How Does the Minimum Wage Affect Firm Investments in Fixed and Human Capital? Evidence from China.*

Tobias Haepp[a,b] **and Carl Lin**[c,d]

[a] *Graduate Institute of National Development, National Taiwan University*
[b] *Chung-Hua Institution for Economic Research (CIER)*
[c] *Department of Economics, Beijing Normal University*
[d] *Institute for the Study of Labor (IZA)*

SOLE/EALE World Conference 2015 Submission. April 29, 2015.

Abstract

This paper empirically analyzes the impact of the Chinese minimum wage regulations on the firm decision to invest in physical and human capital. We exploit the geographical and inter-temporal variation of county-level minimum wages in a large panel data set of Chinese firms covering the introduction of the new Chinese minimum wage regulations in 2004. In our basic regressions including all Chinese firms, we find significant negative effects of the minimum wage on human capital investment rates and significant positive effects on fixed capital investment rates. When grouping firms by their ownership structure, we find that all company groups - including state-owned and foreign-owned companies - have reduced their human capital investments, while only Chinese privately owned companies have increased their fixed capital investment rates.

Keywords: Minimum wages, investment, fixed capital, human capital
JEL classification: J31, J38

* Corresponding author: Tobias Haepp. Email: d96323009@ntu.edu.tw.

I. Introduction

As part of its endeavour to ensure the provision of basic living standards of its workforce, China accepted the ILO Minimum Wage Fixing Convention in 1984 and issued the 'Enterprises Minimum Wage Regulations' in 1993. In 2004, the government passed new minimum wage regulations, requiring each province to increase its minimum wage at least biannually and increasing the fines for non-compliant companies. The frequency and scale of minimum wage adjustments across the Chinese economy has subsequently increased significantly. In those parts of the country that had implemented a minimum wage by 1996, nominal minimum wage levels increased by 90.42% until 2004. This was followed by an increase of 178.05% in the subsequent years until 2012. According to data from the Urban Household Survey used in Fang and Lin (2013), 8.91% of urban workers and 57.01% of urban female workers were earning the minimum wage or less between 2004 and 2009. While data on rural migrant workers are scarce, the effect of the minimum wage on this group is estimated to be even larger due to their predominance in low-wage sectors (Wang and Gunderson, 2011).

The expansion of the Chinese minimum wage system has been accompanied by an ongoing controversy regarding the suitability of the policy for the Chinese economy. Proponents argue that it is a necessary means to warrant sufficient living standards for vulnerable workers and introduces incentives for companies to upgrade excessively labor intensive production technology, while opponents of the minimum wage policy argue that the policy interferes with the transition to a market economy and that it raises production costs, in turn harming the international competitiveness of Chinese companies (Cooke, 2005; Wang and Gunderson, 2011). Recent research has investigated the effect of the minimum wage on employment and found adverse effects for parts of the Chinese labor force, including female labor (Wang and Gunderson, 2012; Jia, 2014), workers in non-state owned enterprises and slow-growing regions (Wang and Gunderson, 2011) as well as young adults and low-skilled workers (Fang and Lin, 2013). The effect of the Chinese minimum wage policy on firm behaviour has not been analyzed thus far and the current work aims make a contribution to fill this gap in the literature. We focus on investment

behaviour, which is a direct determinant of the long term competitiveness of companies. We first analyze whether the cost burden imposed on companies through an increase in minimum wages has harmed company competitiveness in terms of the ability to invest in fixed capital. We then investigate how minimum wages affect the ability of companies to invest in human capital. Investment in human capital is of particular importance in the Chinese case, since it is a key channel to achieve the envisioned skill-upgrading in the industrial sector.

The theoretical predictions regarding the effect of an exogenous change in the price of labor due to an increase in the minimum wage differs between standard neoclassical models and non-competitive models of the labor market. Based on standard neoclassical theory, an increase in the price of labor induces firms to substitute away from affected workers. The effect on capital thus depends on the degree of substitutability or complementarity between the two factors of production. Moreover, the cost burden imposed on companies through minimum wages potentially affects capital investments via a scale effect as product prices rise and the level of output drops. The overall effect of an increase in the minimum wage on capital investment therefore depends on the direction and size of the substitution effect and the size of the scale effect.

For the theoretical effect of minimum wage hikes on company training investments, the standard human capital model with competitive labor markets based on Becker (1993) predicts a negative effect on company training expenditures since workers finance their on-the-job training through lower wages. In this case, the introduction of a minimum wage reduces the level of training since it restricts the pay reductions workers can accept to finance the training (Rosen, 1972; Feldstein, 1973).

More recently, non-competitive models of the labor market have been developed in which labor market frictions and asymmetric information lead to a wedge between wages and marginal productivity (Acemoglu and Pischke, 1999). In these models it can be profitable for a firm to retain a worker despite the increase in wage costs if it can increase worker productivity through investments in capital or training and claim the resulting rents. Contrary to the results from traditional models, a compression of wages

through minimum wages may thus induce an increase in fixed capital investments and firm-sponsored training in non-competitive models (Pischke, 2005; Acemoglu and Pischke, 2003). Hybrid models of the labor market that relax the assumption of perfect competition generally predict that the incidence of the minimum wage varies with the degree of competition and the amount of rents that can be allocated.

Currently, there is an ongoing debate reinforced by mixed empirical evidence about which model provides a better fit for empirical data. The present work aims to contribute to this debate by jointly analyzing the effect on the two types of investments and by providing the first piece of evidence on the link between the minimum wage and firm financed training from a developing economy.

In order to empirically analyze our research question, we employ the widely used Chinese Annual Census of Industrial Firms (CASIF) panel data set which covers the introduction of the new minimum wage regulations in 2004. We include the three years leading up to the reform as well as the four subsequent years during which the magnitude and frequency of minimum wage adjustments across China increased significantly. We then estimate dynamic panel data regressions accounting for the inter-temporal adjustment of fixed capital investments as well as logit and tobit panel data regressions accounting for the incidence of censoring of our dependent variable in the human capital regressions. We find that the minimum wage hikes have caused an increase in fixed capital investments, while they have imposed a negative effect on human capital investments. Our results therefore point to a substitution effect between the two types of investments due to the increase in labor costs, which is somewhat supportive of the predictions based on neoclassical models of the labor market.

The rest of this paper is structured as follows. Section II reviews the empirical literature on the effects of minimum wages on companies and their investment behaviour. Section III outlines our research methodology. Section IV introduces the minimum wage and the firm data used in this paper. Section VI provides our results, while section VII elaborates our research outcomes and concludes the paper.

