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THE IMPACT OF SOCIAL INSURANCE CONTRIBUTIONS ON FIRMS' EMPLOYMENT AND WAGES: EVIDENCE FROM CHINA EMPLOYER-EMPLOYEE MATCHING SURVEY DATA

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ABSTRACT

Using China Employer-Employee Matching Survey (CEES) data from 2014 to 2016, this study examines the influence of social insurance contributions on the levels of employment and the wage levels in Chinese firms. We construct three indices of social insurance enforcement: the city contribution rate (CCR), the rate of city enforcement of social insurance (CE), and the firms' actual contribution rate (FAR) to employ an empirical study. The new findings are as follows. First, those firms in regions with high city contribution rates or a high rate of city enforcement of social insurance are likely to employ more workers. A bipolarization phenomenon is found in the relation between the firms' actual social insurance contributions and the adjustments to levels of wage and employment. Second, the impact of social insurance contribution on firms' level of wages and employment differ by firms' ownership types, in response to the increased social insurance burden, privately-owned enterprises are more likely to reduce wage levels than the state-owned enterprises.

Contribution/ Originality: This study contributes the first logical analysis on the influence of social insurance contributions on both the employment and the wage levels in Chinese firms using China Employer-Employee Matching Survey data. Regarding of the regional policy disparities, we constructed the original three types of social insurance contributions in the study.

1. INTRODUCTION

Since 1978, the Chinese government has gradually implemented economic transition and replaced the governmental social security systems. As state-owned enterprises (SOEs) were reformed the governmental security systems were replaced with new social insurance systems. From the 1990s these social insurance systems expanded to cover all firms including SOEs, privately-owned enterprises (POEs) and foreign-owned enterprises (FOEs). The regulations and policies of the Ministry of Human Resources and Social Security provide six kinds of social security: (a) pension insurance, (b) health care insurance, (c) unemployment insurance, (d) worker injury compensation insurance, (e) maternity insurance, and (f) the housing fund. Except for unemployment insurance (c) and worker injury compensation insurance (d), the social insurance contributions for firms and workers are determined

according to wage levels and social insurance contribution ratios to wage. The average lowest wage level[1] for the social insurance contribution is 60% of the regional average wage level in the prior year, and the highest wage level is three times the regional average wage level in the prior year. The total social insurance contribution ratio paid by firms, excluding the housing fund, was around 43% in 2015. China has regulated for one of the highest social insurance premiums in the world.

According to the rules of perfect market competition in order to gain the maximum profit a firm may transfer the burden of increased social insurance contributions onto its employees by reducing their wage levels and the number of workers. Most previous empirical studies find that an increased social insurance premium may induce a firm to transfer this burden onto its workers by reducing the workers' wage level or employment (Hamermesh, 1979; Summers, 1989; Gruber and Krueger, 1991; Gruber, 1994;1997; Fishback and Kantor, 1995; Anderson and Meyer, 2000; Kugler and Kugler, 2003; Iwamoto and Hamaaki, 2006; Sakei and Kazegami, 2007; Ma and Zhang, 2018; Ma and Cheng, 2019). Yet these empirical study results are not conclusive and there are insufficient empirical studies on the issue for China. This study may help to fill the gap in research knowledge.

In this study China Employer-Employee Matching Survey (CEES) data and imputed values based on wage and employment functions are used. Three indices of social insurance enforcement and four types of combinations of wage and employment are examined to investigate the influence of social insurance contributions on wage and employment in Chinese firms.

The innovative features of this study are as follows. First, numerous studies investigate the influence of social insurance contributions on wage or employment separately, but they do not consider that firms may simultaneously adjust the workers' wage level and employment to mitigate the social insurance burden. The firm may not make the decision about the wage level separately from the decision about employment level. The firm decides on wage level and number of employees in the same decision making process: there is a combined decision by the firm on the adjustment of wage and employment. To the authors' knowledge, there is little empirical study on the issue and this study uses those methods most likely to provide useful insights.

In order to test the heterogeneity of the behavior of firms, we conducted four types of combinations of firms' wage and employment based on wage and employment functions. In China social security policies are set by central government but these policies are interpreted and applied differently by each local government department. As a result there is no standardized implementation of policy but a regional patchwork of compliance differentials. For example, a firm's required social insurance contribution is lower in Guangdong province in the South Region than in Hubei province in the Central Region. Therefore the differences between local governments in contributions and enforcement of social insurance should be considered in the design of an empirical study of this issue. This study conducts two unique indices to investigate the impact of social insurance contributions at local city government level to investigate local government influences. According to current regulations, the *de jure* contribution rates for social insurance are more than 40 per cent of the total wage bill. However, there is a huge heterogeneity of *de facto* contribution rates among firms. These compliance anomalies result in the actual social insurance contributions paid by firms frequently being lower than the social insurance contributions stated in the regulations and legislation. Thus, examination of the effect on firm behaviors of differences in actual implementation of social insurance is an important issue for China.

In order to examine the influence of social insurance contributions on workers' wages and on employment in firms this study uses data from the China Employer-Employee Matching Survey (CEES) to construct three indices of social insurance enforcement: the city contribution rate (CCR); the rate of city enforcement of social insurance

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[1]However, the lowest wage level for social insurance contribution differs for each region. For example, in Beijing it is 40% of the prior year's average wage.

(CE), and the firms' actual contribution rate (FAR) (Cheng *et al.*, 2018; Ma and Cheng, 2019).[2] The results provide new and relevant evidence for social insurance policy reform.

The influence of social insurance contributions may differ for various sectors and groups. For example, there is labor market segmentation of the public sector and private sector[3], and of workers with rural or urban registrations (*Hukou*). Few studies compare these sectors and groups. This study analyzes and compares the influence of social insurance enforcement on wages for different sectors and groups. Analysis is conducted according to the type of ownership of the firm (SOEs, POEs, or FOEs), firm size (small, medium and large), firm technology type (capital-intensive vs. labor-intensive) and region (Guangdong vs. Hubei). These results make clearer the complexities of Chinese social security policies.

The two most useful new findings are as follows: first, the results suggest that firms in a region with a high city contribution rate (CCR) or a region with a high rate of city enforcement of social insurance (CE) are likely to employ more workers. In order to assess the impact of the actual contribution rate (FAR), a comparison is made with the probability of becoming a firm with a low wage and less employment (LWLE). Firms with high FAR are more likely to have a high wage and more employment (HWME) or to have a high wage and less employment (HWLE), but the probability of having a low wage and more employment (LWME) is low. A bipolarization phenomenon is found in the relation between the firms' actual social insurance contributions and the adjustments of wage and employment. The impact of the actual contribution rate for social insurance is found to be greater on levels of employment than on wages.

