} (\frac{\sigma}{\sigma - 1})^{-\sigma} \Big((\frac{\tau_{ij}}{\phi})^{1-\sigma} w_i^{-\sigma} \Big) \tag{3}$$

where $g(\epsilon) = \frac{dG(\epsilon)}{d\epsilon}$ is the probability density function (PDF) of ϵ. By inspection, $\frac{\partial Pr(FDI|\phi)}{\partial w_i} > 0$. This gives our first proposition.

Proposition 1 *An increase of the wage in the home country raises the firms' probability of conducting outward FDI.*

To study the heterogeneous effects, we take the second-oder derivatives with respect to ϕ and f_{gap}. These derivatives are given by

$$\begin{aligned}\frac{\partial^2 Pr(FDI|\phi)}{\partial w_i \partial \phi} &= g(\epsilon) \cdot \frac{1}{f_{gap} w_j} \frac{E_j}{(P_j)^{1-\sigma}} (\frac{\sigma}{\sigma - 1})^{-\sigma} \Big((\tau^{ij})^{1-\sigma} w_i^{-\sigma} \Big) (\sigma - 1) \phi^{\sigma - 2} \\ &+ \frac{dg(\epsilon)}{d\epsilon} \Big(\frac{1}{f_{gap} w_j} \frac{E_j}{(P_j)^{1-\sigma}} (\frac{\sigma}{\sigma - 1})^{-\sigma} \Big)^2 \Big((\frac{\tau^{ij}}{\phi})^{1-\sigma} w_i^{-\sigma} \Big) \phi^{\sigma-2} \Big(w_j^{1-\sigma} - (\tau^{ij} w_i)^{1-\sigma} \Big)\end{aligned}$$

$$\begin{aligned}\frac{\partial^2 Pr(FDI|\phi)}{\partial w_i \partial f_{gap}} &= -g(\epsilon) \cdot \frac{1}{f_{gap}^2 w_j} \frac{E_j}{(P_j)^{1-\sigma}} (\frac{\sigma}{\sigma - 1})^{-\sigma} \Big((\frac{\tau_{ij}}{\phi})^{1-\sigma} w_i^{-\sigma} \Big) \\ &- \frac{dg(\epsilon)}{d\epsilon} \Big(\frac{1}{f_{gap} w_j} \frac{E_j}{(P_j)^{1-\sigma}} (\frac{\sigma}{\sigma - 1})^{-\sigma} \Big)^2 \frac{\Big((\frac{\tau_{ij}}{\phi})^{1-\sigma} w_i^{-\sigma} \Big)}{f_{gap}(\sigma - 1)} \Big((\frac{w_j}{\phi})^{1-\sigma} - (\frac{w_i \tau_{ij}}{\phi})^{1-\sigma} \Big)\end{aligned}$$

For convenience, we assume that ϵ follows a uniform distribution, so that $\frac{dg(\epsilon)}{d\epsilon} = \frac{dG^2(\epsilon)}{d\epsilon^2} = 0$.[7] By inspection, $\frac{\partial^2 Pr(FDI|\phi)}{\partial w_i \partial \phi} > 0$ and $\frac{\partial^2 Pr(FDI|\phi)}{\partial w_i \partial f_{gap}} < 0$. These results give rise to our second proposition.

Proposition 2 *The effects of home wage on the probability of FDI are larger for firms with higher productivity and for firms with lower fixed cost of conducting FDI relative to exporting.*

[7] Proposition 1 can be derived with a weaker assumption, namely that $\frac{dg(\epsilon)}{d\epsilon} = \frac{dG^2(\epsilon)}{d\epsilon^2}$ is not too negative.

2.5 Discussion

Proposition 1 shows that the increase in labor costs, such as that induced by an increase in the minimum wage, raises the probability of domestic firms to conduct outward FDI. Proposition 2 shows that such a relationship is stronger for firms with higher productivity and firms with the lower fixed cost gap. While we derive the comparative statics between outward FDI and home wage, our empirics are on the relationship between outward FDI and the minimum wage, because changes in the minimum wage are determined by the local government and hence more exogenous than changes in other measures of labor costs, as will be discussed in Section 4.

In view of the large literature that finds larger and more productive firms to pay higher average wage to their workers (Brown and Medoff, 1989), a natural question is to what extent the labor costs of firms with potential FDI projects are affected by the increase in the local minimum wage. Specifically, since firms with FDI tend to be larger and more productive, one may suspect that the local minimum wage might not be binding for these firms and therefore should not affect these firms' probability of conducting outward FDI. In practice, workers within the same firm are usually paid different wages, with higher wage for non-production workers than for production workers (Bernard, Jensen and Lawrence, 1995). Therefore, even when the average wage of a firm is well above the local minimum wage, a substantial share of the workforce may be directly affected by the local minimum wage. According to Ye et al. (2015), up to 11.6% of workers at firms with 300 to 3000 employees receive a basic wage that is between 100% to 110% of the local minimum wage, indicating that many workers are in fact directly affected by the minimum wage.[8]

Local minimum wage can also affect the labor costs of firms indirectly. The local minimum wage has established itself as an important benchmark for setting wage, even for workers well above the minimum wage.[9] Therefore, by raising a crucial reference point for wage setting, increase in the minimum wage can shift the entire wage distribution upward. In Table A2, we study the relationship between firm-level average wage and the local minimum wage using data from Annual Surveys of Industrial Firms (See Section 3 for a data description). We find a significant relationship in which a 10 yuan increase in local monthly minimum wage is associated with an increase of between 20 yuan to 28 yuan in the average monthly wage. The magnitude, which is larger than a factor of

[8] Firms with more than 3000 employees account for only 0.6% of the ASIF data in 2009.

[9] As an example, Foxconn Technology, a well-known supplier for Apple Inc., responded to criticisms of low wages by pointing out that the average wage of their workers is substantially higher than the local minimum wage in Shenzhen (Kan, 2012).

one, suggests that minimum wage increase also affects workers with wage above the minimum.[10] For larger firms (firms with more than 100 employees), we find a 10 yuan increase in minimum wage to be significantly associated with an increase of 41 yuan in the average wage. This provides empirical support for the indirect effects of minimum wage. Theoretically, Burdett and Mortensen (1998) and Van Den Berg (2003) show in different models that an increase in the minimum wage will raise the wage paid by firms, even when firms' wages are already above the minimum wage. In summary, increase in local minimum can raise the labor costs of firms both directly and indirectly, thereby affecting both high-productivity and low-productivity firms.

In addition to testing the predictions of Propositions 1 and 2, we can also examine the differential effects of minimum wage increase on firms of different ownership types. It is well known that foreign-invested firms in China are more productive than domestic firms. Higher productivity for firms would imply larger response to minimum wage increases according to Proposition 2. Furthermore, since foreign firms may have higher level of valuable knowledge about the destination markets, f_{gap} should be smaller for foreign firms (Johanson and Vahlne, 1977; Brouthers and Hennart, 2007). On the one hand, since the required level of knowledge about the destination market is high for FDI entry, domestic firms may have to incur much larger costs to conduct FDI due to greater information friction ($f_I^{domestic} - f_I^{foreign}$ is large). On the other hand, while domestic firms might have a slightly higher fixed cost of exporting than foreign firms, the difference between the two types of firms should be small ($f_E^{domestic} - f_E^{foreign}$ is positive but small). This implies a smaller f_{gap} for foreign firms ($f_I^{domestic} - f_E^{domestic} > f_I^{foreign} - f_E^{foreign}$). Finally, stricter compliance by foreign firms, perhaps due to larger potential cost of negative publicity, can also contribute to larger response in outward FDI probability.[11] Overall, we expect the minimum wage-OFDI linkage to be stronger for foreign firms than for domestic firms.

Lastly, we test additional heterogeneous effects related to the theoretical predictions. Specifically, we examine the effects by labor-capital ratio of the sector, by region, by dif-

[10] Another explanation for the large magnitude is the regulations on overtime pay in China. Under the 1994 Labor Law, firms are required to pay 150%, 200%, 300% of the regular wage rate, for working outside regular hours, on weekends, and on national holidays respectively. Crucially, workers affected by the minimum wages are also more likely to work overtime. For example, while only 26.6% of workers with college education and above reported having worked overtime hours, 48.9% of workers with junior high school education or below reported having done so (Ye et al., 2015). Therefore, regulations on overtime pay likely interacts with the increase in minimum wage.

[11] Ye, Gindling and Li (2015) provide detailed discussion on the compliance with minimum wages based on a matched employer-employee dataset that covers six provinces for 2009 and is collected by a team from Beijing Normal University. In the data, 2.3% of workers at foreign firms earn less than the minimum wage, compared to 2.8% for state-owned firms and 2.9% for domestic private firms.

ferent types of FDI, by whether the destination is a developed or a developing country, and across different periods.

3 Data

We combine four different datasets in our analysis. First, we use the firm-level data from Annual Survey of Industrial Firms (ASIF) in China. This dataset has been widely used in previous studies of the Chinese economy (e.g., Brandt, Van Biesebroeck and Zhang (2012); Fan, Li and Yeaple (2015b); Fan, Lai and Li (2015a); Gan, Hernandez and Ma (2016); among others). Until 2007, these surveys cover all state-owned enterprises, as well as large and medium-sized non-state-owned enterprises with annual sales above five million RMB (around 770,000 US dollars under current exchange rate). After 2007, the smaller state-owned enterprises with annual sales below five million RMB are excluded from the surveys. From 2011 onwards, the ASIF surveys include only manufacturing firms with annual sales above 20 million RMB.[12] This dataset contains rich firm-level information, including ownership structure, employment, capital stock, gross output, value added, firm identification (e.g., company name), and complete information on the three major accounting statements (i.e., balance sheet, profit and loss account, and cash flow statement).[13]

Our second dataset is a compilation of outward FDI projects by Chinese companies, which is provided by the Chinese Ministry of Commerce and include all outward FDI transactions approved by the ministry from 1998 to 2013. This dataset includes both greenfield projects, and mergers and acquisitions (M&A's), although there is no variable to indicate whether a project belongs to either category. The dataset records detailed information of each outward FDI transaction, including the starting year, the destination country and the name of the firm. Since any project is included in the FDI dataset only once in the starting year, we consider a firm to be conducting outward FDI if it has reported one or more outward FDI projects in any previous year. We exclude outward FDI to tax-haven countries in the definition of the indicator variable for outward FDI.[14] Since there is no consistent firm identification code between the two databases, we match

[12] We include all available observations in our baseline analysis. However, our results are robust to sample adjustment where we exclude the smaller SOEs or apply a sales threshold of 20 million RMB for all years. Results are available upon request.