II. Review of the empirical literature

A monumental body of literature has analyzed the various adjustment channels through which firms absorb the labor cost increase due to minimum wage hikes. In addition to the employment effect, which has been identified for the case of China at least for parts of the labor force, profit reductions are generally considered a key channel of adjustment. Analyzing this topic for another Asian developing economy, Cuong (2013) employs a difference-in-difference methodology with propensity score matching and finds no statistically significant effect on firm profits in Vietnam after a minimum wage hike of about 20% in 2005. Draca et al. (2011) adopt a difference-in-difference approach and show that the introduction of the UK minimum wage in 1999 has reduced firm profitability. Metcalf (2008) concludes that the ability of firms to absorb the increase in labor costs through a reduction in company profits is one of the reasons for an absence of a negative employment effect of the policy in the UK. In a detailed survey study jointly analyzing a range of adjustment channels for local US quick-service restaurants, Hirsch et al. (2011) find that companies adjust through a range of channels, including price increases, profit reductions, lower wage growth for high-pay workers and savings on other cost components. While an extensive exposition of the literature analyzing company effects of minimum wages other than those on firm investment is beyond the scope of this paper, it is important to bear in mind that the ability of companies to absorb the cost increase due to minimum wages via other channels also affects the impact on fixed and human capital investments.

Regarding the company fixed capital investment decision, little research has been conducted on this topic so far and mixed effects have been found in these studies. Rama (1999, 2001) finds that doubling the minimum wage in Indonesia during the early 1990s has led to a decrease in employment of 2% and a decrease in investment of 5%. Based on a model of labor markets with frictions, Pischke (2005) argues that labor market institutions such as unions and minimum wages, which distribute rents to lower skilled workers, raise the incentive for firms to invest in their training and the fixed capital which is associated with their jobs. His empirical analysis based on OECD economies and differences in labor market institutios between Europe and the US roughly supports this theory. A

recent report by Riley and Bondibene (2013), however, concludes that the introduction of a national minimum wage in the UK has not affected employment and investment levels.

As explained in the introduction, according to the two different theories on the link between the minimum wage and training, minimum wages could either lead to a reduction in on-the-job training (Rosen, 1972; Feldstein, 1973) or an increase in training (Acemoglu and Pischke, 2003). Interestingly, the empirical evidence on this topic is also mixed which could either be due to the absence of any effect, heterogeneous and potentially offsetting effects or problems related to the measurement of training in the different studies (Neumark and Wascher, 2008). After most of the earlier studies on the topic were plagued by methodological problems, Neumark and Wascher (2001) were the first to control for US state variation in minimum wage levels and inter-state differences in training unrelated to the minimum wage. The authors conclude that the minimum wage has led to a reduction in on-the-job training. Acemoglu and Pischke (2003) critize the methodology in Neumark and Wascher (2001) for using all young workers as treatment group and arriving at unreasonably high estimates for the size of the negative effect. After revising their treatment group to workers with wages below the minimum wage, the authors find no significant effects of the minimum wage. The effect on training expenditures may therefore vary between companies and industries depending on these factors. More recently, Fairris and Pedace (2004) were the first to use an employer survey on the incidence of training and find no evidence of a reduction in training hours or the amount of workers covered by staff training. In the only notable study conducted outside the US, Arulampalam et al. (2004) find no evidence that the minimum wage has reduced training and some evidence that it has improved training in the UK.

The inconsistency of previous results, the scarcity of studies from less advanced economies and a frequent focus on the introduction of a uniform national level minimum wage as single policy shift underline the fact that significant scope exists for future research on the effect of minimum wages on firm investment behaviour.

III. Methodology

Measuring the firm-level impact of the minimum wage

For our empirical analysis of the effect of Chinese minimum wages on the capital investment decision we construct a panel data set of Chinese companies. Since the new minimum wage regulations were introduced in 2004, we choose the period from 2000 until 2007 as our study period. Including the reform year as well as pre- and post-reform period provides significant variation over time in terms of the impact of the minimum wage on individual companies.[1]

A crucial element of our methodology is to identify the companies that are affected by the minimum wage in their county.[2] As in previous work using company data (Draca et al., 2011; Riley and Bondibene, 2013; Cuong, 2013) we make use of average worker wage cost data to measure the extent to which firms are affected by the local minimum wage level.[3] In particular, we calculate two measures for the exposure to the minimum wage for the firms in our data set: a dichotomous treatment indicator variable and a continuous variable measuring the treatment intensity for those companies whose average wage is below the minimum wage. Using aw_{it} to denote the logarithm of the average wage level of firm i in year t and mw_{jt} to denote the logarithm of the minimum wage level of county j in period t, our treatment dummy variable takes the following values:

$$treatdum_{it} = \begin{cases} 0 & \text{if } aw_{it} \geq mw_{jt} \\ 1 & \text{if } aw_{it} < mw_{jt} \end{cases} \tag{1}$$

[1] Since we need to take first differences for the calculation of our investment variable, our study period includes three pre-policy years, the year when the new minimum wage regulations were implemented (2004) as well as three post-policy years.

[2] Compliance with minimum wage regulations is generally problematic in developing countries (see, for example, Rani et al. (2013)). However, recent research concludes that Chinese companies broadly comply with minimum wage laws (Ye et al., 2014).

[3] Due to regional differences in the Chinese minimum wage regulations, the minimum wage level in five jurisdictions also includes social security contributions in addition to wage expenditures. For the calculation of the explanatory variables calculated in this subsection we therefore add the contributions for labor and health insurance and pensions incurred by companies located in Beijing, Henan, Jiangsu, Jiangxi and Shanghai to their wage expenditures.

while our continuous variable measuring the treatment intensity for the treated companies is as follows:[4]

$$treatint_{it} = \begin{cases} 0 & \text{if } aw_{it} \geq mw_{jt} \\ mw_{jt} - aw_{it} & \text{if } aw_{it} < mw_{jt} \end{cases} \tag{2}$$

Both of our treatment indicators therefore take on the value zero for our control group companies and values greater than zero for treated companies.

Fixed capital investments: estimation strategy

After identifying our treatment and control groups, we proceed to the estimation strategy for our fixed capital and human capital regressions. Our empirical specification for our fixed capital estimations is based on an error-correction model of firm investment (Bean, 1981; Bond et al., 2003). In this framework firms face barriers to instant adjustment of their capital stock and the movement of a firm towards its optimal capital stock can be modelled as a dynamic process. Assuming that the optimal capital stock (K^*) of firm i is a function of its output (Y), unobserved firm-specific effects (θ_i) and unobserved year-specific effects (ζ_t), a second-order autoregressive distributed lag model of the dynamic relationship between the realized (K) and the optimal capital stock can be written in error-correction form as:

$$\Delta k_{it} = \alpha_0 \Delta k_{i,t-1} + \alpha_1 \Delta y_{it} + \alpha_2 \Delta y_{i,t-1} + \alpha_3 (k_{i,t-2} - y_{i,t-2}) + \theta_i + \zeta_t + \varepsilon_{it} \tag{3}$$

where lower-case latin letters denote the logarithms of upper-case variables. Similar to the empirical implementation in Chen and Zheng (2008), we also include current and lagged firm profits and debt levels as additional explanatory variables to control for the impact of financial factors on the investment decision.[5] We normalize both of these variables with capital stock at the beginning of each period. Using I to denote investment rates, *treat*

[4] An alternative variable measuring the intensity of the minimum wage treatment effect on companies has been proposed by Mayneris et al. (2014). Implementing our regressions with their explanatory variable does not qualitatively alter our treatment intensity results and we do not report the alternative results.