The second new finding is that the impact of the level of social insurance contribution on a firm's wage and employment differs for each group. Privately-owned enterprises are likely to reduce the number of workers to mitigate the social insurance burden; the negative impact of increased social insurance contributions is greater for small-size firms, and labor-intensive firms suffer a larger negative impact from the burden of social insurance.

The remainder of this paper is constructed as follows: Section 2 introduces the channels for the influence of social insurance contributions on wage and employment, and summarizes previous empirical studies. Section 3 gives the methodological framework for empirical analysis and introduces the data and variables used. Section 4 presents and explains the estimated results. Section 5 summarizes the conclusions and presents policy implications.

2. THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.1. The Theoretical Framework for the Influence of Social Insurance Contributions on Wages and Employment

Following the partial equilibrium model, the impact of social insurance contributions on wage and employment are as follows:

The demand for labor is determined by the wage level (w) and the social insurance contribution rate (t_f) charged by the enterprise: it can be expressed by Equation 1:

$$D = D(w(1 + t_f)) \tag{1}$$

The labor supply is determined by the wage (w) and the social insurance contribution rate (t_e) charged to the individual worker. If the workers consider the benefits of social insurance contributions to be a kind of payment for

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[2] For the details of the definitions of these three indices, please see the section 3 and refer Cheng, Du and Park, (2018) and Ma and Cheng, (2019).

[3] For empirical studies on Chinese labor market segmentation of the public sector and the private sector, please refer to Chen Démurger and Fournier, (2005); Demurger, Fournier, Li and Wei, (2007); Luo and Li, (2007); Juwei and Xinxin, (2008); Ye, Shi and Chuliang, (2011); Démurger, Li and Yang, (2012) and Ma (2018a;2018b).

future security in old age (e.g. pension benefit), the labor supply may increase (Summers, 1989). Therefore, the labor supply can be expressed by Equation 2:

$$S = S(w(1 - at_e) + qwt_f)$$ (2)

Here, a and q stand for two kinds of benefit from contributions that workers expect: the benefit from the contribution charged to the worker (a), and the benefit from the contribution charged to firms (q).

Based on the partial equilibrium model, the labor demand is equal to the labor supply in a perfect competitive market, which can be expressed by Equation 3:

$$\left[\sigma^d(1 + t_f) - \sigma^s(1 - at_e + qt_f)\right]\frac{dw}{w} = (-\sigma^d + \sigma^s q) + dt_f - \sigma^s s dt_e)$$ (3)

Here, σ^d stands as the wage elasticity of labor demand, σ^ss is the wage elasticity of labor supply. Based on Eq. (3), the impact of firms' social insurance contributions on wage or employment can be expressed by Equation 4:

$$\frac{dw}{w}\Big/dt_f = \frac{-\sigma^d + \sigma^s q}{\sigma^d(1+t_f) - \sigma^s(1-at+qt_f)}$$ (4)

It is indicated that the impact of social insurance contributions on wage and employment is determined by the wage elasticity of labor demand (σ^d) and labor supply (σ^s), and the benefit from contributions that the workers expect (a and q). The labor market, the wage elasticity of labor demand and supply, and the social security systems differ in different regions, industry sectors (i.e. capital-intensive vs. labor intensive) and various groups (i.e. public sector vs. private sector; large-firm vs. small-firm). Therefore the influence of social insurance contributions on wage and employment is not explicable by conventional theoretical Economics and an empirical study is required (Hamermesh, 1979; Kotlikoff and Summers, 1987; Gruber and Krueger, 1991; Gruber, 1997; Bojas, 2004; Adhikari *et al.,* 2009).

2.2. Published Empirical Studies

Empirical studies made in the 1970s and early 1980s usually employ the social insurance premium or the ratio of social insurance contribution to wages, as an independent variable in wage functions. Most empirical studies found that social insurance contributions negatively affect wage and employment and this indicates that firms transfer the increased social insurance contribution burden to workers. For example, Hamermesh (1979) finds firms in the UK immediately transfer 33% of the social insurance contribution rise onto workers. Holmlund (1983) uses Swedish time series data to analyze the social insurance reform which led to a social insurance contribution ratio increase from 14% to 40% of the wage: the study finds that firms transferred half of the social insurance contribution burden onto their workers.

Triplett (1983); Smith and Ronald (1983) and Asher (1984) argue that there is an endogeneity problem. Later empirical studies address the endogeneity problem. For example, most empirical studies use a quasi-natural experiment method (Difference in Difference: DID method) to analyze the impact of social insurance policy change on firms' wages or employment. Notable studies are: the influence of health care insurance, worker injury compensation law, employment insurance for the USA (Gruber and Krueger, 1991; Gruber, 1994; Fishback and Kantor, 1995; Gruber, 1997; Anderson and Meyer, 2000) health care insurance for Japan (Sakei and Kazegami,

2007) and total social insurance contributions for Chile (Gruber, 1997) and Columbia (Kugler and Kugler, 2003); Ma and Zhang (2018) and Ma and Cheng (2019) for China. However, the results of these empirical studies are not consistent. For example, Fishback and Kantor (1995); Anderson and Meyer (2000); Kugler and Kugler (2003); Sakei and Kazegami (2007); Ma and Zhang (2018) and Ma and Cheng (2019) indicate that the level of social insurance contributions negatively affects workers' wage levels, whereas Gruber and Krueger (1991) and Gruber (1994;1997) find that the influence of the rise of social insurance contributions on wages is not statistically significant.

As far as the authors are aware there is a paucity of detailed empirical study of the influence of firms' social insurance contributions on wage or employment for China. This study provides new evidence about China.

2.3. Four Special Features of the Chinese Labor Market

Four features emerge for the labor supply and labor demand situation in China which are not found in the published studies of other countries.

First, regarding the wage elasticity of labor supply in China, a surplus of labor persists in rural regions (Minami and Ma, 2014). In 2018 the number of internal migrants is estimated to be around 200 million (National Bureau of Statistics, 2019). Based on the unlimited supplies of labor hypothesis (Lewis, 1954) the wage elasticity of the labor supply for low-skilled migrants is small. In addition, even though pension benefit increased with public pension reform, for example, the annual per capita benefit from the Urban Employee Pension increased from 2,558RMB in 1993 (before reform) to 34,512 RMB in 2017, the replacement rate of pension to average wage decreased from 79.0% in 1993 to 46.4% in 2017 (NBS, 2018; 2019). It appears that with the replacement rate of pension to wage decreasing, the labor supply may increase and cause the decrease in the wage elasticity of the labor supply.