[13] We follow Fan, Li and Yeaple (2015b) and Fan, Li and Yeaple (2018) to delete problematic observations resulting from misreporting. We use the following rules: (i) a firm must have a unique identification number; (ii) the date of establishment must be valid; (iii) the export value must be valid.

[14] We follow the list of tax haven countries in Hines and Rice (1994). These tax-haven countries include Cayman Islands, Bermuda Islands, Hong Kong (China) and Singapore.

outward FDI transactions data to the ASIF data using the text of company names. For company names that are not identical across the two databases, we employ approximate matching and verify the quality of the matches manually.

Our third dataset includes information on minimum wage at the city level. Since there is no uniform data source for the minimum wage information, we manually collect the data from the local government websites, statistical bulletins, local labor and civil reports, and public statistics sources on the Internet. Our fourth dataset includes city-level socioeconomic data from CEIC, which is a commercial data provider.

Finally, we merge the resulting firm-level dataset with the city-level minimum wage dataset using information on the location of firms.[15] Our cleaned dataset from 2001 to 2012 includes 2116310 firm-year observations, containing information on 668140 unique firms from 319 cities. Table A1 in the appendix summarizes the key variables employed in the empirical analysis.

4 Institutional Background

Minimum wages were first introduced to China in the early stage of the economic reform. In 1984, China ratified the 1928 Minimum Wage Fixing Machinery Convention of the International Labor Organization (ILO). In the following years, a number of coastal cities in Guangdong Province including Zhuhai, Shenzhen and Guangzhou became the first cities to implement local minimum wage regulations in response to slow wage growth and high inflation (Fang and Lin, 2015). In 1993, the Chinese Ministry of Labor issued China's first national minimum wage regulations. These regulations are subsequently written into the new version of the Labor Law in 1994. All provincial, autonomous-region, and municipal governments are authorized to set their local minimum wage which could vary across cities within a province.

The minimum wage system was reinforced in 2004 when the Chinese Ministry of Labor and Social Security (restructured from the Chinese Ministry of Labor) passed the "Minimum Wage Regulations." Under the revised regulation, in addition to the existing monthly minimum wages catering to full-time workers, an hourly minimum wage was introduced for part-time workers. The revised regulation significantly increases the penalties for violations, from 20-100% of the owed wage to 100-500%. This significantly strengthened the enforcement of the regulation (Gan, Hernandez and Ma, 2016). The 2004

[15] The ASIF data provide information on the location of the plant but not the location of the headquarter. We use the minimum wage level at the city of production in our empirics, since this minimum wage directly affects the labor costs of producing in China for the firm.

regulation also clarifies that overtime pay and legally-mandated supplements cannot be included by firms to meet minimum wage requirements. Furthermore, the regulation requires provincial governments to renew the standard of minimum wage at least once every two years. Local governments are also required to publish the minimum wage rates in government bulletins and newspapers within a week after any new changes. After the 2004 reform, adjustment to the local minimum wages became more frequent, accompanied by rapid increases.

In setting the level of minimum wage, the governments are required to consider local factors such as the cost of living for workers, labor productivity, local employment, and levels of economic development across regions. In practice, the regulations provide substantial flexibility for provincial governments in setting their own minimum wage (Wang and Gunderson, 2011). Specifically, the provincial government divides the cities into several groups according to their economic development, and then sets a minimum wage standard for each of these groups.[16] In Appendix C, we study the empirical relationship between local minimum wage and a host of city-level socioeconomic variables. While minimum wage is found to be negatively correlated with local population and positively correlated with GDP per capita, we do not find any correlation between minimum wages and other city-level variables including price level, unemployment rate, R&D labor share and log number of patent applications. To address the concerns of omitted variable bias, we control for these city-level variables, especially log population and log GDP capita, in our empirical specifications in Section 5 and Section 6.

Another major development in the Chinese labor market over the period of our study is the introduction of a Labor Contract Law which came into force in 2008 (Du, Park and Giles, 2016; Gallagher, Giles, Park and Wang, 2015).[17] The new law contains provisions considered to be highly protective of workers, including regulations on the nature of labor contracts firms are required to offer workers, and regulations on severance conditions for firing workers. Among other changes, the new law requires employers to make employment contracts to a worker open-ended or permanent after two fixed-term contracts or ten years of employment. Gallagher, Giles, Park and Wang (2015) find that the new law significantly increased the fraction of workers with a formal employment contract. Fur-

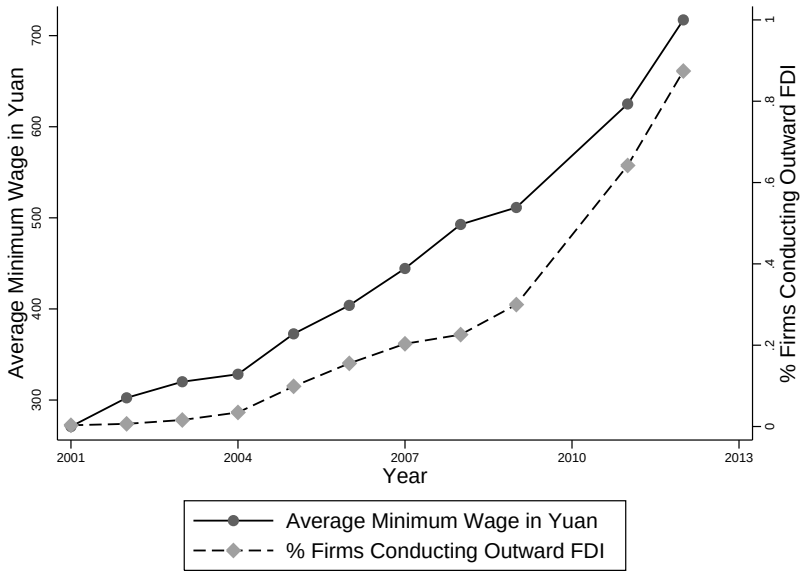
[16] In some provinces, the grouping of cities are fixed over time. For example, in Yunnan Province located in the southwest of China, cities are divided into three minimum-wage groups and wages were adjusted 7 times between 2000 and 2012. In other provinces, the number of groups of cities can change over time. For example, the cities in Inner Mongolia Province were divided into 3 groups before 2005 but into 4 groups since 2006.

[17] Under the civil law system of China, the 2008 Labor Contract Law and the 1994 Labor Law formally have different legal standings. The 1994 Labor Law is a general law while the 2008 law is a special law that does not replace but rather is explicitly aimed to strengthen the 1994 law (Ji and Wei, 2013).

thermore, the new law reiterated the importance of minimum wage standards as a key component of labor market regulations in China (Huang, Loungani and Wang, 2014). Du, Park and Giles (2016) find the 2008 law further contributed to uniform enforcement of labor regulations across Chinese cities. Based on the preceding discussion and in line with the existing literature, in Section 6.5 we divide the sample period into three sub-periods — before 2004, from 2004 to 2008, and after 2008 — to examine the differential effects of minimum wage across time.

Figure 1 plots average minimum wage across cities in our sample from year 2001 to 2012. As the figure shows, average minimum wage (CPI-adjusted) increases from a monthly average of 271 yuan in 2001 to an average of 717 yuan in 2012, an increase of 165%. Figure 1 also plots the percentage of firms conducting outward FDI to non-tax-haven countries in our sample. In our matched sample, the overall percentage of firm-year observations with any outward FDI project is 0.222%. As Figure 1 shows (right axis), outward FDI from China is a new phenomenon, with only 0.0033% of all firms conducting any outward FDI as recently as in 2001. This percentage increases to 0.874% by 2012. Interestingly, the trend of minimum wage in China mirrors that of the percentage of firms conducting outward FDI. We propose an empirical specification to analyze the relationship more formally in the next section.

Figure 1: Minimum Wage and Outward FDI from China



5 Empiric Specification and Results

5.1 Baseline Specification

We consider the following specification for our empirical investigation

$$FDI_{it} = \beta_0 + \beta_1 \ln(\text{mwage}_{ct}) + \beta_2 Z_{ct} + \beta_3 X_{it} + \varphi_i + \varphi_{rt} + \varphi_{ot} + \epsilon_{it} \tag{4}$$

where FDI_{it} is an indicator variable that takes a value of 1 if firm i conducts any outward FDI in year t and takes a value of 0 otherwise. In Equation 4, mwage_{ct} is the minimum wage in city c, Z_{ct} is a vector of the city-level characteristic, X_{it} is a vector of firm-level characteristics, and φ_i, φ_{rt} and φ_{ot} are firm, region-year and ownership-year fixed effects respectively. The vector Z_{ct} in Equation 4 include log city population, log GDP per capita, log local price level, and city unemployment rate, while X_{it} includes log firm employment, log capital and log firms sales.[18] The firm fixed effects φ_i account for unobserved time-invariant differences across firms that may affect a firm's decision to conduct FDI overseas. In other words, we focus on the within-firm variation arising from changes in minimum wage faced by the firm. Furthermore, we use the region-year fixed effects to capture time-varying regional characteristics, and the ownership-year fixed effects to capture time-varying characteristics common to firms of the same ownership type.

We estimate Equation 4 using the linear probability model. In our baseline, we report standard errors clustered at the city level to account for serial correlation. This follows a number of papers on the effects of minimum wages in China, for example, Gan et al. (2016), Mayneris et al. (2017) and Huang et al. (2014). However, since minimum wages are set by the provincial governments, the error terms within a province-year cell may be correlated. Therefore, we also cluster the standard errors at the province-year level. Lastly, we adopt the multi-way clustering method in Cameron, Gelbach and Miller (2011). We cluster the standard errors at *both* the city level and province-year level. Table A4 in the appendix shows that our baseline results are robust to these two alternative methods of calculating standard errors. This also applies to all the other results in this paper.[19]

5.2 Baseline Results

Table 1 presents the estimation results of Equation 4. In Column (1), besides the variable log minimum wage, we include only firm fixed effects and year fixed effects. The

[18] We use the city-level consumer price index (CPI) from China City statistical Yearbooks at various years as the measure for local price level.

[19] Details are available upon request.

estimated coefficient on log minimum wage is 0.00305, and statistically significant at 1% level.