[5] A difference to the implementations in Bond et al. (2003) and Chen and Zheng (2008) is that we resort to operating profits since cash flow data have only been included in the CASIF data set since 2003. Operating cash flows and operating profits are highly correlated.

to denote either our dichotomous or continuous treatment variable and summarizing the above coefficients ($\boldsymbol{\alpha}$) and variables ($\boldsymbol{x_{it}}$) in matrix notation, we obtain our fixed capital investment regression equation as:

$$I_{it} = \boldsymbol{\alpha}' \boldsymbol{x_{it}} + \beta \, treat_{it-1} + \varepsilon_{it} \tag{4}$$

Special attention needs to be given to the appropriate estimation strategy for this equation. In particular, estimating this dynamic process via an OLS estimation of the levels or via estimating the within-group fixed-effect transformation of the above equation would both yield biased estimators due to the positive correlation of regressors with the error term (Nickell, 1981). An estimator that yields unbiased and consistent results for such an autoregressive process with possibly endogenous regressors in a situation with a large number of cross-sectional units and few time periods as in our case is the first-difference Generalized Method of Moments (GMM) estimator developed by Arellano and Bond (1991). Their estimation procedure first removes the time-invariant firm-specific effects through first differencing and then derives instruments to be used in the estimation from lagged values of the regressors. Since the problem of instrument proliferation is negligible in our case, we adopt the most general specification and use all available higher-order lagged values of our right hand side variables in equation 3 as well as of our financial variables as instruments.[6] The consistency and unbiasedness of our GMM estimator relies on the assumptions that serial correlation in the error term is absent and the instruments are valid.[7] We implement the Sargan/Hansen test for joint instrument validity and autocorrelation tests proposed in Arellano and Bond (1991) to ascertain the validity of both assumptions.

[6] Roodman (2009) provides a detailed analysis of the problems arising from employing too many instruments in GMM estimation. The rule of thumb in empirical GMM estimations is that the number of instruments should be less than the number of cross-sectional units. In our case we employ a maximum of 37 instruments, while the minimum number of cross-sectional units included in the GMM regressions for the smallest subset of firms is 26331.

[7] Note that first order autocorrelation of the differenced error terms is expected due to the common element of first-differenced error terms in adjacent periods.

Human capital investments: estimation strategy

For our analysis of the effect of minimum wage hikes on the human capital investment decision, we estimate the following regression:

$$H_{it} = \boldsymbol{\gamma}' \boldsymbol{z_{it}} + \delta \, treat_{it-1} + \varepsilon_{it} \tag{5}$$

Where our dependent variable H are investments in human capital measured as training expenditures per worker, $treat$ is either our dichotomous or our continuous treatment variable, $\boldsymbol{z}$ is a vector of control variables and ε is a stochastic error term. As in previous literature analyzing the effect of the minimum wage on firm training expenditures (Arulampalam et al., 2004; Fairris and Pedace, 2004), our firm level controls essentially aim to capture firm level heterogeneity by including variables such as workforce size, wages, labor productivity and dummy variables for state or foreign ownership and exporter status of a firm. These dummies take on zero values for non-state owned companies, local companies and non-exporters, respectively.[8]

Due to the censoring of our human capital investment variable, least squares estimation of human capital models would result in biased estimators (see, for example, Greene (2003)). We therefore first estimate a logit model with a binary dependent variable measuring the presence or absence of human capital investment in order to analyze the impact of the minimum wage on the likelihood of firms to undertake human capital investments for those firms that have invested in human capital in some periods and have not invested in others. Secondly, we then estimate tobit models with human capital investment rates as dependent variable and analyze the effect of the minimum wage on the level of human capital investment rates of all firms. In our logit regressions for human capital investment we are able to control for firm level fixed effects. For the tobit model panel data estimator, no estimator with individual fixed effects exists that allows for conditioning on covariates. In our tobit regressions we thus control for industry-level fixed

[8] Our definition of state-owned companies includes all state-owned and state-holding companies, i.e. all companies in which the state holds a majority. This is the broad definition adopted by the Chinese National Bureau of Statistics. Local non-state owned companies include collectively owned and private companies. For foreign ownership we also adopt the Chinese definition and consider companies with a foreign capital share of at least 25% as foreign invested.

effects at the two-digit level and mimic individual effects by including a range of variables reflecting the staff structure of companies. These variables have only been investigated in the 2004 version of the CASIF survey and we include those values for each firm in all time periods covered. In particular, we include a dummy variable for the presence of a workers' union and calculate the shares of technological staff, staff with university degree and the share of female workers.

IV. Data set and statistics of key variables

Data sources and data editing

The first type of data used in this section are the minimum wage data which have been collected from the websites of local governments across China. In particular, we obtain the precise dates of minimum wages amendments and minimum wage levels for a total of 2,606 Chinese counties and calculate the respective weighted annual average minimum wage in each of these geographical units.[9] The development of real minimum wages over time is shown in table 1. As mentioned in the introduction, Chinese minimum wages have increased rapidly especially after the introduction of the new regulations in 2004. From an empirical perspective, another interesting feature of the Chinese system of minimum wages is that it not only developed rapidly over time, but the levels also differ significantly between provinces and within provinces between different counties. At the end of our study period in 2007, the nominal minimum wage in Shanghai was at 840 RMB, roughly 2.6 times the level of 320 RMB in the less developed areas of Gansu province. At the same time the minimum wage level in Lanzhou, the capital of Gansu province, was already at 430 RMB, hence about 34% above the lowest level in the same province. Liaoning province can be credited with the most complex minimum wage system and its nominal minimum wages ranged from 420 to 700 RMB in the final year of our study.

[Table 1 about here]

[9] In this paper we collectively refer to counties and prefecture level cities as "counties". These administrative units included in our analysis are located across all of the Chinese provincial level administrative divisions, i.e. the 22 provinces, five autonomous regions and four municipalities, to which we collectively refer as "provinces".

The second data source used in this section is the China Annual Survey of Industrial Firms (CASIF) which is conducted by the National Bureau of Statistics (NBS). The survey includes data from all state-owned firms as well as all non-state owned industrial firms with a revenue of more than 5 million RMB.[10] This firm level data set enables us to calculate our dependent and explanatory variables as well as a range of control variables including sales volume, employment levels and industry classifications. In order to construct a panel data set, our main method to match companies over time is to use their registration ID. Since some company IDs change over time and a few IDs occur for multiple firms, we adopt the procedure proposed in Brandt et al. (2012) and also use other firm information such as the names of legal firm representatives, office phone numbers and addresses to merge firms over time.[11] Disaggregated deflators for the prices of output and capital at the industry and province level have been collected from various editions of the China statistical yearbook (NBS, 2009).[12] We deflate all monetary values in our data set to the price level in year 2000, which is the first year included in our data set. We then clean our data set from reporting errors and typos in the construction of the data base by deleting all companies with zero or negative values for one of the following variables: capital stock, number of employees, output or sales volume and wage expenditures. As a final logical consistency check, we also exclude observations reporting a depreciation in the current period that is higher than the capital stock in the previous period. As in other work analyzing the effects of policies on company investments, we exclude the companies with fixed capital investment rates greater than one from our analysis in order to prevent outliers from contaminating our results. Our company data set is then merged with our minimum wage data set through a six digit administrative division code.