Second, with the progress of global value chains numerous privately owned enterprises developed due to the advantage of low labor costs in China and therefore the wage elasticity of labor demand in China may be higher. It is thought that compared with the labor supply side, the influence of social insurance on wage and employment may be greater for the labor demand side (firms). This is one reason why this study focuses on the firm and not on individual workers.

Third, in China the trade unions are usually managed by the government, and the ratio of worker participation in the trade unions is low in the private sector (e.g. POEs, FOEs), and the influence of collective bargaining on wages is weak. Therefore firms in the private sector may easily transfer the social insurance contribution burden onto their workers, which causes the level of workers' wages and the number in employment to decrease.

Fourth, the Chinese government favored gradualism in implementing reforms[4], thus the labor market is divided into different sectors and groups and the influences of social insurance on wage may differ for each sector and group (i.e. public sector and private sector; large firm and small firm; labor-intensive firm and capital-intensive firm). Therefore further detailed empirical study is required to examine these varied features in the Chinese labor market, particularly the results for public sector and private sector are findings not analyzed in the published literature.

Many features of the labor market in China are different from those in developed countries, for example, social insurance contributions differ because the differences in enforcement practices between local governments, and the labor market is segmented by sectors (e.g. public sector and private sector). These features are not analyzed in published studies. Particularly, firms may link or combine their decision on wage and employment: an element of this study which is not analyzed in the published literature.

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[4] The economic transition pattern is distinguished by radicalism (shock therapy, big-bang approach) in Russia and Central and Eastern European countries, but by gradualism in China Balcerowicz (1994); Liew (1995); Sonin (2013); Shleifer and Treisman, (2014).

3. METHODLOGY

3.1. Models

First, in order to construct a set of situations for the joint decisions, we calculate the reference standards of wage and employment which are expected to be the market equilibrium wage and employment based on firm characteristics and the local labor market situations. A firm's wage and employment functions are estimated based on the Ordinary Least Squares (OLS) regression model shown by Equation 5 and Equation 5.1.

$$LnW_{ic} = a + \beta_F F_{ic} + \beta_c C_c + v_i \tag{5}$$

$$Em_{ic} = b + \beta'_F F_{ic} + \beta'_C C_c + u_i \tag{5.1}$$

In Equation 5 and Equation 5.1, LnW stands for the logarithm of workers' average wage in a firm, Em stands for the number of workers in a firm, F is firm characteristics (e.g. firm size, industry sector), C is city characteristics (e.g. per capita GDP, population density), i for firm, c for city, the constant terms are a and b, and v and u are the error terms. β an β' represents the estimated coefficient for each variable.

Using the estimated results of Equation 5 and Equation 5.1, we calculated the imputed wage level ($Ln\widehat{W}$) and employment ($\widehat{Em}$) for each firm. These are the appropriate values for each firm based on the same wage and employment determinate mechanism. Then we calculated the gap of actual value and imputed value (wage gap $= LnW - Ln\widehat{W}$; employment gap $= (Em - \widehat{Em})$, and constructed four kinds of combinations of wage and employment: i. high wage and more employment (HWME), ii. high wage and less employment (HWLE), iii. low wage and more employment (LWME), iv. low wage and less employment (LWLE).

There are two advantages in using this method. First, in comparison with other methods such as using median and mean values of wage and employment, the imputed values based on wage and employment functions are thought to be the appropriate values for each firm based on the similar wage and employment determinate mechanism. The imputed value can be thought of as an optimum value after the heterogeneity of firms and the market mechanism are considered because in wage and employment functions, we control the factors (e.g. firm size, industry, ownership) which may affect wage and employment. Second, we use the city level variables as identification variables in the first step estimations (wage and employment functions), which is similar to the approach of the instrument variables (IV) method to address in part the endogeneity problem.

Second, to investigate the impact of social insurance on the probabilities of joint decision on both wage and employment, the multinomial logistic regression (MLR) model is used:

$$Y^*_{mi} = a_m + \beta_{SIm} SI_{mi} + \beta_{Fm} F_{mi} + \varepsilon_{mi} \qquad (i = 1,2 \dots N)$$

$$Y^*_{ni} = a_n + \beta_{SIn} SI_{ni} + \beta_{Fn} F_{ni} + \varepsilon_{ni} \qquad (i = 1,2 \dots N)$$

$$Y^* = n \quad if \ \beta_{SIn} SI_{ni} + \beta_{Fn} F_{ni} - \beta_{SIm} SI_{mi} - \beta_{Fm} F_{mi} > (a_m - a_n) + (\varepsilon_{mi} - \varepsilon_{ni})$$

$$(m \neq n)$$

$$\Pr(Y_i^* = n) = \frac{\exp(a_n + \beta_{SIn}SI_{ni} + \beta_{Fn}F_{ni})}{\sum_{m=1}^{r} \exp(a_m + \beta_{SIm}SI_{mi} + \beta_{Fm}F_{mi})} \qquad (m = 1, n \ldots r) \qquad (6)$$

In Equation 6, $\Pr(Y_i^* = n)$ stands for the probability of adopting one kind of combination for the wage and employment joint decisions in a firm (for example, a firm decides to reduce both workers' wage level and employment), *n* stands for the four kinds of combination for the wage and employment joint decisions: i, high wage and more employment (HWME); ii, high wage and less employment (HWLE); iii, low wage and more employment (LWME), and iv, low wage and less employment (LWLE). *SI* denotes the social insurance index including the city contribution rate (CCR); the rate of city enforcement of social insurance (CE), and the firms' actual contribution rate (FAR). We use low wage and less employment (LWLE) as a reference group in the MLR model.

When the coefficient of social insurance (β_{SIn}) is a negative value and is statistically significant, it indicates that an increased social insurance contribution may negatively affect the probability of one kind of wage and employment joint decision occuring. For example, compared with the probability of becoming an LWLE, a firm is more likely to make one of the other kinds of joint decision (HWME, HWLE, or LWME).

It can be argued that the endogeneity problem may remain in Equation 2, for example, the variables of *F* such as firm size may influence social insurance. Notably, it can be thought that larger firms may have more influence over local government enforcement actions or they can get away with skimping on their mandated contributions due to their regional employment market power in developed countries. However in China, because there is one party for which the Communist Party of China (CPC) is the guiding organization, the collective bargaining power of large firms to local (or central) government is small (Ma, 2019; Ma and Iwasaki, 2019) therefore it is expected that the influence of the reverse causality problem between social insurance contributions and firm size on results is small. We estimate the influence of firm size in *t-1* year on social insurance contribution in *t* year to check the reverse causality problem, the results indicate that the coefficients are not statistically significant, it is shown statistically that the reverse causality problem does not remain.