As is well-known, there are large variations in economic conditions across regions in China. Following National Bureau of Statistics, we classify the provinces into four regions: East, Central, West and Northeast. We include region-year fixed effects φ_{rt} to capture any time-varying regional shocks that may affect both the minimum wage and outward FDI. The results are presented in Column (2). The point estimate increases slightly to 0.00318 and remains significant at 1%.

Our sample includes firms of different ownership types: state-owned enterprises (SOE), domestic private firms, and foreign firms. Since cities have different composition of firm ownership types, ownership-specific policy shocks may be correlated with both minimum wage of a city and outward FDI decisions of firms. To address this concern, we include ownership-year fixed effects in Column (3). In addition, we control for city characteristics including log population and log GDP per capita, log price level and unemployment rate. In Column (4), we further control for log firm capital stock, log firm employment and log firm sales. The point estimate of the coefficient on log minimum wage becomes 0.00289, but remains statistically significant at 1% level. From Column (1) to Column (4), both the point estimate and the standard error of the coefficient on log minimum wage are barely changed.[20]

We take Column (4) as our preferred baseline results. According to the point estimate, a 10% increase in the minimum wage of a city raises the probability of a firm to conduct outward FDI by 0.0289 percentage points. Since the probability of conducting outward FDI among the firms in our sample is only 0.222%, this is a large effect. To gauge the importance of minimum wage increase for the overall trend in outward FDI from China, we conduct a simple back-of-envelop calculation. First, our preferred estimate in Column (4) is 0.00289. Second, the average monthly minimum wage increases by 0.97 log points (from 271 yuan to 717 yuan) in our sample. Combining these two numbers, our specification predicts an increase in outward FDI probability of 0.281 percentage points ($(\ln(717) - \ln(271)) * 0.00289 = 0.00281$), accounting for 32.3% ($\frac{0.00281}{0.00874-0.00003} = 0.323$) of the total increase in outward FDI probability over the sample period. This is a large fraction since many other factors, including changes in external investment environment, also affect outward FDI decisions.

According to empirical estimates in this section, the effects of minimum wages on out-

[20]To address the concern that firm-level variables such as firm employment, capital stock and firms sales are endogenous to outward FDI decisions, we also conduct regressions in which we lag these firm-level variables by one year. Our results are not affected by the adjustment.

Table 1: Baseline Results

	(1)	(2)	(3)	(4)
Log Minimum Wage	0.00305***	0.00318***	0.00299***	0.00289***
	(0.00092)	(0.00106)	(0.00102)	(0.00100)
Log Population			-0.00032	-0.00031
			(0.00028)	(0.00027)
Log GDP per capita			0.00136	0.00120
			(0.00106)	(0.00104)
Log Price Level			-0.00015	-0.00016
			(0.00021)	(0.00021)
Unemployment Rate			0.00321**	0.00321**
			(0.00155)	(0.00155)
Log Firm Capital				0.00041***
				(0.00008)
Log Firm Employment				-0.00047***
				(0.00013)
Log Firm Sales				0.00013
				(0.00010)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Region-Year FE	No	Yes	Yes	Yes
Ownership-Year FE	No	No	Yes	Yes
Observation	2116310	2116310	2116310	2116310
R-Square	0.611	0.611	0.611	0.611
FDI Probability	0.00222	0.00222	0.00222	0.00222

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors clustered at the city level are reported in parentheses.

ward FDI in China are large in magnitude and statistically significant. Are these results sensible? We discuss this question below. The ASIF data contain only large manufacturing firms (see Section 3 for a description of the ASIF dataset). As we show in Table A5, the effect of minimum wages on outward FDI is stronger for firms with larger sales or employment. Intuitively, smaller firms would not find it profitable to conduct outward FDI even if they face rising labor costs at home. Therefore, the estimated effect of minimum wages on outward FDI would be reduced if our sample were to include smaller firms which are not covered by the ASIF. However, the estimate effects from the ASIF data are important since aggregated data on the manufacturing output of industrial sector in the annual China's Statistical Yearbook by the NBS are in fact compiled from the firms in the ASIF data (Yu, 2015). Lastly, our estimates are in line with the literature which finds large impacts of the minimum wage increase in China along many different dimensions, including employment, capital investment, exporting behaviors and management practice (Huang et al., 2014; Hau et al., 2016; Gan et al., 2016; Mayneris et al., 2017).

In summary, we find that increase in the minimum wage of a city is associated with higher outward FDI probability by firms. The results are robust to controlling for a number of firm-level variables and city-level variables, as well as including region-year and ownership-year fixed effects. However, other confounding factors may also generate the positive association between increase in minimum wage and outward FDI. In the remainder of this section, we employ three different empirical exercises to address potential endogeneity issue.

5.3 Controlling for Macroeconomic Variables

In this subsection, we examine the sensitivity of the baseline estimates to the inclusion of additional macroeconomic variables that might affect firms' outward FDI decisions. Table 2 reports results from the regressions with the additional controls.

We first examine the role of technical progress. According to the model, only the more productive firms conduct outward FDI. Therefore, productivity improvement induced by technical progress may increase firms' probability of conducting outward FDI. Our estimates could be biased if technical progress is correlated with minimum wage increases. In Column (1) of Table 2 , we use a number of control variables, including GDP growth rate, log number of patent applications and R&D labor share, to proxy for technical progress at the city level. We obtain data on real GDP growth rate and R&D labor share from China City Statistical Yearbooks, and the number of patent applications from the State

Table 2: Controlling for Macroeconomic Variables

	(1)	(2)	(3)	(4)
Log Minimum Wage	0.00292***	0.00297***	0.00289***	0.00298***
	(0.000988)	(0.000993)	(0.000995)	(0.000980)
GDP Growth Rate	-0.00006***			-0.00007***
	(0.00001)			(0.00002)
R & D Labor Share	0.0165			0.0168
	(0.0152)			(0.0150)
Log Patent Apps	0.00005			-0.00001
	(0.00030)			(0.00032)
Log Exchange Rate (Import-Weighted)		0.0102**		0.0104**
		(0.00397)		(0.00401)
Log Exchange Rate (Export-Weighted)		-0.00339		-0.00361
		(0.00339)		(0.00342)
Input Tariff			0.00003	0.00003
			(0.00007)	(0.00007)
Output Tariff			-0.00003	-0.00003
			(0.00004)	(0.00004)
Firm-level Controls	Yes	Yes	Yes	Yes
Other City-level Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Region-Year FE	Yes	Yes	Yes	Yes
Ownership-Year FE	Yes	Yes	Yes	Yes
Observation	2116310	2041946	2116310	2041946
R-Square	0.619	0.620	0.619	0.620
FDI Probability	0.00222	0.00222	0.00222	0.00222

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors clustered at the city level are reported in parentheses. City-level controls include log city population, log per capita city GDP, log local price level and city unemployment rate; firm-level controls include log of capital stock, employment and firm sales.

Intellectual Property Office (SIPO).[21]

We then consider the role of exchange rate shocks. Due to differences in the composition of trade partners, cities are exposed to different exchange rate shocks. First, changes in exchange rate should be an important factor when considering potential FDI projects. Second, changes in exchange rate may affect government decisions when setting local minimum wages. This would then lead to biases in the estimated effects of minimum wage. To address this concern, we include additional control variables. We adapt the approach of Xu, Mao and Tong (2016) who construct firm-specific exchange rates. Specifically, we construct the city-specific exchange rate $\text{CityXR}_{i,t}$ as a geometric average of country exchange rates, as indicated below

$$\text{CityXR}_{i,t} = 100 \times \prod_{k=1}^{n} \left(\frac{e_{k,t}}{e_{k,2000}} \right)^{w_{i,k,2000}}$$

where $e_{k,t}$ is the exchange rate between the currency of country k and the *renminbi* (a larger value corresponds to a *renminbi* depreciation), and $w_{i,k,2000}$ is the share of country k in the total trade of city i at year 2000. We use the trade share from 2000, one year before our sample period, to avoid potential endogeneity problem. In calculating $\text{CityXR}_{i,t}$, we divide each country-specific exchange rate $e_{k,t}$ by its 2000 value to standardize across currencies. We use the formula above to produce two different exchange rate measures at the city level: one weighted by import shares and the other weighted by export shares. We include the logs of these city-specific exchange rates to our baseline regression in Column (2).

Lastly, we consider the role of trade shocks. Since tariffs faced by firms decreased substantially over the sample period, our results may be biased by differential exposure to trade shocks. To address this issue, Column (3) controls for output tariffs and input tariffs.[22] First, to obtain a measure for output tariffs, we calculate the simple average of output tariffs in each sector using the concordance between IO sector and HS8. Second, following the approach in Amiti and Konings (2007), we use the 2002 provincial-level input-output table to calculate the province-sector input tariffs.[23] Specifically, we com-

[21] The SIPO dataset contains detailed information on each patent filing, including date of filing, official name and address of the applicant, name of the patent. We sum the number within each prefecture at different years.

[22] We control for input tariffs separately because China's imports are mostly dominated by intermediate inputs with tiny share of final consumption goods.

[23] The 2002 provincial-level input and output table covers 42 sectors.

pute the province-sector input tariffs as

$$\tau_{i,s,t}^{input} = \sum_k a_{i,s,k,t} \tau_{k,t}^{output}$$

In the above equation, $\tau_{k,t}^{output}$ is the output tariff imposed on sector k at time t; $a_{i,s,k,t}$ is the percentage of sector s's total costs that were expended on products supplied by industry k as intermediate inputs for industry s in province i. Column (4) puts all the above variables into the regression. The baseline estimate of the effect of minimum wage on OFDI probability is robust to the inclusion of these additional controls. Across Columns (1)–(4) of Table 2, a 10% increase in the minimum wage of a city raises the probability of a firm to conduct outward FDI by from 0.0289 (Column (3)) to 0.0298 (Column (4)) percentage points.