[10] The China national economic census conducted by the NBS in 2004 allows for a comparison with the 2004 CASIF data set. The firms included in the 2004 CASIF survey constitute about 20.3% of all Chinese firms included in the economic census. They contribute about 90.7% of Chinese industrial output, hence covering almost all of Chinese industrial activity.

[11] Amongst the company observations that could be matched to the previous year, we were able to match 95.93% based on company IDs, while the remaining 4.07% were matched using other company information.

[12] Upward et al. (2013) have collected the deflators from NBS and make them available on their website. Since we also need deflators from 1999, we supplement their data set with deflators obtained directly from national yearbooks.

Dependent variables, explanatory variable and descriptive statistics

We then proceed to the calculation of our wage variable and our dependent variables. We calculate the average wage per worker in year t as firm level wage expenditures divided by the average of the staff number at the beginning and the end of each year. Since wage costs are incurred throughout the year while the number of employees is only reported at the end of the year, this measure will be inaccurate if large lay-offs or hirings occur unevenly throughout the year. In order to prevent this effect from congesting our explanatory variable, we delete all observations with excessive staff growth or staff reductions in each year by deleting the outlying top and bottom 1% of the firm employment growth distribution.

For the calculation of our fixed capital investment variable, we employ the perpetual inventory method and calculate firm level investment rates as the change in the firm capital stock plus depreciation, divided by the capital stock in the previous period. Firm investment rates in human capital are calculated as the amount of training expenditures divided by the number of employees.[13] Our final data set consists of 1,092,378 firm-year observations from the seven year period between 2001 and 2007.[14]

[Table 2 about here]

Table 2 shows the key statistical properties of our dependent variables as well as the ratio of the minimum wage to the firm level average wage for each year in our data set. The steady growth in size and number of Chinese companies results in the successive inclusion of additional firms in our data base and the number of annual observations increases from 98,101 observations in 2001 to 232,747 observations in 2007. The minimum wage level amounts to roughly between 50% and 60% of the company-level average wage in most years covered. In the reform year of 2004 and the first year thereafter, the minimum wage rises to more than 60% of average wages until companies adjust their wage levels and the ratio drops to a level below the pre-reform period. Average training expenditures

[13] The training expenditures variable refers to a range of expenditures related to staff training, including training in new technologies, continued staff education and the purchase of teaching equipment.

[14] Observations from the years 1999 and 2000 are only used as lagged values in our GMM estimations.

per worker rise from 57 RMB in the first year to a level of about 89 RMB towards the end of our study period. Differences between companies are large for this variable and companies with high investment expenditures in human capital spend more than 1406 RMB per worker. Moreover, about 58.81% of our company-year observations report zero investment in human capital, hence necessitating the estimation of human capital investment regressions through logit and tobit models. The variable with the highest variation both over time and between firms is our fixed capital investment rate. Starting from 22.5% in 2001 it rises to about 37.7% in 2005 before dropping again to a level just above 30% in the final two years of our analysis. All three indicators exhibit significant variation both over time and between firms.

V. Wage growth comparison of firms in treated and control group

The key underlying assumption of the theoretical link between minimum wage regulations and company development indicators is that a minimum wage increase drives up company wage expenditures for affected companies. We briefly investigate the link between the two variables by analyzing the difference in subsequent wage growth between treated and non-treated companies. In order to control for the difference in average wage levels between treated and non-treated companies, we split our companies into fifty quantiles according to their wage level and then compare subsequent changes in the log wage for the two groups in order to analyze whether they have been affected differently. The results displayed in table 3 show that wage growth of treated companies is about twice as high as wage growth of the non-treated group in the lowest quantiles. As we move up towards higher quantiles in the wage distribution, wage growth of the treated group amounts to about four times the wage growth of non-treated companies.[15]

[Table 3 about here]

We also regress subsequent average wage growth on minimum wage growth for treated and non-treated companies separately in order to compare the intensity of the impact

[15] Above the 20th wage quantile our treatment group contains less than thirty observations and we therefore do not report these results.

of subsequent minimum wage growth on average wage growth. As displayed in figure 1 below, the coefficient of the subsequent wage growth variable is also significantly higher for treated companies compared to non-treated companies. The assumption therefore proves valid for our data set and our instrument is an adequate tool to identify affected companies.

[Figure 1 about here]

As pointed out by Ye et al. (2014), compliance rates with the minimum wage policy differ between companies depending on the ownership structure of a firm.[16] We therefore also investigate whether the impact of the minimum wage treatment differs between different company types. In particular, we distinguish between local non-state-owned companies, state-owned companies, companies with investors from Hong Kong, Macao or Taiwan as well as foreign invested companies. As displayed in table 4, the four company types differ markedly in terms of their wage growth even within the same wage quantile. Foreign companies exhibit the highest wage growth, while wage growth in the state-owned sector is the lowest amongst the four at about a quarter of foreign company wage growth. The four company groups, however, hardly differ in terms of the treatment effect on wage growth and wage growth amongst treated companies is higher in almost all quantiles for all four company types. Despite the differences in policy compliance rates and wage growth, the treatment effect on wage growth therefore occurs for all four company types.

[Table 4 about here]

VI. Fixed and human capital investment regression results

Basic investment regression results

The first column in table 5 below displays the regression results of our fixed capital investment models with our dummy treatment indicator as explanatory variable, while the

[16] According to Ye et al. (2014), compliance rates are lowest for Hong Kong, Macao and Taiwan invested companies and 9.4% of workers for this company type earn below the minimum wage. Compliance rates for non-state domestic companies and state-owned companies are 2.9% and 2.8%, respectively. Foreign owned companies are the most compliant and only 2.3% of their workers earn less than the minimum wage.

second column shows our fixed capital investment results with our treatment intensity indicator as explanatory variable. For both of our explanatory variables, we find a significant positive effect of the minimum wage on fixed capital investments.

Regarding the coefficient of our control variables, the change in the logarithm of output correlates positively and significantly with fixed capital investment, hence confirming the predictions of the accelerator model of investment. The error-correction term is negative and significant, hence confirming error-correction behaviour of firms towards their optimal capital stock. The financial variables are insignificant, which was also previously found in Chen and Zheng (2008) for companies in most Chinese regions. The average wage correlates positively with investment rates, possibly reflecting the fact that a higher human capital stock raises the returns to physical capital investments.

[Table 5 about here]

Table 6 below displays the logit and tobit regression results of our human capital investment regressions with the dummy treatment indicator as explanatory variable (Models 3 and 5) and our treatment intensity indicator as explanatory variable (Models 4 and 6). In our logit estimations, we omit the companies which do not display any variation in the dependent variable, i.e. the ones that either invest in human capital in every period or never invest in human capital. Our logit results for both explanatory variables indicate that the total effect on the likelihood of firms to invest in human capital is insignificant. Overall, the minimum wage policy therefore neither encourages nor discourages initial non-investors from undertaking human capital investments. For our tobit regressions we can retain all firms and all censored and uncensored firm-year observations.[17] Our tobit regressions with two alternative explanatory variables unequivocally show that the minimum wage has reduced the amount of training expenditures incurred per worker for Chinese companies.