Finally, to examine the heterogeneities for different groups, a set of subsamples (groups by firm sizes, ownership types, technology types, and regions) are used to facilitate more detailed analyses based on Equations. 1.1, 1.2 and 2.

3.2. Data

Matched datasets with both the firms and the workers' information are rarely available today. Indeed, only few small developed countries such as Denmark have an employer-employee survey matched dataset (Yu, 2017). This paper uses the latest data collected in a firm sampling survey, the China Employer-Employee Matching Survey (CEES), for firms in two provinces of China. The CEES was jointly conducted by the Chinese Academy of Social Sciences, Hong Kong University of Science and Technology, Stanford University, and Wuhan University for 2014, 2015 and 2016. The survey objects are focused on firms in the manufacturing industry sector.

Sampling was conducted in two stages, each using probability proportionate-to-size sampling, with the size defined as manufacturing employment. Thus, the firm sample is representative of the firm employment size in China. First, firms were sampled according to the size of their labor force as categorized in the third National Economic Census Database of China in 2013. Second, teams of enumerators visited selected firms to gather data. The firms were located in 19 different counties across 13 prefecture-level cities in Guangdong province (South Region) and 20 different counties across 13 prefecture-level cities in Hubei province (Central Region). Between 6 to 10 employees at each firm were sampled using stratified random sampling. The firm was asked to provide a list of all employees enrolled at the end of the previous year.

Approximately 30% of the sampled employees were middle and senior-level managers, and 70% of the samples were front-line workers. The firm survey instrument gathers useful information including the firm's characteristics (e.g. ownership type, firm size, and industrial sector), wage, employment and social insurance contributions et cetera. The worker survey dataset includes employee's individual information including the individual characteristics (e.g. gender, education, age, and health), and working conditions (e.g. wage, working hours, occupation, and industry) et cetera. The unique employer-employee matching datasets allow an effective empirical analysis in this study. We use only the information about firms from the CEES data because this study focuses on the wage and employment levels set by firms.[5]

After excluding the missing variable and abnormal value samples, 570 firms were surveyed in Guangdong province in the first wave survey in 2015. The response rate in the firm survey was 82% in Guangdong. In the second wave survey in 2016 data was collected for about 531 firms in Guangdong province. The tracking samples are 486 firms, the response rate in the firm survey was 82% in Guangdong. 548 firms were surveyed in Hubei province in 2016. Combining the samples, 84% of the firms were successfully interviewed in Guangdong and Hubei provinces. Although the firm sample is not large, because the sampling of the survey in wave 1 is based on the third National Economic Census Database of China in 2013 which is a national governmental survey, and the attrition rates of panel survey in both wave 2 and wave 3 are low, it is thought that the samples of firms in manufacturing industry from wave 1 to wave 3 are representative of Guangdong and Hubei provinces.

3.3. Variables

Using the CEES data, the dependent variables[6] are constructed as follows: first, for the wage function, the logarithm of firm average wage was calculated by dividing the total wage by the number of workers in a firm. Secondly, for the employment function, the number of workers is used. Third, in the multinomial logistic regression model, a category variable is used. It is constructed using the four types of combinations of wage and employment shown in Table 1.[7]

Table-1. Four combinations of wages and employment.

Group type	Classifications
i, high wage and more employment (HWME)	$LnW - Ln\hat{W} \geq 0$ and $Em - E\hat{m} \geq 0$
ii, high wage and less employment (HWLE)	$LnW - Ln\hat{W} \geq 0$ and $Em - E\hat{m} < 0$
iii, low wage and more employment (LWME)	$LnW - Ln\hat{W} < 0$ and $Em - E\hat{m} \geq 0$
iv, low wage and less employment (LWLE)	$LnW - Ln\hat{W} < 0$ and $Em - E\hat{m} < 0$

Notes: $Ln\hat{W}$ and $E\hat{m}$ are calculated based on wage and employment functions.

The main independent variables are three indices of social insurance, they are the city contribution rate (CCR) which is defined as the contribution rate based on a city's policies, city enforcement of social insurance (CE) which calculated based on CCR and wage base levels, and firms' actual contribution rate (FAR) which is defined as the proportion of total payments to social insurance from contributors to total labor compensation for employees. CCR and CE are city level social insurance indices, FAR is firm level index which can be regarded as firms' actual

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[5] For the issue on the impact of social insurance contributions on wage levels using individual data and firm data of CEES, please refer Ma and Cheng, (2019).

[6] For the statistical description of dependent and independent variables, please see Appendix Table A1.

[7] The results of wage and employment functions are summarized in Appendix Table A2. We use firm size, survey year and social insurance (CCR, CE, and FAR) dummy variables as the identification variables.

enforcement or the firm compliance. CCR can be obtained from city policies, and FAR can be calculated based on CEES data.[8]

Other variables are constructed that may affect firms' wage and employment (1) *firm age* may affect wage, we calculate firm age based on the year the firm was established and the survey year.

(2) The survey year dummy variables (*y2014* and *y2015*) are used to control the time trend influence which is in relation with the changes of business cycles or macroeconomic environment on wage and employment.

(3) According to the law of economies of scale, firm size may affect the revenue, or profit, therefore it may affect the workers' wage and employment. *Micro, small, medium and large-size* dummy variables are used in the analysis.

(4) The ownership types are classified into three kinds based on the dataset: state-owned enterprises (*SOEs*); privately-owned enterprise (*POEs*), and foreign-owned enterprises (*FOEs*).

(5) Global business may affect the workers' wage levels and employment, the ratio of export productions value to total revenue (*export*), is constructed to control for the global business influence.

(6) The *ratio of capital to labor* is calculated as the firm's assets divided by the number of workers; an *automation* utilization dummy variable which is equal to 1 when a firm utilizes and to 0 if the others, and a *robot* utilization dummy variable which is equal to 1 when a firm utilizes and to 0 if the others. The *ratio of skilled workers* is calculated as the proportion of the number of skilled workers to the total number of workers. These variables are used to control the disparity of firms' capital, technology and skills.

(7) It is thought that wage levels differ for each industry sector. Based on CEEMS, 12 kinds of *industry sector* dummy variables (*food, beverage and tobacco, textile and leather, wood, paper and printing, chemical and plastic, nonmetallic mineral, metal, electronic and machinery, motor vehicles, other transportation, others*) are constructed to control for the industry sector disparities.

4. ESTIMATION RESULTS

4.1. The Impact of Social Insurance on Wage and Employment

Table 2, Table 3 and Table 4 summarize the marginal effect for the social insurance (CCR, CE and FAR) and control variables based on Eq. (2). The three main results are as follows.