5.4 Identification from City Pairs across Province Borders

To further address endogeneity issue, we follow the approach of Dube, Lester and Reich (2010) who use contiguous county pairs across state borders in the US to identify the employment effects of minimum wage. Huang, Loungani and Wang (2014) employ a similar empirical strategy to address endogeneity concerns in their study of the employment effects of the minimum wage in China. Similar to these papers, we exploit policy discontinuities at province borders. Specifically, we construct a dataset of all city pairs in China that straddle a province border. We consider two cities to be a pair if they share a border and belong to two different provinces. We assign a pair id p to each city pair. Since a city may belong to multiple city pairs, an individual city may have multiple replicates in this city-pair dataset.[24] We then match our baseline firm-level dataset with the city-pair dataset.[25] This new city-pair-firm dataset reduces endogeneity concerns in two ways. First, the new dataset allows us to control for time-varying unobserved factors using city-pair-year fixed effects. As argued by Dube et al. (2010), contiguous regions are relatively similar in terms of underlying economic conditions. Second, since cities on province borders tend to be further away from the province government which sets

[24]For example, Meizhou of Guangdong Province borders Zhangzhou and Longyan of Fujian Province to the east, and Ganzhou of Jiangxi Province to the north. As a result, Meizhou appears in the dataset three times, with the Meizhou-Zhangzhou, Meizhou-Longyan and Meizhou-Ganzhou pair id respectively. The issue of duplicates in this empirical strategy is discussed in Dube et al. (2010). To address concerns arising from duplicates, we also report results from regressions weighted by (the inverse of) the number of duplicates.

[25]A firm-year observation will appear multiple times in the new dataset if the city of this firm belongs to multiple city pairs.

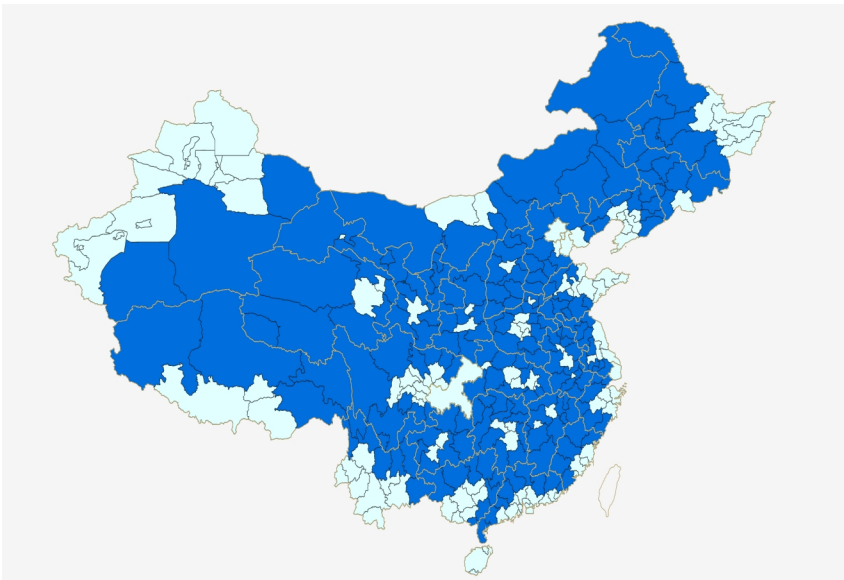
the minimum wage, minimum wage in the border cities may be less affected by local economic conditions. Since the minimum wage at the municipalities Beijing, Tianjing, Shanghai and Chongqing are set by the local government, we drop pairs containing these cities from our city-pair dataset. The final sample contains 2375789 observations from 279 city-pairs and 214 unique cities. Figure 2 provides a map of China in which we highlight in dark blue the cities used for the current empirical strategy.

We consider the following specification for our empirical investigation

$$FDI_{it} = \beta_0 + \beta_1 \ln(\text{mwage}_{ct}) + \beta_2 Z_{ct} + \beta_3 X_{it} + \varphi_i + \varphi_{ot} + \varphi_{pt} + \epsilon_{it} \tag{5}$$

where φ_{pt} are the city-pair-year fixed effects. The city-pair-year fixed effects φ_{pt} in Equation 5 account for the city-pair-specific time-varying shocks. By including φ_{pt}, we are effectively comparing the outward FDI probability of firms to those in the bordering city within the same city pair, exploiting only the *relative* changes in the minimum wage between these two cities, because bordering cities within a city pair are more similar than non-bordering cities. We cluster the standard errors at both the city level and the city-pair-year level using the multiple-way clustering approach in Cameron et al. (2011).

Figure 2: Neighboring City Pairs Across Province Borders



Notes: The cities included for the regressions in Section 5.4 are colored in dark blue. Provincial borders are colored in yellow while city borders are colored in black. We consider two cities to be a pair if they share a border and belong to two different provinces. The municipalities Beijing, Tianjing, Shanghai and Chongqing are not included (See text).

Table 3 reports results from our city-pair firm sample. Panel A reports results from the unweighted regressions. For comparison, we also report results from specifications without city-pair-year fixed effects. The coefficients on log minimum wage in Panel A differ

Table 3: Regression Results from the City-Pair Firm-level Sample

	(1)	(2)	(3)	(4)
	Without Pair-Year FE		With Pair-Year FE	
Panel A: Unweighted Regressions				
Log Minimum Wage	0.00154*	0.00151*	0.00159*	0.00156*
	(0.000830)	(0.000830)	(0.000931)	(0.000932)
R^2	0.634	0.634	0.635	0.635
Panel B: Weighted Regressions				
Log Minimum Wage	0.00183**	0.00179**	0.00219**	0.00215**
	(0.000809)	(0.000804)	(0.000985)	(0.000985)
R^2	0.637	0.637	0.638	0.638
Firm-level Controls	No	Yes	No	Yes
City-level Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Ownership-Year FE	Yes	Yes	Yes	Yes
City-Pair-Year FE	No	No	Yes	Yes
Observations	2375789	2375789	2375789	2375789

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors corrected by two-way clustering at the city and city-pair-year levels are reported in parentheses. City-level controls include log city population, log per capita city GDP, log local price level and city unemployment rate; firm-level controls include log of capital stock, employment and firm sales. Regressions in Panel A are unweighted while those in Panel B are weighted by the inverse of the number of duplicates in the city-pair firm-level sample. Regressions in Columns (3) and (4) include city-pair-year fixed effects while those in Columns (1) and (2) do not.

from those in Table 1. This is not surprising since the sample for this empirical strategy differs substantially from the baseline sample.[26] As Column (1) shows, without including city-pair-year fixed effects, the coefficient on log minimum wage is 0.00154 and statistically significant at 10%. This coefficient barely changes when we add firm-level controls in Column (2). In Columns (3) and (4), we add city-pair-year fixed effects and find that the coefficient on log minimum wage changes very little from Columns (1) and (2). Therefore, there is no evidence that omitted variables that are correlated across provincial borders are driving our results in Section 5.2.

While Dube et al. (2010) treat all observations in the sample equally by using unweighted FE regressions, Huang et al. (2014) propose assigning less weight to the duplicate observations. In Panel B, we conduct regressions by weighing observations according to (the inverse of) the number of duplicates. As Column (2) shows, without city-pair-year fixed effects, the coefficient on log minimum wage is 0.00179 and statistically significant at 5%, for the specification with firm-level controls. This increases to 0.00215 and remains significant at 5% when city-pair-year fixed effects are added. This is consistent with Huang et al. (2014) who find a *more* negative effect of minimum wage on employment in China when city-pair-year fixed effects are added to the regression. Therefore, accounting for omitted variables that are correlated across provincial borders might in fact strengthen our results in Section 5.2.

5.5 Placebo Test

As a final step to address concerns about endogeneity issues, we conduct a placebo test by studying the effects of minimum wage increase on FDI to tax-haven countries. Since FDI to tax-haven destinations does not involve the relocation of actual production activities, the increase in minimum wage should have little effect on tax-haven FDI if our results in Table 1 are not driven by confounding factors. In contrast, since the effects of minimum wages on FDI probability in Table 1 are large in magnitude, if the results were entirely driven by confounding factors, the confounding factor should be large in magnitude and should also apply to FDI to tax-haven destinations. In that case, we should find a significant relationship between minimum wage and tax-haven FDI.

The dependent variable in Table 4 is whether a firm conducts FDI in a tax-haven country. We follow the list of tax-haven countries in Hines and Rice (1994). We then regress this new dependent variable on log minimum wage. Column (1) of Table 4 presents the

[26]The sample differs from the baseline sample in two aspects. First, we only include cities that belong to at least one city pair that straddles a provincial borders. Second, as discussed above, there are duplicates for firms in cities that belong to multiple city pairs.

Table 4: FDI to Tax-haven Countries

	(1)	(2)	(3)	(4)
Log Minimum Wage	-0.00074	-0.00030	-0.00020	-0.00032
	(0.00090)	(0.00085)	(0.00085)	(0.00086)
Firm-level Controls	No	No	No	Yes
City-level Controls	No	No	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Region-Year FE	No	Yes	Yes	Yes
Ownership-Year FE	No	No	Yes	Yes
Observation	2116310	2116310	2116310	2116310
R-Square	0.598	0.598	0.598	0.598
FDI Probability	0.00115	0.00115	0.00115	0.00115

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors clustered at the city level are reported in parentheses. City-level controls include log city population, log per capita city GDP, log local price level and city unemployment rate; firm-level controls include log of capital stock, employment and firm sales.

results when we include only firm and year fixed effects in the regression. In Column (2), we add region-year fixed effects. In Column (3), we also add ownership-year fixed effects and city-level controls. In Column (4), we further add firm-level controls. We do not find minimum wage to be significantly associated with probability of conducting FDI in tax-haven destinations in all specifications. These results contrast sharply with the results in Tables 1. Therefore, Table 4 rules out strong confounding factors as being responsible for the relationship between minimum wage and outward FDI.[27]

6 Heterogeneous Effects

Our sample covers firms of different ownership types, including state-owned enterprises (SOE), domestic private firms, and foreign firms. Additionally, there are large variations in economic conditions across regions (East, Central, West, Northeast) in China, in firm productivity within an industry, and in labor shares across industries. Moreover, the FDI projects in the dataset differ in terms of their primary activities (production versus distribution) and destinations (develop or developing countries). Finally, as discussed in Section 4, the enforcement of minimum wage varies over time. Given these rich varia-

[27] On its own, the placebo test does not rule out weak confounding factors.

tions, it is interesting to examine the heterogeneous effects of minimum wage increase on outward FDI decisions.

