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**Employee medical welfare and firm productivity: Evidence from China**

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**Abstract**

The unexpected outbreak of COVID-19 has raised concerns about human health and medical care. Employee medical insurance is an important part of the current employee welfare system in China. This paper investigates the impact of employee medical welfare on firm productivity. We present strong evidence that employee medical welfare significantly increases firm productivity. To solve issues with endogeneity, we develop 2SLS-IV regressions, and this relationship still holds. This effect is more pronounced for non-state-owned firms, and firms with more low-skilled employees and low R&D intensity. We further show that managerial ability and local medical development levels are two potential mechanisms through which employee medical welfare affects productivity. In addition, we find that firms with higher employee medical expense have better stock performance and firm growth opportunities when COVID-19 virus suddenly spreads.

**Keywords:** Employee treatment, Medical insurance, Firm productivity, Covid-19

**JEL Codes:** G30, I13, J32

*“Health and human capital - an engine for economic growth“*

- Joshua Graff Zivin and Matthew Neidell

1. **Introduction**

On 30 January 2020, the continued spread of the novel coronavirus (COVID-19) prompted the World Health Organization to declare it a public health emergency, and on 12 March 2020, COVID-19 was declared a pandemic all over the world. At the macro level, the massive impact of the COVID-19 on different sectors such as trade, logistics and healthcare has led the global economy into its worst recession since the Great Depression of the 1930s (Shen et al., 2020). From the perspective of the individual, many people face unemployment due to job losses (Fu and Shen, 2020), while mobility restrictions and illnesses mean they suffer from mental and physical health problems (Trmcic et al., 2021; Bennett et al., 2021). This highlights the importance of health insurance for employees to protect themselves (Probst et al., 2020) and raises the question of whether firms keep providing welfare and such benefits to employees in the face of great operating difficulties and uncertainty.

The debate as to whether employees are assets or liabilities has been popular in past decades. Many finance papers argue that firm performance is partially predicted by managerial characteristics of the top-level management team, e.g., the CEO, according to upper echelons theory proposed by Hambrick and Mason (1984). Similarly, managerial power theory also shows that a powerful manager could impose his or her desires on firm decisions or behaviours (Lambert et al., 1993). However, recent researchers are paying increasing attention to employee treatment and wellbeing as employees are viewed as the most valuable assets in strategy implementation (Garel and Petit-Romec, 2020) and indispensable competitive advantage (Coff, 1997). As modern economies are orienting more toward high technology, services and innovation industries, the strategic significance of human capital, defined as the knowledge, intelligence, working skills and experience possessed by employees, has inspired finance and management scholars to examine how employee-friendly practises and investment influence organization outcomes (Guo et al., 2021; Li, 2022; Saeed, 2021).

The traditional view of employee treatment, for example, that of Taylor (1911), argues that employees perform unskilled work and any extra focus on welfare is an added cost burden. The agency theory (Jensen and Meckling, 1979) views better treatment of employees as a tool to pursue managers’ personal interests (Fama and Jensen, 1983). Generous benefits allow managers to develop pleasant working relationships with their subordinates, and employees turn a blind eye to management misconduct and making internal corporate monitoring ineffective (Miller, 1995; Cennamo et al., 2009; Ben-Nasr and Ghouma, 2018). Also employee-friendly leaders appear as moral leaders, making investors less vigilant about their misbehaviour (Petrovits, 2006; Prior et al., 2008). On the other hands, modern theories illustrate the valuable roles of employees in the pursuit of firms’ long-term success (Pfeffer, 1994). According to the new growth theory, productivity increases with investment in the quality of human capital, e.g., health status and life expectancy (Hofmarcher, 1999; Kirsten, 2010). The stakeholder theory argues that employees are the most important stakeholders and have a significant positive impact on firm performance (Titman, 1984; Edmans, 2011; Bae et al., 2011). Attracting and retaining loyal employees is a key component of modern business competitiveness (Barney, 2001). Social exchange theory (Eisenberger et al., 1986; Whitener, 2001) argues that employees pay back firms’ friendly treatment and welfare with strong loyalty and commitment (Bridges and Harrison, 2003; Faleye and Trahan, 2011). Also, other interpersonal and sociological theories suggest that focusing on the psychological wellbeing of employees helps the organization to develop a psychological connection with employees (Patrick et al., 2007), leading to a better work performance (Glavas and Kelley, 2014; Korschun et al., 2014).