First, the marginal effects of city contribution rate (CCR) are positive values for HWME, and LWME, negative values of HWLE and LWLE, and they are statistically significant at 1% Table 2. It is shown that firms in the high city contribution rate regions have a greater tendency to become the high wage and more employment (HWME) type of firm, or the less wage and more employment (LWME) type. The results suggest that firms in the high city contribution rate regions (e.g. cities in Hubei province in this study) are likely to employ more workers. This may be because due to the terms of the labor contract, employment adjustment is much more difficult than wage adjustment. Also, the proportion of SOEs is larger in the high city contribution rate regions. Retention and increase of the numbers in employment is promoted as a social security policy by local government, and is an important management objective for SOEs. Moreover, the soft-budget enables the SOEs to obtain more financial support from the government and the monopolistic rent controls may allow SOEs to employ more workers than market equilibrium alone would allow.

Second, the marginal effects of the rate of city enforcement of social insurance (CE) are similar to the results of CCR Table 3. It is found that firms in regions with a high rate of city enforcement of social insurance tend to become HWME and the LWME firms rather than firms with LWLE and HWLE.

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[8] In the firm questionnaire, we asked the managers responsible for social insurance, human resources or finance to give the firm's social insurance contribution rates applicable to the enterprises according to local government regulations, and also the total annual social insurance contributions for the past three years. The labor cost refers to salaries, bonuses and social insurance contributions for employees.

Third, the marginal effects of the actual contribution rate for firms (FAR) are positive values for the HWME and the HWLE, and negative value for the LWME. They are statistically significant at 1%. There appears to be a bipolarization phenomenon among firms: 'good' firms, that support their workers' welfare, and pay both high social insurance contributions and a fair wage to their workers and employ more workers, and 'bad' firms which pay both less social insurance contribution and lower wages and decrease employment. These results indicate that even though most firms are likely to adjust the number of workers to address the actual contribution burden, in reality, there is a combination of wage and employment adjustment strategies. These results suggest that the human resource management strategies and ability to address the social insurance burden differ for each firm, and this results in the differentials in wage and employment combinations.

4.2. Estimations by Privately-Owned Enterprises and State-Owned Enterprises

Even with the progression the central government's reform of SOEs, the proportion of workers in SOEs to the total workers in urban China decreased greatly from 76.8% in 1980 to 34.3% in 2017. The government still controls the management of SOEs including the basic wage levels and number in employment, therefore the determination mechanisms of wage and employment are not the same for the public sector and the private sector (Chen *et al.*, 2005; Demurger *et al.*, 2007; Luo and Li, 2007; Ye *et al.*, 2011; Démurger *et al.*, 2012; Ma, 2018a;2018b). It can be thought the influence of social insurance contributions may differ by firms' ownership types. The results by privately-owned enterprises and state-owned enterprises are summarized in Table 5. The main findings are as follows.

The results indicate that the influence of social insurance contribution on wages and employment is greater for the private sector (POEs and FOEs) than for the public sector (SOEs). For example, the marginal effect of CCR and CE for the probability of becoming an LWLE firm are statistically negatively significant for both the POEs and the FOEs, but they are not significant for the SOEs. Also, the impacts of CCR, CE and FAR differ by ownership sectors. Notably, in higher contributions regions, SOEs and FOEs is likely to become the HWME firms, but POEs is tendency to become the LWME firms. It should be noted that the probability of becoming a high wage and increased employee (HWME) type of firm is higher for both the SOEs and FOEs in the high CCR and high CE regions, but the marginal effects is greater for SOEs than FOEs. The results suggest that the POEs in higher contributions regions are likely to reduce the wage to address the social insurance burden.

These new findings can be accounted for by the following three points. Firstly, in SOEs part of the level of wages and employment is controlled by the government, so in order to compare SOEs and POEs and FOEs the workers' wages and employment levels are adjusted independently. Secondly, it is expected that the motives of firm management differ for SOEs and POEs. For example, the SOEs may act with concern for China's security and long-term governmental aims and transfer less of the social insurance burden onto employees. Conversely, the POEs may implement a short-term management strategy to pursue profit maximization and they may transfer more of the social insurance burden onto their workers. Thirdly, the SOEs can obtain more government financial support than the POEs, therefore the labor cost increase caused by the rise of social insurance contributions may not be such a severe problem for the SOEs.

Table-2. Results for the impact of social insurance (CCR) on Chinese firms' wages and employment.

	(1) HWHE			(2) HWLE			(3) LWME			(4) LWLE		
	df/dx		z-value	df/dx		z-value	df/dx		z-value	df/dx		z-value
CCR	0.006	**	2.00	-0.005	**	-2.31	0.008	***	2.58	-0.008	***	-3.47
Sales	-0.076	***	-20.73	0.004		1.22	-0.018	***	-4.52	0.090	***	24.16
Ratio of skilled worker	0.220	**	1.98	0.079		0.87	-0.409	***	-3.32	0.111		1.17
Rate of capital to labor	-0.014		-0.87	-0.024	**	-2.07	0.042	***	2.75	-0.004		-0.34
Firm age	0.015	***	12.58	0.018	***	19.16	-0.027	***	-18.35	-0.006	***	-5.43
Ownership (SOEs)												
POEs	0.065	***	2.44	0.026		1.15	0.051	*	1.69	-0.141	***	-5.11
FOEs	0.027		0.78	0.019		0.73	0.005		0.14	-0.052		-1.61
Exported firm	-0.107	***	-5.54	0.055	***	3.08	-0.006		-0.28	0.058	***	3.09
Robot	-0.083	**	-2.00	0.083	***	2.57	-0.066		-1.59	0.066	**	2.23
Industry sector (Ind1)												
Ind1	-0.055	*	-1.79	-0.038		-1.19	-0.058	*	-1.80	0.151	***	4.77
Ind2	-0.007		-0.12	-0.017		-0.33	0.023		0.42	0.001		0.02
Ind3	0.004		0.10	-0.050		-1.25	-0.077	*	-1.67	0.123	***	2.95
Ind4	-0.014		-0.40	0.012		0.32	-0.014		-0.36	0.017		0.51
Ind5	-0.031		-0.92	-0.047		-1.29	-0.045		-1.32	0.124	***	3.60
Ind6	-0.006		-0.19	-0.047		-1.49	-0.039	***	-1.19	0.092	***	3.01
Ind7	-0.019		-0.59	-0.031		-0.97	-0.038		-1.11	0.088	***	2.94
Ind8	-0.112	***	-2.72	-0.059		-1.55	0.081		1.69	0.090	**	2.31
Ind9	0.093		0.94	-0.011		-0.10	-0.260	***	-4.56	0.178		1.59
Ind10	-0.091	**	-2.02	-0.032		-0.72	-0.017		-0.33	0.139	***	2.83
Province (Guangdong)												
Hubei	-0.006		-0.16	0.067	**	2.00	-0.098	***	-2.74	0.037		1.09
Survey year (y2013)												
y2014	-0.015		-0.78	-0.023		-1.34	0.034	*	1.76	0.004		0.24
y2015	-0.036	*	-1.90	-0.010		-0.56	0.064	***	3.25	-0.018		-1.02
observations				9392								
log likelihood				-3023.8								