6.1 Effects by Firm Productivity

Research has shown that productivity varies substantially within narrowly-defined industries. In our model, the more productive firms are more likely to conduct outward FDI. Furthermore, as Proposition 2 shows, an increase in minimum wage has larger effects on the outward FDI probability of more productive firms. Therefore, we examine the heterogeneous effects of minimum wage increase by TFP.[28]

We construct two measures of revenue-based TFP. Specifically, we employ the Levinsohn and Petrin (2003) (hereafter LP) method and the Olley and Pakes (1996) (hereafter OP) method, augmenting both methods with the approach in Ackerberg, Caves and Frazer (2015). In estimating revenue TFP, we use value-added to measure production output.[29] We back out the physical quantity and capital by deflating these values with sector-specific price indices provided by Brandt et al. (2012). When using the augmented OP method, we also construct the real investment variable by adopting the perpetual inventory method to investigate the law of motion for real capital and real investment. To measure the depreciation rate, we use each firm's real depreciation rate provided by the National Bureau of Statistics of China (NBSC) firm-production database.

We first use the firm productivity estimated from the LP method. We divide our sample into two subsamples according to the initial productivity of a firm. We repeat the regression of our preferred specification in Column (4) of Table 1 for each subsample. The results are presented in Columns (1) and (2) of Table 5. The total number of observations in Columns (1) and (2) decreases substantially from the sample size in Table 1 due to missing values for firm variables (such as value added) required for productivity estimation. As Table 5 shows, while the coefficient on log minimum wage is positive for both group of firms, the coefficient is statistically significant at 1% for the more productive firms but insignificant for the less productive firms. The point estimate for the more productive

[28]The ASIF data do not have information on either intermediate goods or value added for the years after 2007, preventing the calculation of firm TFP for the later years. Consequently, we do not control for TFP in our baseline regressions.

[29]We use the following translog production function:

$$q_{ft} = \beta_l l_{ft} + \beta_k k_{ft} + \beta_{ll} l_{ft}^2 + \beta_{kk} k_{ft}^2 + \beta_{lk} l_{ft} k_{ft} + \omega_{ft} + \varepsilon_{ft} \tag{6}$$

where l_{ft} and k_{ft} is the vector of (log) physical inputs: labor and capital, $\beta_l, \beta_k, \beta_{ll}, \beta_{kk}$ and β_{lk} are the production function coefficients to be estimated; ω_{ft} is firm-specific productivity; and ε_{ft} is an i.i.d. error term. Our results are not sensitive to TFP measures estimated by total output with material input. The results are available upon request.

firms is more than twice of that for the less productive firms. In Column (3), we include an interaction between log minimum wage and log firm productivity in the regression with the full sample. The coefficient on the interaction term is 0.00342 and statistically significant at 1%. Therefore, the effect of minimum wage on outward FDI probability increases rapidly with initial firm productivity. In Columns (4)-(6), we use firm productivity computed from the OP method, and repeat the analysis. The results are not substantively different from those in Columns (1)-(3).

Table 5: Results by Firm Productivity

	(1)	(2)	(3)	(4)	(5)	(6)
TFP Measure		LP			OP	
	<Median	>Median	Full	<Median	>Median	Full
Log Min Wage	0.00155	0.00401***	-0.0187***	0.00152	0.00426***	-0.0180***
	(0.00120)	(0.00144)	(0.00351)	(0.00112)	(0.00155)	(0.00355)
Log Min Wage			0.00342***			0.00354***
× Log TFP			(0.00057)			(0.00063)
Firm-level Controls	Yes	Yes	Yes	Yes	Yes	Yes
City-level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Region-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Ownership-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observation	865083	865084	1730167	865082	865085	1730167
R-Square	0.553	0.600	0.584	0.557	0.598	0.584
FDI Probability	0.00140	0.00284	0.00212	0.00141	0.00284	0.00212

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors clustered at the city level are reported in parentheses. City-level controls include log city population, log per capita city GDP, log local price level and city unemployment rate; firm-level controls include log of capital stock, employment and firm sales.

Due to missing values for TFP, the sample size in Table 5 is smaller than in Table 1. To mitigate concerns about sample attribution, we also use firm size as a proxy for productivity. We examine the effects by firm size in Table A5 and find the effects to be stronger for larger firms.

6.2 Effects by Ownership Type

We classify each firm in our sample as belonging to one of three ownership types: SOE firms, domestic private firms and foreign firms. As noted in Section 3, the ASIF data include firms with annual sales above 5 millions yuan and all state-owned enterprises

before 2007. Starting from 2011, the data include all firms with annual sales above 20 millions yuan. This implies that the subsample of SOEs contains some smaller firms. To ensure sample comparability across ownership types, we drop all firms with annual sales below 5 millions *yuan* for the years before 2011 and all firms with sales below 20 millions *yuan* for the years after 2011. Consequently, the sample size in this subsection is different from that in Table 1.[30] Across firm-year observations, we find that the probability of conducting outward FDI is 0.136% for SOE firms, compared to 0.231% for domestic private firms and 0.271% for foreign firms. This is consistent with Chen, Tian and Yu (2016) which also find that SOE firms are less likely to conduct outward FDI. To examine the effects of minimum wage on firms by ownership status, we repeat the regression in Column (4) of Table 1 for each subsample. The results are reported in Columns (1) to (3) of Table 6. As Table 6 shows, the coefficient on log minimum wage is positive for all three ownership-type subsamples. However, the effect of minimum wage on outward FDI probability appears to be largest for foreign firms and to be smallest for SOE firms. In terms of the magnitude, the point estimate for foreign firms is 0.00489, larger than the estimate for domestic private firms by 86%, and larger than the estimate for SOE firms by 150%. In Column (4), we interact log minimum wage with ownership type dummies in a regression for the full sample.[31] Consistent with Columns (1)-(3), Column (4) shows that the effect of minimum wage is largest for foreign firms. A 10% increase in the minimum wage of a city raises the probability of a foreign firm to conduct outward FDI by 0.0585 percentage points, compared to an increase of 0.0176 percentage points for SOE firms and an increase of 0.0226 percentage points for domestic private firms. The difference in the point estimate for foreign firms and for the other two types of firms are statistically significant at 1% level. However, the difference in the point estimate for SOE firms and domestic private firms is not statistically significant.

As Table 6 shows, foreign firms are most responsive to minimum wage increase while domestic firms (including domestic private firms and SOEs) are less responsive. As discussed in Section 2.5, there are three reasons for the differential response. First, it is well known that foreign-invested firms in China are more productive than domestic firms. Second, the fixed cost gap f_{gap} should be smaller for foreign firms. Lastly, stricter compliance by foreign firms can also contribute to larger response in outward FDI probability.

We further examine the issue of compliance by exploiting the policy reform in 2004 which significantly strengthened the enforcement of minimum wage regulations. Specif-

[30] As shown in Table A6, our results are not substantively changed if we use the same sample in Table 1.

[31] The difference between Column (4) and Columns (1)-(3) is that we do not allow for ownership-type-specific effects of city level characteristics and firm level variables in Column (4)

Table 6: Results by Ownership Type

	(1) SOE	(2) Domestic Private	(3) Foreign	(4) Full
Log Minimum Wage	0.00195	0.00263*	0.00489**	
	(0.00130)	(0.00139)	(0.00227)	
Log Min Wage × SOE				0.00176
				(0.00129)
Log Min Wage × Private				0.00226*
				(0.00136)
Log Min Wage × Foreign				0.00585***
				(0.00223)
Firm-level Controls	Yes	Yes	Yes	Yes
City-level Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Region-Year FE	Yes	Yes	Yes	Yes
Ownership-Year FE	No	No	No	Yes
Observation	223996	1337383	475510	2036889
R-Square	0.607	0.627	0.609	0.621
FDI Probability	0.00136	0.00231	0.00271	0.00230

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors clustered at the city level are reported in parentheses. To ensure sample comparability across ownership types, we drop all firms with annual sales below 5 millions *yuan* for the years before 2011 and all firms with sales below 20 millions *yuan* for the years after 2011. City-level controls include log city population, log per capita city GDP, log local price level and city unemployment rate; firm-level controls include log of capital stock, employment and firm sales.

ically, we study the effects of minimum wage on outward FDI before and after the 2004 reform within each ownership type. As Table A7 shows, before the 2004 reform, the effects of minimum wage were significant only for foreign firms. Crucially, the effects for foreign firms are larger than for domestic firms both before and after 2004, perhaps due to stricter compliance by foreign firms. The effects for domestic private firms increase (relative to the pre-2004 period) and become statistically significant after 2004, perhaps due to improved enforcement. This is suggestive that differential compliance across ownership types plays a role for the differential response in terms of outward FDI probability.

Lastly, as shown in both Table 6 and Table A7, SOEs are less responsive to change in minimum wages than domestic private firms. There are two potential reasons. First, the OFDI activities of SOEs, which are tightly connected to the government, may be driven by non-economic and strategic reasons. Second, SOEs may enjoy a cost advantage over domestic private firms due to domestic distortions in domestic factor markets (Chen et al., 2016). Therefore, SOEs have less incentive to relocate their production activities when minimum wage increases.

6.3 Effects by Sector Labor Intensity

We examine how the effect of minimum wage on outward FDI varies across different industries. We conjecture that the same increase in minimum wage should have a greater effect on the marginal cost of production for firms in industries with higher labor intensity, and consequently a larger effect on firms' probability to conduct outward FDI. We use two sector-level measures of labor intensity: labor capital ratio ($\log(L/K)$) and labor sales ratio ($\log(L/S)$).[32] For each measure of labor intensity, we divide the sample into two subsamples accordingly. We repeat the regression of our preferred baseline specification for each subsample. The results are presented in Table 7. As shown in Columns (1) and (2) of Table 7, the coefficient on log minimum wage is positive and statistically significant for both subsamples when we use labor capital ratio as the labor intensity measure. The point estimate for the firms in the more labor-intensive sectors is 0.00364, about 50% higher than the value of 0.00242 for the less labor-intensive sectors. In Column (3), we include an interaction between log minimum wage and $\log(L/K)$ ratio in the full sample. The coefficient on the interaction terms are positive and statistically significant at 5%. Columns (4)-(6) show that we obtain the same results when using the Labor/Sales ratio as the labor intensity measure. Therefore, the effect of minimum wage on outward FDI

[32] We construct the time-invariant measure $\log(L/K)$ as the ratio of labor payment to capital stock and calculate the time-invariant measure $\log(L/S)$ as the ratio of labor payment to total sales.

probability is significantly larger for firms in the more labor-intensive sectors.