Some interesting findings also emerge from the results of our human capital regression covariates. The human capital stock and firm size both correlate positively with human capital investments. Foreign-owned companies in the Chinese market are characterized

[17] The sample for these regressions includes 350,311 censored and 287,833 non-censored observations.

by lower investment rates than local companies. Exporters are less likely to invest in human capital and generally invest less than non-exporters, reflecting the reliance of the export sector on labor-intensive low skill production. The establishment of a workers' union as well as the shares of technical staff and university graduates in total staff all correlate positively with human capital investment rates, while the share of female workers correlates negatively with human capital investment rates.

[Table 6 about here]

Investment regression results for different firm ownership types

In this subsection we again split our companies into groups according to the four different ownership types introduced in the previous section and implement our fixed and human capital investment regressions separately for each group.[18] For our fixed capital investment regressions shown in table 7 the results differ markedly between company types.[19] The positive impact of the minimum wage policy on capital investment rates is only confirmed for locally owned companies, while the other three company types have not adjusted their fixed capital investment behaviour in response to the minimum wage. Error correction behaviour and the output effect predicted by the accelerator model of investment are confirmed in all regressions except for the state-owned group.

[Table 7 about here]

In contrast to the fixed capital investment regression results, the results of our human capital investment regressions are remarkably homogeneous across different company types and mirror the results of our basic regression results. The logit model treatment

[18] In order to make the exposition more concise, we only report the results of our dummy treatment variable regressions in this subsection. The results for our treatment intensity variable are in line with the results for the treatment dummy variable, i.e. either both insignificant or significant with the same sign.

[19] To simplify the search for the optimal number of instruments, we drop the insignificant financial variables and implement the basic error-correction model shown in equation 3. Our strategy for selecting the optimal instruments is to start from the specification implemented for our complete sample. If this specification fails the Hansen test or the second order autocorrelation test for any of our sub-samples, we move on towards deeper lags, see Guariglia et al. (2011). The number of instruments employed therefore differs between different sub-samples of firms.

variable is insignificant for all company types. The respective coefficient in our tobit model is negative and significant and its size is very similar for all four company types. The minimum wage policy therefore does not significantly affect the likelihood of firms to engage in human capital investment for non-investors, but lowers firm level human capital investment rates irrespective of the ownership structure of the firm.

[Table 8 about here]

VII. Conclusions and discussion

During the past two decades, China has implemented a complex system of minimum wages across the country. Consequently, minimum wages have risen sharply, especially since the introduction of the new minimum wage regulations in 2004. In this paper we focus on the potential adverse effects on firm behaviour due to the Chinese minimum wage policy by empirically analysing the effect on the firm investment decision. According to standard economic theory, an increase in labour costs through minimum wage adjustments imposes a negative scale effect on companies, in turn leading to a reduction in fixed capital investment. Standard models of human capital theory also predict a negative effect on human capital investment since a wage floor reduces the ability of employees to accept wage reductions in order to enable companies to finance worker training. On the other hand, models of non-competitive labor markets generally predict that company fixed and human capital investments associated with affected labor groups will rise in face of an exogenous increase in labor costs.

Our empirical results indicate that the Chinese minimum wage policy has indeed reduced firm investment rates in human capital, while it has generally led to an increase in fixed capital investment rates. The substitution effect identified in our fixed capital investment regressions as well as the negative scale effect found in our tobit regression results for human capital investments provide general support for the predictions of neoclassical models of the labor market. Our logit regressions estimating the likelihood of companies to invest in human capital, however, provide some support to alternative theories in the sense that offsetting effects exist in this part of our analysis and previous non-investors

are not significantly discouraged from undertaking human capital investments in face of minimum wage hikes.

An important detail of our analysis is the finding that the ownership structure of a firm matters and that only Chinese privately owned companies have shifted away from investing in labor and increased their investments in fixed capital. Our human capital regression results, however, do not differ by ownership structure and the minimum wage policy unequivocally lowers training expenditures per worker for all ownership types.

Overall, the negative scale effect imposed on companies due to minimum wage regulations outweighs other consequences of the policy and the competitiveness of Chinese companies may suffer as a consequence of the minimum wage regulations. The decrease in human capital investment rates is likely to reduce labor productivity growth and further adverse effects on the labor market may occur in the long term.

References

Acemoglu, Daron and Jörn-Steffen Pischke (1999). "The Structure of Wages and Investment in General Training." Journal of Political Economy 107(3): 539–572.

Acemoglu, Daron and Jörn-Steffen Pischke (2003). "Minimum wages and on-the-job training." Research in Labor Economics 22: 159–202.

Arellano, Manuel and Stephen Bond (1991). "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations." The Review of Economic Studies 58(2): 277–297.

Arulampalam, Wiji, Alison L. Booth, and Mark L. Bryan (2004). "Training and the new minimum wage." The Economic Journal 114(494): C87–C94.

Bean, Charles (1981). "An Econometric Model of Manufacturing Investment in the UK." Economic Journal 91(361): 106–21.

Becker, Gary (1993). Human capital: a theoretical and empirical analysis, with special reference to education. Chicago: The University of Chicago Press.

Bond, Stephen, Julie Ann Elston, Jacques Mairesse, and Benoît Mulkay (2003). "Financial Factors and Investment in Belgium, France, Germany, and the United Kingdom: A Comparison Using Company Panel Data." The Review of Economics and Statistics 85(1): 153–165.

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

Chen, Minjia and Yongnian Zheng (2008). "China's Regional Disparity and Its Policy Responses." China & World Economy 16(4): 16–32.

Cooke, Fang Lee (2005). HRM, work and employment in China. London: Routledge.

Cuong, Nguyen Viet (2013). "Do minimum wage increases matter to firm profitability? The case of Vietnam." Journal of International Development, forthcoming.

Draca, Mirko, Stephen Machin, and John Van Reenen (2011). "Minimum Wages and Firm Profitability." American Economic Journal: Applied Economics 3(1): 129–51.

Fairris, David and Roberto Pedace (2004). "The Impact of Minimum Wages on Job Training: An Empirical Exploration with Establishment Data." Southern Economic Journal 70(3): 566–583.

Fang, Tony and Carl Lin (2013). "Minimum wages and employment in China." , IZA Discussion Paper No.7813.

Feldstein, Martin (1973). "The Economics of the New Unemployment." Public Interest 33(Fall): 3–42.

Greene, William (2003). Econometric analysis. N.J.: Prentice Hall.

Guariglia, Alessandra, Xiaoxuan Liu, and Lina Song (2011). "Internal finance and growth: Microeconometric evidence on Chinese firms." Journal of Development Economics 96(1): 79 – 94.