Notes: (i) * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. (ii) The low wage and less employment (LWLE) group is used as the reference group in the MLR model. (iii) HWME: high wage and more employment; HWLE: high wage and less employment; LWME: low wage and more employment. (iv) Ind1: Food, beverage and tobacco industry; Ind2: Textile and leather industry; Ind3: Wood industry; Ind4: Paper and printing industry; Ind5: Chemical and plastic industry; Ind6: Nonmetallic mineral industry; Ind7: Metal industry; Ind8: Electronic and machinery industry; Ind9: motor vehicles industry; Ind10: other transportation industry; Ind11: Other industry.

Table-3. Results for the impact of social insurance (CE) on Chinese firms' wage and employment.

	(1) HWME		z-value	(2) HWLE		z-value	(3) LWME		z-value	(4) LWLE		z-value
	df/dx		z-value	df/dx		z-value	df/dx		z-value	df/dx		z-value
CE	0.211	*	1.89	-0.206	**	-2.33	0.256	**	2.31	-0.261	***	-2.93
Sales	-0.076	***	-20.70	0.004		1.19	-0.018	***	-4.51	0.090	***	24.12
Ratio of skilled worker	0.225	**	2.03	0.076		0.84	-0.406	***	-3.28	0.105		1.10
Rate of capital to labor	-0.014		-0.88	-0.024	**	-2.07	0.042	***	2.77	-0.004		-0.36
Firm age	0.015	***	12.61	0.018	***	19.16	-0.027	***	-18.26	-0.006	***	-5.51
Ownership (SOEs)												
POEs	0.063	**	2.37	0.027		0.19	0.049	*	1.63	-0.139	***	-5.04
FOEs	0.026		0.75	0.020		0.75	0.002		0.04	-0.047		-1.47
Exported firm	-0.108	***	-5.58	0.055	***	3.10	-0.007		-0.33	0.059	***	3.15
Robot	-0.084	**	-2.04	0.084	***	2.58	-0.066		-1.60	0.047	**	2.26
Industry sector (Ind1)												
Ind1	-0.054		-1.76	-0.039		-1.22	-0.058	*	-1.79	0.151	***	4.76
Ind2	-0.006		-0.11	-0.018		-0.35	0.023		0.41	0.002		0.04
Ind3	0.005		0.11	-0.052		-1.30	-0.076	*	-1.64	0.123	***	2.94
Ind4	-0.014		-0.38	0.011		0.29	-0.014		-0.37	0.017		0.52
Ind5	-0.029		-0.85	-0.049		-1.33	-0.044		-1.27	0.121	***	3.53
Ind6	-0.006		-0.18	-0.047		-1.50	-0.039		-1.18	0.092	***	2.99
Ind7	-0.017		-0.53	-0.034		-1.02	-0.037		-1.09	0.088	***	2.94
Ind8	-0.111	***	-2.69	-0.061		-1.59	0.082	*	1.72	0.089	**	2.28
Ind9	0.094		0.95	-0.011		-0.10	-0.259	***	-4.54	0.176		1.57
Ind10	-0.091	**	-2.02	-0.033		-0.74	-0.018		-0.36	0.142	**	2.88
Province (Guangdong)												
Hubei	0.004		0.14	0.062	**	1.99	-0.081	***	-2.45	0.014		0.45
Survey year (y2013)												
y2014	-0.015		-0.76	-0.024		-1.35	0.035	*	1.78	0.004		0.21
y2015	-0.036	*	-1.87	-0.010		-0.57	0.065	***	3.28	-0.019		-1.07
observations				9392								
log likelihood				-3024.6								

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The low wage and less employment (LWLE) group is used as the reference group in the MLR model. HWME: high wage and more employment; HWLE: high wage and less employment; LWME: low wage and more employment. Ind1: Food, beverage and tobacco industry; Ind2: Textile and leather industry; Ind3: Wood industry; Ind4: Paper and printing industry; Ind5: Chemical and plastic industry; Ind6: Nonmetallic mineral industry; Ind7: Metal industry; Ind8: Electronic and machinery industry; Ind9: motor vehicles industry; Ind10: other transportation industry; Ind11: Other industry.

Table-4. Results for the impact of social insurance (FAR) on Chinese firms' wage and employment.

	(1) HWME			(2) HWLE			(3) LWME			(4) LWLE		
	df/dx		z-value	df/dx		z-value	df/dx		z-value	df/dx		z-value
FAR	0.006	***	9.32	0.004	***	5.98	-0.009	***	-10.28	-0.001		-1.27
Sales	-0.068	***	-14.56	0.006		1.48	-0.033	***	-6.81	0.095	***	19.75
Ratio of skilled worker	0.089		0.66	-0.105		-0.88	-0.309	**	-2.09	0.325	***	2.56
Rate of capital to labor	-0.002		-0.12	-0.054	**	-2.15	0.048	**	2.29	0.009		0.45
Firm age	0.015	***	10.09	0.018	***	14.94	-0.028	***	-16.05	-0.005	***	-3.21
Ownership (SOEs)												
POEs	0.129	***	4.94	0.053	**	2.15	-0.023		-0.62	-0.159	***	-4.36
FOEs	0.066	*	1.86	0.023		0.79	-0.064		-1.44	0.025		-0.59
Exported firm	-0.077	***	-3.27	0.064	***	2.93	-0.035		-1.42	0.048	**	1.99
Robot	-0.121	***	-3.07	0.055		1.61	0.021		0.43	0.045		1.19
Industry sector (Ind1)												
Ind1	-0.056		1.41	-0.048		1.20	-0.095	***	-2.49	0.198	***	5.30
Ind2	0.061		0.76	-0.126	**	-2.19	-0.026		-0.37	0.091		1.46
Ind3	-0.030		-0.57	-0.047		-0.98	-0.075		-1.39	0.152	***	3.09
Ind4	0.003		0.08	0.000		0.00	-0.047		-1.05	0.043		1.08
In5	-0.047		1.10	-0.106	***	-2.47	-0.026		-0.63	0.179	***	4.31
Ind6	-0.056		-1.43	-0.033		-0.84	-0.028		-0.71	0.118	***	3.22
Ind7	-0.047		-1.12	-0.050		-1.260	-0.027		-0.66	0.124	***	3.45
Ind8	-0.135	***	-2.850	-0.057		-1.260	0.092	*	1.67	0.100	**	2.15
Ind9	-0.156	*	-1.68	-0.054		-0.46	-0.121		-0.89	0.331	**	2.03
Ind10	-0.101	*	-1.74	-0.121	***	-2.74	0.006		0.08	0.216	***	3.54
Province (Guangdong)												
Hubei	0.068	***	2.73	-0.009		-0.36	-0.007		-0.27	-0.052	*	-1.89
Survey year (y2013)												
y2014	-0.019		-0.69	-0.016		-0.60	0.047	*	1.79	-0.012		-0.42
y2015	-0.038		-1.42	-0.007		-0.27	0.081	***	3.03	-0.035		-1.21
observations				5888								
log likelihood				-1773.1								