Table 7: Results by Sectoral Labor Intensity

	(1)	(2)	(3)	(4)	(5)	(6)
Measure	Labor/Capital Ratio			Labor/Sales Ratio		
	<Median	>Median	Full	<Median	>Median	Full
Log Minimum Wage	0.00242**	0.00364**	0.00616***	0.00245**	0.00346**	0.00880**
	(0.00111)	(0.00162)	(0.00197)	(0.00111)	(0.00171)	(0.00350)
Log Minimum Wage			0.00185**			0.00190*
× Log Labor Intensity			(0.00082)			(0.00103)
Firm-level Controls	Yes	Yes	Yes	Yes	Yes	Yes
City-level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Region-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Ownership-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observation	1034172	1082138	2116310	1056710	1059600	2116310
R-Square	0.613	0.624	0.611	0.613	0.625	0.611
FDI Probability	0.00196	0.00247	0.00222	0.00201	0.00243	0.00222

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors clustered at the city level are reported in parentheses. City-level controls include log city population, log per capita city GDP, log local price level and city unemployment rate; firm-level controls include log of capital stock, employment and firm sales.

6.4 Effects by Region

Economic activities are very unevenly distributed across regions in China. In our sample firms from the east region account for 67.2% of the total, while firms from the northeast region only accounts for 8.3% of the total. We examine the heterogeneous effects of minimum wage increase by regions. Since the more productive firms are clustered in the much more developed the eastern coastal region and the minimum wage in the east region are much higher than in the other regions, we expect the minimum wage-OFDI-probability linkage to be the strongest in the east region.[33]

We divide our sample into four regional subsamples: east, central, west and northeast. Table 8 presents the results. For the east region, the coefficient on log minimum wage is large with a value of 0.00471 and statistically significant at 1%. However, the coefficient is less than half of that for the central region, and negative and statistically insignificant for the west region and the northeast region. In Column (5), we include the interactions

[33]Variation in compliance might also contribute to differential effects across regions. According to Ye, Gindling and Li (2015), about 1.5% of workers in Jiangsu earn less than the minimum wage in 2009, compared to 2.8% for Shandong and 3.4% for Shaanxi.

Table 8: Results by Region

	(1) East	(2) Central	(3) West	(4) Northeast	(5) Full
Log Minimum Wage	0.00471**	0.00135	-0.00059	-0.00117	
	(0.00179)	(0.00098)	(0.00128)	(0.00202)	
Log Min Wage × East					0.00496***
					(0.00186)
Log Min Wage × Central					0.00132
					(0.00104)
Log Min Wage × West					-0.00030
					(0.00125)
Log Min Wage × Northeast					-0.00248
					(0.00166)
Firm-level Controls	Yes	Yes	Yes	Yes	Yes
City-level Controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Region-Year FE	No	No	No	No	Yes
Ownership-Year FE	Yes	Yes	Yes	Yes	Yes
Observation	1388225	341418	214140	172527	2116310
R-Square	0.617	0.635	0.619	0.622	0.619
FDI Probability	0.00244	0.00129	0.00209	0.00245	0.00222

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors clustered at the city level are reported in parentheses. City-level controls include log city population, log per capita city GDP, log local price level and city unemployment rate; firm-level controls include log of capital stock, employment and firm sales. Region is represented by a set of four dummies: East, Central, West and Northeast of China.

terms between log minimum wage and the regional dummies. The results in Column (5) are consistent with the regression results from the subsamples. One concern with our results in Table 8 is that different regions in China are exposed to differential trade shocks which may be a confounding factor. In Table A8, we control for both input and output tariffs and find the results to be unchanged. In summary, we show that the effects of minimum wage on outward FDI are the strongest for firms from the coastal provinces.

6.5 Effects Across Time

In this subsection, we consider the effects of minimum wage on outward FDI probability across time. As noted in Section 3, there was a policy reform to the national minimum wage system by the Ministry of Labor and Social Security in 2004. Another major development is the introduction of a new Labor Contract Law in 2008 which contributed to more uniform enforcement of labor regulations across Chinese cities and substantially increased labor costs for firms in China (Du, Park and Giles, 2016; Gallagher, Giles, Park and Wang, 2015). Consequently, we classify the period under study into three sub-periods: before 2004, from 2004 to 2008 and after 2008. Since the regulations of labor market are increasingly stringent over time, we expect the marginal effect of minimum wage on outward FDI probability to be progressively larger over the three sub-periods.

We examine time-varying effects of minimum wages on firms' FDI activities in Table 9. In Column (1), we interact log minimum wage with a "pre-2004" dummy and a "post-2004" dummy. We find that the effect of minimum wage on FDI probability is positive for both periods. However, the coefficient is statistically significant only for the period after 2004. In Column (2), we further classify the post-2004 period into two periods, from 2004 to 2008 and after 2008, and interact log minimum wage with the dummies for the three periods. While the effects of minimum wage on FDI probability are statistically significant for the two later periods, we find them to be the strongest for the years after 2008.

6.6 Effects by FDI Types and Destinations

In this subsection, we examine the heterogeneous effects of minimum wages across different types of FDI and destinations. While both the anecdotal evidence in the introduction and the theoretical model are associated with horizontal FDI, our data do not allow us to distinguish between horizontal FDI versus vertical FDI. Nevertheless, for each FDI project in our MOFCOM data, there is a short description text on the planned activities of the investment, allowing a relatively crude classification of the projects. Following Tian

Table 9: Effects of Minimum Wage by Policy Periods

	(1)	(2)
Log Min Wage × Pre-2004	0.00178	0.00177
	(0.00146)	(0.00144)
Log Min Wage × Post-2004	0.00309***	
	(0.00098)	
Log Min Wage × Years 2004-2008		0.00284***
		(0.00093)
Log Min Wage × After-2008		0.00577***
		(0.00218)
Firm-level Controls	Yes	Yes
City-level Controls	Yes	Yes
Firm FE	Yes	Yes
Region-Year FE	Yes	Yes
Ownership-Year FE	Yes	Yes
Observation	2116310	2116310
R-Square	0.611	0.611
FDI Probability	0.00222	0.00222

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors clustered at the city level are reported in parentheses. City-level controls include log city population, log per capita city GDP, log local price level and city unemployment rate; firm-level controls include log of capital stock, employment and firm sales.

Table 10: Results by FDI Type and Destinations

	(1)	(2)	(3)	(4)
	by FDI Type		by Destination	
	Production	Distribution	Developing	Developed
Log Minimum Wage	0.00191***	0.00093	0.00131***	0.00150
	(0.00062)	(0.00094)	(0.00051)	(0.00113)
Firm-level Controls	Yes	Yes	Yes	Yes
City-level Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Region-Year FE	Yes	Yes	Yes	Yes
Ownership-Year FE	Yes	Yes	Yes	Yes
Observations	2116310	2116310	2116310	2116310
R-Square	0.603	0.606	0.608	0.604
FDI Probability	0.00139	0.00098	0.00116	0.00118

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors clustered at the city level are reported in parentheses. City-level controls include log city population, log per capita city GDP, log local price level and city unemployment rate; firm-level controls include log of capital stock, employment and firm sales.

and Yu (2015), we use the text variable to classify each project into either "production FDI" and "distribution FDI."[34] Based on the model, we expect the effects of minimum wages on outward FDI to be stronger for production FDI than for distribution FDI. As Table 10 shows, the coefficient on log minimum wage is 0.00191 and statistically significant at 1% when we restrict our dependent variable to production FDI. In contrast, when restricted to distribution FDI, the coefficient is only 0.00093 and statistically insignificant.

Lastly, we examine the heterogeneous effects across different destinations. On the one hand, one would expect the effects to be stronger for outward FDI to developing country, as firms move to other low-wage countries such as Vietnam and Cambodia to deal with rising minimum wages in China. On the other hand, the mechanism in the model should hold independent of whether wage is higher in the home country than in the destination country, when looking at any destination country in isolation. This is consistent with the example in the introduction that rising labor costs in China are cited as one of the driving forces behind Fuyao Glass Industry Group's decision to set up a plant in the US, even though labor costs are higher in the US than in China.[35] We classify all

[34]Specifically, we classify a project as distribution FDI if the description text contains one or more keywords associated with sales activities but does not contains keywords associated with production. Similarly, we classify a project as production FDI if the description text contains any keywords associated with production activities.

[35]The reason for Fuyao Glass Industry Group's decision can be a combination of demand factors (US

the FDI projects in MOFCOM data into FDI projects to developing countries and those to developed countries, using country classification from the IMF.[36] As Column 3 of Table 10 shows, the coefficient on log minimum wage is 0.00131 and statistically significant at 5% when restricting the destinations to developing countries. Consistent with the discussion above, when we restrict the destinations to developed countries, the coefficient is similar in magnitude but statistically insignificant.

7 Conclusion

The spectacular rise of minimum wage standards in China has received a lot of attention in academics and policy forums. There is an ongoing discussion on how higher labor costs and stricter regulations are affecting the international competitiveness of Chinese firms. At the same time, outward FDI from China has risen exponentially and the existing literature is silent on the reasons behind this phenomenon. This paper contributes to the debate by empirically examining firms' outward FDI decisions in response to rising labor costs in China, as reflected by the increase in the minimum wage. We construct a rich firm-level dataset with information on outward FDI activities over 2001-2012 to study the relationship between minimum wage and firms' outward FDI probability.

The estimation results indicate substantial effects of the increase in the local minimum wage on the probability of conducting outward FDI. Our baseline results show that a 10% increase in minimum wage raises the outward FDI probability by around 0.0289 percentage points. Since labor costs are set to increase further in China, our study strongly suggests that outward FDI from China will continue to rise in the coming decades. Lastly, we find the effects on outward FDI to be most pronounced for more productive firms, those with foreign ownership, those in the more labor-intensive sectors, those located in the prosperous coastal region, for the years after 2004 and for production-oriented FDI projects.

is a large market) and cost factors (the *total* cost of doing business in US may be lower). Dewang Cao, founder and head of the company, stated that the total cost of doing business, including taxes, energy and transportation costs, may be higher in China than in the US (Lui, 2016).

[36] Our results remain the same if we use the classication from the World Bank.

References

Ackerberg, Daniel A, Kevin Caves, and Garth Frazer, "Identification properties of recent production function estimators," *Econometrica*, 2015, *83* (6), 2411–2451.