Previous research in the finance area about employee treatment mainly focuses on employee compensation. Akerlof (1982) finds that firms are willing to pay employees more, as employees view wages as a “gift” and respond with increased effort; this is known as the efficiency wage theory. Later studies show that money is only an effective motivator for meeting employees’ physical needs, but not enough to improve overall wellbeing (Herzberg et al., 2017). Research on the pay gap between executives and employees has found evidence of both a positive and negative relationship with firm performance and productivity (Lallemand et al., 2004; Faleye et al., 2013; Prefer and Langton, 1993; Tao et al., 2016) as well as a non-linear relationship (the inverse U-curve) (Dai et al, 2017). In terms of the measurement of employee treatment in finance studies, existing literature normally uses corporate social responsibility (CSR) index as the proxy, e.g., KLD or B&C 100 List in the U.S. and Hexun in China (e.g. Edmans, 2011; Faleye and Trahan, 2011; Mao and Weathers, 2019; Wen et al., 2020; Wang et al., 2021; Chen et al., 2022). KLD rates the employee relationship with firms using these categories: employee involvement, cash profit-sharing, union relations, retirement benefits, health and safety and workforce reductions. B&C 100 List[[2]](#footnote-2) is compiled from two sources, with two-thirds of the score coming from an employee survey and the remaining one-third from the Institute’s evaluation of factors in four firm areas: credibility, respect, fairness, and pride/camaraderie. In the Chinese market, Hexun CSR rating evaluates CSR employee activities of all Chinese listed firms based on their CSR reports, as well as annual financial reports, in respect to employee income and training, work safety and caring for the employee.

However, few studies in finance have focused on the impact of employee specific welfare on firm productivity. Especially with COVID-19 as a global public health emergency in the past two years, research on employee level medical benefits is important in developing employee wellbeing studies in corporate finance. To fill this gap, we specifically investigate the relationship between employee medical welfare and firm productivity using firm medical insurance expenditure data retrieved from the Winds database. We choose the Chinese market in our study for several reasons. First, unlike firms in the American market, Chinese listed firms are required by regulators to disclose information about employee compensation, insurance and other relevant information. This ensures we have sufficient data to avoid selection bias (Dai et al., 2017; Faleye et al., 2013). Second, as an emerging market, the expenditure on employee insurance by listed companies in China is close to half of the cost of employment (Niselen and Smyth, 2008), and it is a pressing concern for companies to know whether they are being rewarded for this huge expenditure. Third, significant heterogeneity exists in the Chinese market across the firms and time. According to the   
China Enterprise Social Insurance White Paper 2018[[3]](#footnote-3), the listed firms vary greatly in their employee insurance payments. Many firms pay below the lower limit of the base, with 27% firms of which social security payments meets or exceeds the standard. This provides a huge variation in our sample. Last, Chinese employees, influenced by traditional Confucianism, are more conservative and cautious about secure themselves and their families against uncertain risk (King and Bond, 1985). The health care system in China is not well developed and the support services are not adequate, with a huge population exacerbating the shortage of resources (Li et al., 2012; Zhou et al., 2017). Therefore, we think Chinese employees rely more on medical insurance provided by their employers.

Therefore, we investigate the relationship between employee medical welfare and firm productivity. We construct yearly total employee medical insurance expenditure from the Winds database and calculate the average employee medical welfare using the total expenditure divided by the total number employees in a firm in that year. Next, following Giannetti et al. (2015) and Dai et al. (2017), we employ residuals from estimation of the natural log transformation of the Cobb-Douglas function and calculate the firm-level total factor productivity (TFP), which is frequently used to measure firm productivity (Faleye et al., 2013).

Our main results present evidence of a strong positive relationship between employee medical welfare and firm productivity, indicating that treating employees well in terms of medical welfare is an effective way to increase firm productivity, which is consistent with stakeholder theory and growth theory. However, some literature argues that employee protection may reduce firm profitability and damage firm performance by hiding management misconduct or distorting production choices, as predicted by agency theory (Autor et al., 2007; Jensen and Meckling, 1979; Ben-Nasr and Ghouma, 2018). Therefore to provide further evidence for our baseline results, we develop the U-curve test by introducing the square term of employee medical welfare (*EMW2*). We find an inverse U-curve relationship between employee medical welfare and TFP, which indicates that employee welfare is a cost or burden for firms after a certain point. However, by calculating the turning point, we find it is well outside most of our sample, which confirms our initial finding that employee medical welfare contributes to high productivity in Chinese firms.

In some provinces or areas with good economic development, companies may adopt more employee friendly policies and improve employee compensation and welfare (Wang et al., 2021). Therefore to control for possible omitted variable bias, we introduce regional economic conditions (GDP Growth) as one of the control variables. We also include several fixed effects in the regressions to absorb unobserved effects of firm characteristics and time-varying effects. To address the potential endogeneity, we conduct two-stage least square regressions. We use an air quality index and regional green space per capita to construct the employee medical welfare instrumental variables and present significant relationships with our independent variables at the first stage (Wang et al., 2021; Dong et al., 2021). The second stage results indicate that our baseline regression results still hold.