Hirsch, Barry T., Bruce E. Kaufman, and Yetyana Zelenska (2011). "Minimum wage channels of adjustment." , IZA Discussion Paper No. 6132.

Jia, Peng (2014). "Employment and Working Hour Effects of Minimum Wage Increase: Evidence from China." China & World Economy 22(2): 61–80.

Mayneris, Florian, Sandra Poncet, and Tao Zhang (2014). "The cleansing effect of minimum wage." , Paper presented at the Conference on Industrial Upgrading and Urbanization, Stockholm China Economic Research Institute, Stockholm.

Metcalf, David (2008). "Why has the British National Minimum Wage had Little or No Impact on Employment?" Journal of Industrial Relations 50(3): 489–512.

National Bureau of Statistics of China (2009). China Statistical Yearbook. Beijing: China Statistics Press.

Neumark, David and William L. Wascher (2001). "Minimum Wages and Training Revisited." Journal of Labor Economics 19(3): pp. 563–595.

Neumark, David and William L. Wascher (2008). Minimum wages. Cambridge, Mass.: MIT Press.

Nickell, Stephen (1981). "Biases in Dynamic Models with Fixed Effects." Econometrica 49(6): pp. 1417–1426.

Pischke, Jörn-Steffen (2005). "Labor Market Institutions, Wages, and Investment: Review and Implications." CESifo Economic Studies 51(1): 47–75.

Rama, Martin (1999). "The Consequences of Doubling the Minimum Wage: The Case of Indonesia." Policy Research Working Paper 1643The World Bank.

Rama, Martin (2001). "The Consequences of doubling the minimum wage: The case of Indonesia." Industrial and Labor Relations Review 54(4): 864–881.

Rani, Uma, Patrick Belser, Martin Oelz, and Setareh Ranjbar (2013). "Minimum wage coverage and compliance in developing countries." International Labour Review 152(3-4): 381–410.

Riley, Rebecca and Chiara Rosazza Bondibene (2013). "The impact of the National Minimum Wage on firm behaviour during recession." Research Report for the Low Pay CommissionUnpublished.

Roodman, David (2009). "A Note on the Theme of Too Many Instruments." Oxford Bulletin of Economics and Statistics 71(1): 135–158.

Rosen, Sherwin (1972). "Learning and Experience in the Labor Market." The Journal of Human Resources 7(3): 326–342.

Upward, Richard, Zheng Wang, and Jinghai Zheng (2013). "Weighing China's export basket: The domestic content and technology intensity of Chinese exports." Journal of Comparative Economics 41(2): 527 – 543.

Wang, Jing and Morley Gunderson (2011). "Minimum Wage Impacts in China: Estimates from a Prespecified Research Design, 2000–2007." Contemporary Economic Policy 29(3): 392–406.

Wang, Jing and Morley Gunderson (2012). "Minimum wage effects on employment and wages: dif-in-dif estimates from Eastern China." International Journal of Manpower 33(8): 860–876.

Ye, Linxiang, T. H. Gindling, and Shi Li (2014). "Compliance with Legal Minimum Wages in China." , Paper presented at the Reforming Minimum Wage and Labor Regulation Policy in Developing and Transition Economies Conference, Beijing Normal University, Beijing.

Table 1. Chinese provincial minimum wages over time (in RMB per month)

Province	2000	2001	2002	2003	2004	2005	2006	2007
East								
Beijing	406.0	410.8	444.5	458.2	507.6	541.2	581.8	638.0
Fujian	259.8	282.6	302.6	313.9	314.6	343.4	406.6	463.0
Guangdong	338.6	350.7	362.7	371.2	365.0	417.4	447.9	488.9
Hainan	277.5	308.6	348.9	348.4	361.2	383.1	415.2	434.9
Hebei	242.5	241.3	283.9	285.9	354.4	426.9	424.8	419.9
Jiangsu	275.8	301.0	319.6	360.8	404.3	426.2	488.5	535.6
Shandong	264.1	287.0	325.4	347.5	335.3	408.9	416.1	430.8
Shanghai	424.8	467.5	510.0	549.4	586.5	638.8	676.2	720.1
Tianjin	347.3	394.1	425.0	449.0	481.2	524.6	600.6	641.1
Zhejiang	372.5	398.6	410.6	423.8	468.8	525.9	578.6	625.5
Northeast								
Heilongjiang	262.6	260.5	262.4	284.9	274.4	271.2	353.0	377.4
Jilin	231.6	228.6	251.8	278.3	303.0	298.5	369.7	514.6
Liaoning	265.7	268.7	278.4	273.8	276.1	346.1	378.1	424.3
Central								
Anhui	220.1	272.9	290.7	300.5	293.8	308.3	321.5	361.0
Henan	209.8	208.4	208.2	216.5	238.3	253.3	309.0	325.7
Hubei	203.7	203.1	276.8	270.8	258.1	289.7	293.1	351.8
Hunan	231.3	252.4	280.9	311.6	326.1	345.7	373.2	392.1
Jiangxi	214.1	220.3	220.1	218.4	243.1	300.6	301.7	392.6
Shanxi	225.9	226.3	270.7	265.9	387.1	418.6	417.1	431.6
West								
Chongqing	246.2	257.5	279.0	287.9	322.9	343.6	373.9	431.1
Gansu	227.6	235.2	235.2	232.7	283.2	278.4	291.0	304.2
Guangxi	172.0	223.7	313.0	309.7	313.4	354.8	359.0	366.9
Guizhou	213.4	209.6	238.8	290.3	291.1	323.4	349.3	430.5
Inner Mongolia	238.1	236.7	251.2	289.9	324.5	358.6	363.2	375.5
Ningxia	264.2	264.0	311.1	306.1	321.3	319.0	362.7	377.4
Qinghai	236.3	230.3	225.1	220.7	238.8	311.2	352.7	374.3
Shaanxi	213.0	225.7	273.3	269.2	262.4	335.4	420.2	413.8
Sichuan	160.9	161.4	211.0	253.4	276.6	318.1	291.4	366.0
Xinjiang	257.7	258.4	292.0	290.8	306.6	316.4	345.1	401.1
Yunnan	233.1	235.2	261.2	283.2	286.5	339.6	367.3	379.0

Notes: Minimum wages have been calculated as time-weighted and population-weighted average values based on county level minimum wage data. Values have been deflated to the price level in year 2000.