Amiti, Mary and Jozef Konings, "Trade liberalization, intermediate inputs, and productivity: Evidence from Indonesia," *American Economic Review*, 2007, *97* (5), 1611–1638.

Autor, David H, Alan Manning, and Christopher L Smith, "The contribution of the minimum wage to US wage inequality over three decades: a reassessment," *American Economic Journal: Applied Economics*, 2016, *8* (1), 58–99.

Berg, Gerard J Van Den, "Multiple equilibria and minimum wages in labor markets with informational frictions and heterogeneous production technologies," *International Economic Review*, 2003, *44* (4), 1337–1357.

Bernard, Andrew B, J Bradford Jensen, and Robert Z Lawrence, "Exporters, jobs, and wages in US manufacturing: 1976-1987," *Brookings Papers on Economic Activity. Microeconomics*, 1995, *1995*, 67–119.

Blonigen, Bruce A, "A review of the empirical literature on FDI determinants," *Atlantic Economic Journal*, 2005, *33* (4), 383–403.

Bradsher, Keith, "Investors seek asian options to costly China," *New York Times*, June 18, 2008. `http://www.nytimes.com/2008/06/18/business/worldbusiness/18invest.html`, accessed March 4th,2018].

Brainard, S Lael et al., "An empirical assessment of the proximity-concentration trade-off between multinational sales and trade," *American Economic Review*, 1997, *87* (4), 520–44.

Brandt, Loren, Johannes Van Biesebroeck, and Yifan Zhang, "Creative accounting or creative destruction? Firm-level productivity growth in Chinese manufacturing," *Journal of Development Economics*, 2012, *97* (2), 339–351.

Brouthers, Keith D and Jean-Francois Hennart, "Boundaries of the firm: Insights from international entry mode research," *Journal of Management*, 2007, *33* (3), 395–425.

Brown, Charles and James Medoff, "The employer size-wage effect," *Journal of Political Economy*, 1989, *97* (5), 1027–1059.

_ , Curtis Gilroy, and Andrew Kohen, "The effect of the minimum wage on employment and unemployment," *Journal of Economic Literature*, 1982, *20* (2), 487–528.

Buckley, Peter J, "The limits of explanation: Testing the internalization theory of the multinationial enterprise," *Journal of International Business Studies*, 1988, *19* (2), 181–193.

_ , L Jeremy Clegg, Adam R Cross, Xin Liu, Hinrich Voss, and Ping Zheng, "The determinants of Chinese outward foreign direct investment," *Journal of International Business Studies*, 2007, *38* (4), 499–518.

Burdett, Kenneth and Dale T Mortensen, "Wage differentials, employer size, and unemployment," *International Economic Review*, 1998, pp. 257–273.

Cameron, A Colin, Jonah B Gelbach, and Douglas L Miller, "Robust inference with multiway clustering," *Journal of Business & Economic Statistics*, 2011, *29* (2), 238–249.

Card, David and Alan B Krueger, "Minimum wages and employment: A case study of the fast-food industry in New Jersey and Pennsylvania," *American Economic Review*, 1994, *84* (4), 772–793.

Carr, David L, James R Markusen, and Keith E Maskus, "Estimating the knowledge-capital model of the multinational enterprise," *American Economic Review*, 2001, *91* (3), 693–708.

Chen, Cheng, Wei Tian, and Miaojie Yu, "Outward FDI and domestic input distortions: Evidence from Chinese firms," *Working Paper*, 2016.

Chen, Wenjie and Heiwai Tang, "The dragon is flying west: micro-level evidence of Chinese outward direct investment," *Asian Development Review*, 2014.

Cushman, David O, "Real exchange rate risk, expectations, and the level of direct investment," *Review of Economics and Statistics*, 1985, pp. 297–308.

Dautović, Ernest, Harald Hau, and Yi Huang, "The consumption response to minimum wages: Evidence from Chinese households," *Working Paper*, 2017.

Du, Yang, Albert Park, and John Giles, "Labor regulation and manufacturing employment in China," *Working Paper*, 2016.

Dube, Arindrajit, T William Lester, and Michael Reich, "Minimum wage effects across state borders: Estimates using contiguous counties," *The review of economics and statistics*, 2010, *92* (4), 945–964.

Fan, Haichao, Edwin L.-C. Lai, and Yao Amber Li, "Credit constraints, quality, and export prices: Theory and evidence from China," *Journal of Comparative Economics*, 2015, *43* (2), 390 – 416.

_ , Yao Amber Li, and Stephen R. Yeaple, "Trade liberalization, quality, and export prices," *Review of Economics and Statistics*, December 2015, *97* (5), 1033–1051.

_ , _ , and _ , "On the relationship between quality and productivity: Evidence from China's accession to the WTO," *Journal of International Economics*, 2018, *110* (1), 28–49.

Fang, Tony and Carl Lin, "Minimum wages and employment in China," *IZA Journal of Labor Policy*, 2015, *4* (1).

Gallagher, Mary, John Giles, Albert Park, and Meiyan Wang, "China's 2008 Labor Contract Law: Implementation and implications for China's workers," *Human Relations*, 2015, *68* (2), 197–235.

Gan, Li, Manuel A Hernandez, and Shuang Ma, "The higher costs of doing business in

China: Minimum wages and firms' export behavior," *Journal of International Economics*, 2016, *100*, 81–94.

Giovanni, Julian Di, "What drives capital flows? The case of cross-border M&A activity and financial deepening," *Journal of International Economics*, 2005, *65* (1), 127–149.

Hau, Harald, Yi Huang, and Gewei Wang, "Firm response to competitive shocks: Evidence from China's minimum wage policy," *Working Paper*, 2016.

Helpman, Elhanan, Marc J Melitz, and Stephen R Yeaple, "Export versus FDI with heterogeneous firms," *American Economic Review*, 2004, *94* (1), 300–316.

Hines, James R and Eric M Rice, "Fiscal paradise: Foreign tax havens and American business," *The Quarterly Journal of Economics*, 1994, *109* (1), 149–182.

Huang, Yi, Prakash Loungani, and Gewei Wang, "Minimum wages and firm employment: Evidence from China," *Working Paper*, 2014.

Ji, Lin and Shang-Jin Wei, "Learning from a puzzle: When can stronger labor protection improve productivity," *Working Paper*, 2013.

Johanson, Jan and Jan-Erik Vahlne, "The internationalization process of the firm—a model of knowledge development and increasing foreign market commitments," *Journal of International Business Studies*, 1977, *8* (1), 23–32.

Kan, Michael, "Foxconn to increase workers' wages in China," *PC World*, Feb 19, 2012. `https://www.pcworld.com/article/250298/foxconn_to_increase_workers_wages_in_china.html`, accessed March 4th,2018].

Kolstad, Ivar and Arne Wiig, "What determines Chinese outward FDI?," *Journal of World Business*, 2012, *47* (1), 26–34.

Levinsohn, James and Amil Petrin, "Estimating production functions using inputs to control for unobservables," *Review of Economic Studies*, 2003, *70* (2), 317–341.

Long, Cheryl and Jin Yang, "How do firms respond to minimum wage regulation in China? Evidence from Chinese private firms," *China Economic Review*, 2016, *38*, 267–284.

Lui, Kevin, "Meet the Chinese billionaire who's moving manufacturing to the U.S. to cut costs," *Fortune*, December 22, 2016. `http://fortune.com/2016/12/22/us-china-manufacturing-costs-investment`, accessed March 4th, 2018.

Luo, Yadong, Qiuzhi Xue, and Binjie Han, "How emerging market governments promote outward FDI: Experience from China," *Journal of World Business*, 2010, *45* (1), 68–79.

Markusen, James R, "Multinationals, multi-plant economies, and the gains from trade," *Journal of international economics*, 1984, *16* (3-4), 205–226.

Mayneris, Florian, Sandra Poncet, and Tao Zhang, "Improving or disappearing: Firm-level adjustments to minimum wages in China," *Working Paper*, 2017.

Neumark, David and William Wascher, "Minimum wages and employment: A case study of the fast-food industry in New Jersey and Pennsylvania: Comment," *American Economic Review*, 2000, *90* (5), 1362–1396.

Olley, G Steven and Ariel Pakes, "The dynamics of productivity in the telecommunications equipment industry," *Econometrica*, 1996, *64* (6), 1263–1297.

Russ, Katheryn Niles, "The endogeneity of the exchange rate as a determinant of FDI: A model of entry and multinational firms," *Journal of International Economics*, 2007, *71* (2), 344–372.

Tian, Wei and Miaojie Yu, "Distribution outward FDI and productivity heterogeneity: Evidence from Chinese firms," *Working Paper*, 2015.

Tomiura, Eiichi, "Foreign outsourcing, exporting, and FDI: A productivity comparison at the firm level," *Journal of International Economics*, 2007, *72* (1), 113–127.

UNCTAD, *World investment report 2016: Investor nationality: Policy challenges*, UNCTAD ((United Nations Conference on Trade and Development)), Geneva., 2016.

Wallis, William, "China plans multimillion Ethiopia investment," *Financial Times*, June 4, 2013. `https://www.ft.com/content/37011562-cc6d-11e2-9cf7-00144feab7de`, accessed March 4th, 2018].

Wang, Chengqi, Junjie Hong, Mario Kafouros, and Agyenim Boateng, "What drives outward FDI of Chinese firms? Testing the explanatory power of three theoretical frameworks," *International Business Review*, 2012, *21* (3), 425–438.

Wang, Jing and Morley Gunderson, "Minimum wage impacts in China: Estimates from a prespecified research design, 2000–2007," *Contemporary Economic Policy*, 2011, *29* (3), 392–406.

Xu, Jiayun, Qilin Mao, and Jiadong Tong, "The impact of exchange rate movements on multi-product firms' export performance: Evidence from China," *China Economic Review*, 2016, *39*, 46–62.

Ye, Linxiang, TH Gindling, and Shi Li, "Compliance with legal minimum wages and overtime pay regulations in China," *IZA Journal of Labor & Development*, 2015, *4* (1).

Yeaple, Stephen Ross, "Firm heterogeneity and the structure of US multinational activity," *Journal of International Economics*, 2009, *78* (2), 206–215.

Yu, Miaojie, "Processing trade, tariff reductions and firm productivity: evidence from Chinese firms," *Economic Journal*, 2015, *125* (585), 943–988.