Notes: (i) * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. (ii)The low wage and less employment (LWLE) group is used as the reference group in the MLR model. (iii)HWME: high wage and more employment; HWLE: high wage and less employment; LWME: low wage and more employment.(iv) Ind1: Food, beverage and tobacco industry; Ind2: Textile and leather industry; Ind3: Wood industry; Ind4: Paper and printing industry; Ind5: Chemical and plastic industry; Ind6: Nonmetallic mineral industry; Ind7: Metal industry; Ind8: Electronic and machinery industry; Ind9: motor vehicles industry; Ind10: other transportation industry; Ind11: Other industry.

Table-5. Summary of results for the impact of social insurance on wages and employment according to ownership types.

	(1) HWME			(2) HWLE			(3) LWME			(4) LWLE		
	df/dx		z-value	df/dx		z-value	df/dx		z-value	df/dx		z-value
【SOEs】												
CCR	0.023	**	2.21	−0.013		−1.11	−0.013		−1.31	0.003		0.22
CE	0.726	*	1.80	−0.375		−0.79	−0.497		−1.30	0.146		0.28
FAR	0.002		1.34	0.006	***	3.03	−0.004	**	−2.35	−0.005		−0.33
【POEs】												
CCR	−0.002		−0.43	−0.004		−1.16	0.011	**	2.58	−0.006	**	−2.09
CE	−0.057		−0.36	−0.145		−1.25	0.388	**	2.39	−0.186	*	−1.79
FAR	0.008	***	8.13	0.003	***	4.30	−0.011	***	−9.89	0.000		0.42
【FOEs】												
CCR	0.008	***	2.79	−0.001		−0.22	0.005		1.26	−0.012	***	−2.50
CE	0.323	***	2.89	−0. 7		−0.45	0.147		1.05	−0.400	**	−2.24
FAR	0.005	***	4.53	0.005	***	3.46	−0.008	***	−3.51	−0.002		−0.88

Notes: (i) * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. (ii) SOEs: state-owned enterprises; POEs: private-owned enterprises; FOEs: foreign owned enterprises. (iii)CCR: city contribution rate; CE: rate of city enforcement of social insurance; FAR: firms' actual contribution rate. (iv)The low wage and less employment (LWLE) group is used as the reference group in the MLR model. (v) The other variables such as firm sales, ratio of skilled worker, ratio of capital to labor, firm age, industry sector, province and survey year are estimated, these results are not expressed in Table 5.

5. CONCLUSIONS AND POLICY IMPLICATIONS

In the economic transition period, the Chinese Government implemented public security system reforms. As a result, social insurance contributions rose to nearly 40% of the total wage. It is thought firms may transfer these social insurance contributions to their workers by reducing the workers' wages and employment. How does the level of social insurance influence the firms' joint-adjustment of wage and employment? Using the China Employer-Employee Matching Survey data, this study constructs three indices of social insurance enforcement: the city contribution rate (CCR), the rate of city enforcement of social insurance (CE), and the firms' actual contribution rate (FAR) to examine the influence of social insurance contributions on firms' wage and employment situations. The main findings are as follows.

Firstly, in general, (1) the firms in regions with high CCR or CE show a tendency to develop higher wage levels and more employment (HWME) or lower wage levels and more employment (LWME) rather than to become firms with a low wage and less employment (LWLE). The results suggest that a firm in a region with a high city contribution rate or with stricter enforcement of regulations is likely to employ more workers. (2) A firm's actual contribution rate (FAR) positively affects the probability of becoming a firm with HWME and HWLE, and it negatively affects the probability of becoming a firm with LWME. It seems likely the bipolarization phenomenon among firms is persistent, and the impact of social insurance is greater on employment levels than on wages.

Secondly, the influence of social insurance contributions on wage levels and employment is greater for the private sector (POEs and FOEs) than for the public sector (SOEs). The impact of CCR, CE and FAR differs for each ownership sector and the POEs in higher level contribution city regions are likely to reduce the wage level to redress the social insurance burden.

These results have three main policy implications. Firstly, the Chinese government reformed the public social security systems to address the phenomenon of an aging population. As a result of these reforms, social security insurance contributions increased for both workers and firms. The results show that in general an increased social security insurance contribution negatively affects a worker's chances of employment and of earning a high wage. It is indicated that firms may transfer the social security insurance contribution burden onto workers, which may decrease wage levels and employment opportunities leading to a slowing down of economic growth in the long-term. In May 2016 the Chinese government published a set of regulations to reduce the social insurance

contribution burden on firms. According to these new regulations, if the public pension insurance contribution for a firm is more than 20% of the wage, it must be reduced to 20% within two years. The total unemployment insurance contribution must be reduced to between 1% to 1.5%, and the workers' unemployment insurance contribution must be less than 0.5%. Even though the government intends to reduce the social insurance contribution burden for firms, the social insurance contribution from Chinese firms remains relatively high. High social insurance contributions may increase labor costs and damage the international competitive advantage enjoyed by Chinese firms. Thus, a significant decrease in the burden of social insurance contributions on firms should be considered by the government.

Secondly, the results suggest that many firms may take a joint decision on the adjustment for wage levels and staffing levels. The firm does not decide the wage level separately from the decision about employment level. This study divides these combinations into four kinds: HWME, LWME, HWLE, and LWLE. It seems likely a form of bipolarization occurs in China. To generalize, they tend to divide into 'good' firms that pay both a high social insurance premium and a high wage to their workers and employ more workers, and 'bad' firms which pay both less social insurance contributions and lower wages to their workers and reduce the number employed. According to the results for each group, it is shown that privately-owned enterprises in higher city level contribution regions, are likely to decrease their wage levels in order to reduce the social insurance burden. The government might usefully consider the balance of social insurance contributions and firms' sustainable growth in a long-term.