Table 2. Summary statistics for key variables over time

	Variable	*Mean*	*Std. Dev.*	*Min.*	*Max.*	*N*
2001	Investment rate	0.075	0.273	-0.838	1	93419
	Training / labor	0.057	0.130	0	1.404	98101
	Min. Wage / Avg. Wage	0.580	0.356	0.036	4.027	98101
2002	Investment rate	0.089	0.277	-0.838	1	106034
	Training / labor	0.066	0.143	0	1.406	114034
	Min. Wage / Avg. Wage	0.577	0.359	0.040	4.561	114034
2003	Investment rate	0.084	0.287	-0.838	1	112130
	Training / labor	0.071	0.151	0	1.404	122593
	Min. Wage / Avg. Wage	0.559	0.350	0.042	4.852	122593
2004	Investment rate	0.052	0.311	-0.838	1	114881
	Training / labor	0.073	0.143	0	1.404	126341
	Min. Wage / Avg. Wage	0.631	0.327	0.043	5.481	126341
2005	Investment rate	0.121	0.295	-0.838	1	170795
	Training / labor	0.071	0.152	0	1.406	192128
	Min. Wage / Avg. Wage	0.637	0.320	0.042	5.214	192128
2006	Investment rate	0.117	0.294	-0.838	1	185971
	Training / labor	0.086	0.173	0	1.406	206434
	Min. Wage / Avg. Wage	0.517	0.246	0.044	4.922	206434
2007	Investment rate	0.099	0.292	-0.838	1	210733
	Training / labor	0.089	0.181	0	1.404	232747
	Min. Wage / Avg. Wage	0.501	0.246	0.044	5.223	232747

Note: Data have been deflated to the price level in year 2000. The unit of measurement for training expenditures per worker is thousand RMB.

Table 3. Change in log wage for treated vs. non-treated companies

Quantile	Control group	Treatment group
1	0.481	0.734
2	0.273	0.565
3	0.233	0.548
4	0.216	0.529
5	0.211	0.523
6	0.206	0.516
7	0.186	0.514
8	0.180	0.523
9	0.178	0.531
10	0.166	0.516
11	0.163	0.522
12	0.158	0.499
13	0.153	0.504
14	0.147	0.521
15	0.135	0.495
16	0.143	0.509
17	0.138	0.491
18	0.130	0.483
19	0.123	0.532
20	0.121	0.619

Notes: The average wage of companies in the *1*st and *20*th wage quantile is 455.83 RMB and 904.36 RMB, respectively. The treatment groups shrink to less than thirty companies above the *20*th quantile and the remaining quantiles have therefore been omitted.

Table 4. Change in log wage for treated vs. non-treated companies by company type

Quantile	LOEs		SOEs		NMCOEs		FOEs	
	Control	Treatment	Control	Treatment	Control	Treatment	Control	Treatment
1	0.497	0.759	0.306	0.492	1.029	1.193	1.180	1.165
2	0.295	0.581	0.146	0.323	0.359	0.786	0.502	0.806
3	0.244	0.553	0.130	0.302	0.313	0.656	0.445	0.744
4	0.224	0.528	0.100	0.275	0.336	0.612	0.408	0.703
5	0.218	0.517	0.093	0.344	0.284	0.607	0.368	0.592
6	0.208	0.516	0.093	0.287	0.332	0.539	0.337	0.637
7	0.188	0.506	0.056	0.255	0.314	0.585	0.317	0.644
8	0.182	0.512	0.063	0.257	0.270	0.612	0.282	0.598
9	0.180	0.513	0.057	0.347	0.262	0.638	0.265	0.609
10	0.166	0.502	0.057	0.257	0.236	0.583	0.247	0.621

Notes: The average wage of companies in the *1*st and *20*th wage quantile is 455.83 RMB and 904.36 RMB, respectively. LOEs refers to local private or collective firms, SOEs refers to state-owned enterprises, the non-mainland Chinese owned enterprises (NMCOEs) are those owned by investors from either Hong Kong, Macao or Taiwan and FOEs are foreign-owned enterprises. The treatment groups shrink to less than thirty companies above the *10*th quantile in the state-owned sector and the remaining quantiles have therefore been omitted for all ownership types.

Table 5. Fixed capital investment regression results

	GMM models	
	(1)	**(2)**
Treatment dummy (lag)	0.017***	
	(0.005)	
Treatment intensity (lag)		0.030**
		(0.013)
Investment rate (lag)	0.097	0.096
	(0.220)	(0.220)
Change in log output	0.225***	0.227***
	(0.083)	(0.083)
Change in log output (lag)	−0.113**	−0.113**
	(0.048)	(0.048)
Error correction term	−0.123***	−0.123***
	(0.047)	(0.048)
Profit per capital	0.002	0.002
	(0.007)	(0.007)
Profit per capital (lag)	−0.002	−0.002
	(0.006)	(0.006)
Debt per capital	0.000	0.000
	(0.000)	(0.000)
Debt per capital (lag)	−0.002	−0.002
	(0.004)	(0.004)
Average wage	0.000**	0.000**
	(0.000)	(0.000)
Observations	242619	242619
Firms	96209	96209
Number of instruments	37	37
Hansen Test (p-value)	0.706	0.702
AR(1) (p-value)	0.002	0.002
AR(2) (p-value)	0.206	0.207

Notes: Standard errors in parentheses. The respective significance symbols denote: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6. Human capital investment regression results

	Logit models		Tobit models	
	(3)	(4)	(5)	(6)
Treatment dummy (lag)	−0.023		−0.026***	
	(0.229)		(0.000)	
Treatment intensity (lag)		−0.016		−0.064***
		(0.766)		(0.000)
Average wage	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Log workforce size	0.618***	0.619***	0.021***	0.021***
	(0.000)	(0.000)	(0.000)	(0.000)
Labor productivity	−0.398***	−0.401***	−0.064***	−0.064***
	(0.001)	(0.001)	(0.000)	(0.000)
State owned	−0.024	−0.024	0.007***	0.007***
	(0.530)	(0.490)	(0.000)	(0.000)
Foreign owned	0.030	0.030	−0.028***	−0.028***
	(0.335)	(0.227)	(0.000)	(0.000)
Exporter dummy	−0.132***	−0.133***	−0.003***	−0.003***
	(0.000)	(0.000)	(0.002)	(0.001)
Union dummy			0.097***	0.098***
			(0.000)	(0.000)
Technical staff (%)			0.131***	0.131***
			(0.000)	(0.000)
University degree (%)			0.293***	0.294***
			(0.000)	(0.000)
Female staff (%)			−0.061***	−0.063***
			(0.000)	(0.000)
Constant			−0.293***	−0.294***
			(0.000)	(0.000)
Firm fixed effects	✓	✓		
Industry fixed effects			✓	✓
Observations	291047	291047	638144	638144
Log likelihood	-109783.8	-109784.5	-182786.3	-182828.7
Chi^2	1931.0	1352.0	31822.1	31732.4
Prob $\text{Chi}^2 > 0$	0.000	0.000	0.000	0.000
σ_u			0.210***	0.210***
σ_e			0.198***	0.198***
ρ			0.528	0.528

Notes: *P*-values are shown in parentheses. The significance symbols denote: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 7. Fixed capital investment regression results by company type