Appendix

Appendix A Summary Statistics

Table A1: Summary Statistics

Variable	Obs	Mean	Std. Dev.	P10	P50	P90
Firm-Level Variables						
Capital ('000 Yuan)	2116310	36674.25	428084.2	635	4966	46542.5
Sales ('000 Yuan)	2116310	129828.9	1243762	6106	26932	184630
Employment	2116310	266.60	996.63	30	115	498
=1 if from East Region	2116310	0.656	0.475	0	1	1
=1 if from Central Region	2116310	0.161	0.368	0	0	1
=1 if from West Region	2116310	0.101	0.302	0	0	1
=1 if from Northeast Region	2116310	0.082	0.274	0	0	0
=1 if state-owned	2116310	0.126	0.332	0	0	1
=1 if domestic private-owned	2116310	0.646	0.478	0	1	1
=1 if foreign-owned	2116310	0.228	0.419	0	0	1
City-Level Variables						
Minimum Wage (Yuan)	3828	445.307	155.354	262.919	425.463	665.814
GDP per capita (Yuan)	3828	17696.61	15750.28	5340.47	12410.21	37553.28
Population (Thousands)	3828	3886.28	2696.50	1221.20	3347.80	7230.10
Consumer Price Index	3828	2.226	1.075	1.09	1.978	3.604
Unemployment Rate	3828	0.070	0.056	0.027	0.065	0.116
GDP per capita Growth Rate	3828	0.032	0.809	0	0.002	0.003
RD labor share	3828	0.020	0.016	0.006	0.018	0.037
No. of patent (Thousands)	3828	3.885	1.868	1.792	3.738	6.370
Import-Weighted Ex. Rate	3408	4.441	0.389	4.321	4.513	4.619
Export-Weighted Ex. Rate	3408	4.481	0.374	4.282	4.547	4.707

Appendix B The Effect of Minimum Wage on Firm-Level Average Wage

Table A2: Average Firm Wage Regressions

	(1) All	(2) All	(3) Employment>100
Minimum Wage	1.989**	2.837**	4.072**
	(0.939)	(1.130)	(1.767)
Firm-level Controls	No	Yes	Yes
City-level Controls	No	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Region-Year FE	No	Yes	Yes
Ownership-Year FE	No	Yes	Yes
Observations	2116310	2116310	1062324
R-Square	0.716	0.723	0.438

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors clustered at the city level are reported in parentheses. City-level controls include log city population, log per capita city GDP, log local price level and city unemployment rate; firm-level controls include log of capital stock, employment and firm sales.

Appendix C The Determinants of Minimum Wage in China

In this section, we study the empirical relationship between local minimum wage and a host of city-level socioeconomic variables. We consider the following specification at the city level

$$\ln(\text{mwage}_{ct}) = \gamma_0 + \gamma_1 Z_{ct} + \omega_c + \omega_t + v_{it} \tag{7}$$

where mwage_{ct} is the minimum wage in city c, Z_{ct} is a vector of the city-level characteristic, and ω_c and ω_t are city and year fixed effects, respectively.

Table A3 presents the results. As Column (1) shows, the coefficient on log GDP per capita is positive and statistically significant at 1%. This indicates that economic development is an important predictor of minimum wage. In addition, we find that the coefficient on log population to be negative and statistically significant. On the other hand, the coefficients on price level and unemployment rate are not significantly different from zero. In Column (2), we include macroeconomic variables such as GDP growth rate, R&D labor share and log number of patent applications. In Column (3), we control for city-specific

exchange rate shocks (see Section 5.3). As Table A3 shows, we do not find any correlation between minimum wages and the city-level variables except for log population and log GDP per capita. To address the concerns about omitted variable bias, we control for these city-level variables, especially log population and log GDP capita, in our empirical specifications in Section 5 and Section 6.

Table A3: Determinants of Minimum Wage

	(1)	(2)	(3)
Log Population	-0.0323***	-0.0326***	-0.0292*
	(0.0114)	(0.0116)	(0.0158)
Log GDP per capita	0.0389***	0.0388***	0.0391**
	(0.0148)	(0.0148)	(0.0174)
Log Price Level	0.00761	0.00751	0.00075
	(0.0111)	(0.0111)	(0.0118)
Unemployment Rate	0.0700	0.0665	0.0686
	(0.0603)	(0.0611)	(0.0681)
GDP Growth Rate		-0.00010	-0.00027
		(0.00063)	(0.00042)
R & D Labor Share		0.132	0.180
		(0.247)	(0.248)
Log Patent Apps		-0.00137	0.00439
		(0.00337)	(0.00436)
Log Exchange Rate (Export-Weighted)			0.0382
			(0.0536)
Log Exchange Rate (Import-Weighted)			0.0523
			(0.0512)
Year FE	Yes	Yes	Yes
City FE	Yes	Yes	Yes
Observation	3828	3828	3408
R-Square	0.913	0.913	0.914

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors clustered at the city level are reported in parentheses.

Appendix D Baseline Regressions with Alternative Standard Errors

Table A4: Baseline Results with Alternative Standard Errors

	(1)	(2)	(3)	(4)
Log Minimum Wage	0.00305	0.00318	0.00299	0.00289
	(0.00092)***	(0.00106)***	(0.00102)***	(0.00100)***
	[0.00113]***	[0.00119]***	[0.00113]***	[0.00111]***
	{0.00118}**	{0.00132}**	{0.00125}**	{0.00122}**
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Region-Year FE	No	Yes	Yes	Yes
Ownership-Year FE	No	No	Yes	Yes
Observation	2116310	2116310	2116310	2116310
R-Square	0.619	0.619	0.619	0.619
FDI Probability	0.00222	0.00222	0.00222	0.00222

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Each column in this table represents the same regression results as the corresponding column in Table 1 but with alternative ways of calculating standard errors. Robust standard errors clustered at the city level, at the province-year pair level, and using the multiple-way clustering approach (at the city level and the city-pair-year level) are reported in '()','[]' and '{}', respectively.

Appendix E Results by Firm Size

Table A5: Results by Firm Size

	(1)	(2)	(3)	(4)	(5)	(6)
Size Measure		Employment			Sales	
	<Median	>Median	Full	<Median	>Median	Full
Log Min Wage	0.00205*	0.00370**	-0.0476***	0.00139	0.00424**	-0.0998***
	(0.00119)	(0.00162)	(0.00481)	(0.00106)	(0.00172)	(0.00829)
Log Min Wage			0.0105***			0.0104***
× Log Size			(0.00100)			(0.00085)
Firm-level Controls	Yes	Yes	Yes	Yes	Yes	Yes
City-level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Region-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Ownership-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observation	1054275	1062035	2116310	1058136	1058174	2116310
R-Square	0.594	0.626	0.621	0.547	0.635	0.621
FDI Probability	0.00094	0.00349	0.00222	0.00079	0.00365	0.00222

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors clustered at the city level are reported in parentheses. City-level controls include log city population, log per capita city GDP, log local price level and city unemployment rate; firm-level controls include log of capital stock, employment and firm sales.

Appendix F Results by Ownership Type with Full Sample

Table A6: Results by Ownership Type with Full Sample

	(1) SOE	(2) Domestic Private	(3) Foreign	(4) Full
Log Minimum Wage	0.00162	0.00256*	0.00471**	
	(0.00109)	(0.00136)	(0.00225)	
Log Min Wage × SOE				0.00141
				(0.00107)
Log Min Wage × Private				0.00225*
				(0.00133)
Log Min Wage × Foreign				0.00565**
				(0.00223)
Firm-level Controls	Yes	Yes	Yes	Yes
City-level Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Region-Year FE	Yes	Yes	Yes	Yes
Ownership-Year FE	No	No	No	Yes
Observations	267176	1367161	481973	2116310
R-square	0.605	0.626	0.608	0.619
FDI Probability	0.00115	0.00227	0.00268	0.00222

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors clustered at the city level are reported in parentheses. City-level controls include log city population, log per capita city GDP, log local price level and city unemployment rate; firm-level controls include log of capital stock, employment and firm sales.

Appendix G Results before and after 2004 by Ownership Type

Table A7: Effects of Minimum Wage by Policy Periods

	(1) SOE	(2) Domestic Private	(3) Foreign
Log Minimum Wage X Pre-2004	0.00113	0.00003	0.00566*
	(0.00169)	(0.00236)	(0.00335)
Log Minimum Wage X Post-2004	0.00190	0.00285**	0.00455**
	(0.00140)	(0.00133)	(0.00215)
Firm-level Controls	Yes	Yes	Yes
City-level Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Region-Year FE	Yes	Yes	Yes
Observations	267176	1367161	481973
R-Square	0.605	0.626	0.608
FDI Probability	0.00115	0.00227	0.00268

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors clustered at the city level are reported in parentheses. City-level controls include log city population, log per capita city GDP, log local price level and city unemployment rate; firm-level controls include log of capital stock, employment and firm sales.

Appendix H Results by Region with Tariff Controls

Table A8: Results by Region with Tariff Controls

	(1) East	(2) Central	(3) West	(4) Northeast	(5) Full
Log Minimum Wage	0.00472***	0.00132	-0.00059	-0.00116	
	(0.00178)	(0.000967)	(0.00129)	(0.00202)	
Log Min Wage × East					0.00497***
					(0.00186)
Log Min Wage × Central					0.00131
					(0.00104)
Log Min Wage × West					-0.00030
					(0.00125)
Log Min Wage × Northeast					-0.00248
					(0.00167)
Input Tariff	0.00005	0.00011	-0.00006	-0.00005	0.00003
	(0.00010)	(0.00022)	(0.00033)	(0.00022)	(0.00008)
Output Tariff	-0.00005	-0.00008	0.00004	0.00004	-0.00004
	(0.00006)	(0.00017)	(0.00019)	(0.00017)	(0.00005)
Firm-level Controls	Yes	Yes	Yes	Yes	Yes
City-level Controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Region-Year FE	No	No	No	No	Yes
Ownership-Year FE	Yes	Yes	Yes	Yes	Yes
Observation	1388225	341418	214140	172527	2116310
R-Square	0.617	0.635	0.619	0.622	0.619
FDI Probability	0.00244	0.00129	0.00209	0.00245	0.00222

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors clustered at the city level are reported in parentheses. City-level controls include log city population, log per capita city GDP, log local price level and city unemployment rate; firm-level controls include log of capital stock, employment and firm sales. Region is represented by a set of four dummies: East, Central, West and Northeast of China.