Thirdly, there are significant variations in the enforcement of social insurance contributions in each region and the impact of social insurance contributions on wage and employment levels differs for each region. For example, according to analysis of the CEES data, the distribution of regulated contribution ratios in Hubei in the Central Region of from 40% to 45% is close to the national mean average ratio. In Guangdong province in the South Region, the contribution ratios are from 22% to 35%, very much lower than the national mean average ratio. These regional variations indicate that, although the central government's unified social insurance system determines a clear direction for reform, some local governments may choose a low social insurance premium in order to maintain their local economic competitiveness. Social insurance policies are usually implemented at the city level which causes differentials in social insurance contributions for each region. To reduce these large regional inequalities, universal social security systems with effective regional compliance mechanisms should be established in the future.

Finally, the limitations of this study should be noted. The CEEMS data is only available from 2013 to 2015. Further study using detailed analysis of long-term survey data is needed. Scrutiny of the data from the CEES did not show an appropriate instrument variable. A fruitful subject for future research is exploration of the use of a quasi-natural experiment method or an instrument variable method to investigate the causal relation between the level of social insurance contribution and firms' adjustment of wage and employment levels.

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APPENDIX

Table-A1. Descriptive statistics.

Variable	obs.	Mean	S.D.	Min	Max
Total sample					
CCR	2,968	35.70	7.08	22.50	44.50
CE	2,968	0.82	0.17	0.48	1.03
FAR	1,765	15.16	13.39	0.02	59.10
Log of average firm average	2,968	10.37	1.06	1.01	59.49
Log of average firm employees	2,968	5.30	1.58	0.69	10.78
Log of sales	2,473	7.30	2.27	-1.94	17.78
Rate of capital to labor	2,923	0.28	2.77	0.00	145.97
Firm age	2,960	10.45	7.56	0.00	61.00
Firm size (four categories)	2,968	2.50	0.82	1.00	4.00
Ownership (three categories)	2,966	2.13	0.60	1.00	3.00
Exported firm	2,962	0.47	0.50	0.00	1.00
Robot	2,905	0.09	0.29	0.00	1.00
Ratio of skilled worker	2,931	0.07	0.08	0.00	0.66
Industry sector (11 categories)	2,968	5.61	2.81	1.00	11.00
Guangdong province					
CCR	1,507	29.45	4.33	22.50	35.60

CE	1,507	0.68	0.11	0.48	0.85
FAR	780	14.37	12.16	0.03	58.76
Log of average firm average	1,507	10.38	1.11	1.01	19.49
Log of average firm employees	1,507	5.72	1.60	1.79	10.78
Log of sales	1,292	7.47	2.41	-1.94	17.78
Rate of capital to labor	1,484	0.24	3.80	0.00	145.97
Firm age	1,506	11.42	7.24	0.00	56.00
Firm size (four categories)	1,507	2.69	0.85	1.00	4.00
Ownership (three categories)	1,505	2.37	0.60	1.00	3.00
Exported firm	1,507	0.71	0.45	0.00	1.00
Robot	1,444	0.11	0.32	0.00	1.00
Ratio of skilled worker	1,485	0.07	0.08	0.00	0.60
Industry sector (11 categories)	1,507	6.03	2.62	1.00	11.00
Hubei province					
CCR	1,461	42.15	0.78	40.50	44.50
CE	1,461	0.98	0.02	0.94	1.03
FAR	985	15.78	14.27	0.02	59.10
Log of average firm average	1,461	10.35	1.01	5.27	14.52
Log of average firm employees	1,461	4.86	1.44	0.69	10.29
Log of sales	1,181	7.10	2.08	1.13	13.90
Rate of capital to labor	1,439	0.33	0.85	0.00	14.00
Firm age	1,454	9.44	7.75	0.00	61.00
Firm size (four categories)	1,461	2.29	0.72	1.00	4.00
Ownership (three categories)	1,461	1.89	0.48	1.00	3.00
Exported firm	1,455	0.22	0.41	0.00	1.00
Robot	1,461	0.07	0.25	0.00	1.00
Ratio of skilled worker	1,446	0.07	0.08	0.00	0.66
Industry sector (11 categories)	1,461	5.18	2.92	1.00	11.00

Table-A2. Results of wage and employment functions.

	(1) wage			(2) employment		
	Coef.		**t-value**	**Coef.**		**t-value**
Firm age	0.005	*	3.02	0.029	***	442.37
Firm size (large size firm)						
Medium size	0.006		0.21			
Small size	-0.053		-2.33			
Very small firm	-0.012		-0.49			
Ownership (SOEs)						
POEs	-0.059		-0.82	-0.279	***	-24.78
FOEs	0.118		1.97	0.100		2.43
Exported firm	0.125	***	11.96	0.513	***	70.30
Robot	0.250	**	5.62	0.466	**	16.98
Ratio of skilled worker	1.244	***	13.3	-0.830	***	-18.54
Industry sector (Ind1)						
Ind1	-0.114		-1.95	0.508	***	51.90
Ind2	-0.153		-1.7	0.216	**	5.35
Ind3	-0.048		-1.85	0.348	***	40.00
Ind4	-0.059		-1.32	0.281	**	5.61
Ind5	0.067		1.53	0.280	***	10.77
Ind6	-0.112		-2.45	0.193	***	14.83
Ind7	-0.101	*	3.40	0.511	***	93.82
Ind8	0.338	*	3.57	0.299	***	15.38
Ind9	-0.345	**	-4.39	0.165		1.95

Ind10	-0.159	*	-3.72	0.564	***	23.01
Province (Guangdong)						
Hubei	0.081		2.30	-0.166	**	-5.32
Sales				0.391	***	97.67
Rate of capital to labor				-0.193	*	-3.68
Constants	10.180	***	-1258.85	1.902	***	34.60
observations	2853			2447		
adjust- R2	0.036			0.623		

Notes: (i) * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. (ii) Ind1: Food, beverage and tobacco industry; Ind2: Textile and leather industry; Ind3: Wood industry; Ind4: Paper and printing industry; Ind5: Chemical and plastic industry; Ind6: Nonmetallic mineral industry; Ind7: Metal industry; Ind8: Electronic and machinery industry; Ind9: motor vehicles industry; Ind10: other transportation industry; Ind11: Others industry.