	GMM models			
	LOEs	**SOEs**	**NMCOEs**	**FOEs**
Treatment dummy (lag)	0.023***	−0.006	0.000	0.009
	(0.008)	(0.007)	(0.008)	(0.011)
Investment rate (lag)	0.162	−0.187	−0.378**	−0.207
	(0.271)	(0.239)	(0.153)	(0.260)
Change in log output	0.323***	0.008	0.217**	0.263**
	(0.097)	(0.126)	(0.096)	(0.111)
Change in log output (lag)	−0.152***	−0.004	−0.110**	−0.147**
	(0.054)	(0.072)	(0.049)	(0.058)
Error correction term	−0.158***	−0.011	−0.100**	−0.158***
	(0.053)	(0.080)	(0.051)	(0.058)
Average wage	0.000	0.000**	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	157677	26331	31031	29030
Groups	67734	11892	14026	12950
Number of instruments	25	25	37	37
Hansen Test (p-value)	0.655	0.187	0.304	0.206
AR(1) (p-value)	0.005	0.073	0.067	0.090
AR(2) (p-value)	0.162	0.586	0.068	0.867

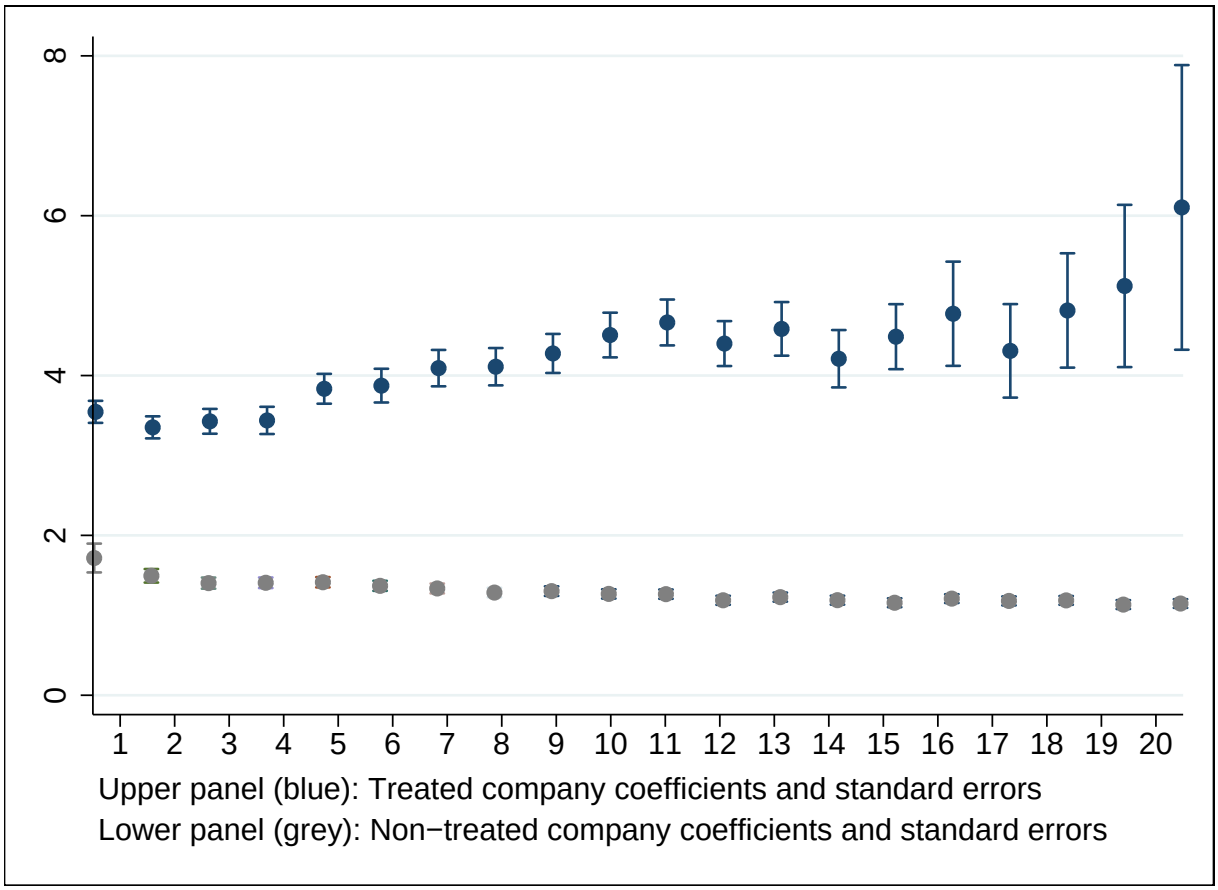
Notes: Standard errors are shown in parentheses. The respective significance symbols denote: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The definitions of LOEs, SOEs, NMCOEs and FOEs are mentioned in the footnote of table 4.

Table 8. Human capital investment regression results

	Logit models				Tobit models			
	LOEs	**SOEs**	**NMCOEs**	**FOEs**	**LOEs**	**SOEs**	**NMCOEs**	**FOEs**
Treatment dummy (lag)	−0.011	−0.127	−0.029	−0.038	−0.028***	−0.029***	−0.026***	−0.028***
	(0.626)	(0.145)	(0.658)	(0.683)	(0.000)	(0.000)	(0.000)	(0.000)
Average wage	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log workforce size	0.678***	0.933***	0.358***	0.442***	0.028***	0.028***	0.018***	0.022***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Labor productivity	−0.236	0.032	−1.211**	−1.040**	−0.037***	−0.063***	−0.088***	−0.091***
	(0.136)	(0.939)	(0.013)	(0.021)	(0.000)	(0.000)	(0.000)	(0.000)
Exporter dummy	−0.142***	−0.218**	−0.054	−0.159***	0.012***	−0.003	−0.017***	−0.002
	(0.000)	(0.014)	(0.185)	(0.000)	(0.000)	(0.258)	(0.000)	(0.432)
Union dummy					0.092***	0.064***	0.094***	0.101***
					(0.000)	(0.000)	(0.000)	(0.000)
Technical staff (%)					0.077***	0.023	0.130**	0.198***
					(0.000)	(0.552)	(0.025)	(0.000)
University degree (%)					0.292***	0.182***	0.446***	0.249***
					(0.000)	(0.000)	(0.000)	(0.000)
Female staff (%)					−0.026***	0.020	−0.090***	−0.160***
					(0.000)	(0.283)	(0.000)	(0.000)
Firm fixed effects	✓	✓	✓	✓				
Industry fixed effects					✓	✓	✓	✓
Observations	200879	14464	27819	28131	449333	43859	75823	71967
Log likelihood	-75544.4	-5299.4	-10447.9	-10481.7	-137698.4	-1043.1	-20579.6	-22128.0
Chi^2	913.0	97.9	115.5	143.3	23176.9	9057.5	3643.4	4571.3
Prob $\text{Chi}^2 > 0$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
σ_u					0.208***	0.146***	0.206***	0.215***
σ_e					0.204***	0.139***	0.187***	0.204***
ρ					0.508	0.523	0.549	0.527

Notes: *P*-values are shown in parentheses. The significance symbols denote: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The (significant) constant term has been omitted to save space. The definitions of LOEs, SOEs, NMCOEs and FOEs are mentioned in the footnote of table 4.

Figure 1. Wage growth coefficients: treated vs. non-treated companies



Note: Shown are coefficients and standard errors for the coefficient on minimum wage growth with average wage growth as dependent variable. The average wage of companies in the *1*st and *20*th wage quantile is 455.83 RMB and 904.36 RMB, respectively.