Subsequently, we perform several subsample analyses to examines the channels through which employee medical welfare affects firm productivity. First, compared with employees in non-SOEs, SOEs offer better job benefits and welfare for their employees such as housing, education and allowances (Rein, 1997; Jiang and Kim, 2015; Zhou, 2004). Thus, we think medical welfare is likely to be more attractive to employees in non-SOEs. In addition, it is widely known that Chinese SOEs experience political pressure from central government to pursue employment and other noneconomic objectives (Bai et al., 2006; Liao et al., 2009), so they always face issues of over-employment and excess labour. Our subsample results provide evidence that employee medical welfare has a strong impact on firm productivity in non-SOEs.

Second, existing literature using the efficiency wage channel suggests that employee compensation helps firms retain and attract talented employees and stimulate firm performance, for example in the area of innovation (Kong et al., 2020). In terms of productivity, we view medical welfare as different from compensation or bonus incentives, as it is more about providing security. Chinese economists find that people with greater work ability and social capital have more connections to access better health care resources compared with low skilled people without strong social connection (Zhou et al., 2014). Also Pan et al. (2013) find that in China the positive effects of health insurance are greater for people with less education. Thus, we should expect a stronger impact of employee medical welfare on productivity in firms with a low percentage of high skilled employees than firms with a high percentage of high skilled employees. We divided our sample based on the education level of employees, following Kong et al., 2020 and Dai et al., 2017, and empirical evidence supports our expectation that employee medical welfare increases productivity only in firms with more low skilled employees.

Third, many studies show that R&D-intensive firms have more skilled labour (Chen et al., 2016; Ouimet and Zarutskie, 2014), so we divide our sample into two samples based on the R&D intensity. The results show a stronger impact of employee medical welfare on firm productivity in low R&D intensive firms, which is consistent with our previous finding that medical insurance is more important for low-skilled employees.

Furthermore, we investigate two potential mechanisms through which employee medical welfare affects firm productivity, namely managerial ability and medical facilities. First, managerial ability index (MA) is the measure of managerial ability based on the efficiency with which managers generate revenues; the measure uses data envelopment analysis, first introduced by Demerjian et al. (2012). Following Demerjian (2012, 2013), we calculate the managerial ability scores of firms in our sample and partition the sample into two subsamples based on the sample median of the MA index of a firm. We find employee medical welfare only has a positive effect in firms with higher managerial ability, indicating that higher efficiency of the management team makes employee treatment produce positive outcomes, while lesser ability in management makes firm investment in employees a huge cost. Second, we develop economic development (GDP per capita) and hospital bed measures to proxy regional healthcare development, following Yin et al.(2018) and Hu and Huang (2004). In general, access to healthcare and medical treatment is a key factor in medical welfare positively affecting employee health and thus improving productivity (Weinick et al., 2000; Newacheck et al., 2002). Our empirical tests show that medical insurance improves productivity when local medical facilities are well developed.

Finally, many scholars in the field of corporate finance have focused on the impact of the COVID-19 on firm performance and decision-making (e.g., He et al., 2020; Ashraf, 2020; Narayan et al., 2020). We conduct what we believe is the first analysis of the impact of employee medical welfare on firm stock performance and growth opportunities during the period of COVID-19 in China. Following Shan and Tang (2022), Broadstock et al. (2021) and Yang and Yang (2021), we construct an event study and estimate cumulative abnormal returns (CARs) for 3-, 5-, and 11-trading day windows around the Wuhan lockdown on 23 January 2020. We find employee medical welfare in 2019 is positively and significantly related to market adjusted return on 3 February 2020 (the first trading day after the Wuhan lockdown) and CARs with different estimation windows. We further explore the importance of medical welfare by employing Tobin’s Q and find that firms with higher employee medical welfare expenditure have better firm growth opportunities during the years 2020 and 2021 when COVID-19 was spreading in China.

Moreover, we conduct a number of robustness tests. In particular, following past papers (Faleye et al., 2013; Dai et al., 2017; Krekel et al., 2019; Kale et al., 2019) we introduce sales per employee, net profits per employee and the forward value of TFP as additional dependent variables.

This study contributes to the existing literature in a number of ways. First, existing studies generally focus on employee compensation or employee welfare as a whole (Dai et al., 2017; Bae et al, 2011; Chen et al., 2016; Edmans et al., 2011), but we pay particular attention to the medical component of employee benefits. To the best of our knowledge, we are the first to test the relationship between employee medical welfare and firm-level productivity and firm performance during COVID-19. Given the fact that the Chinese market is placing increasing emphasis on human capital, research related to employee treatment and wellbeing of employees in the Chinese market is gradually gaining traction and our research enriches the study of employee protection in the area of finance.

Second, the debate over the role of employees based on agency view and stakeholder theory has been going on for the last few decades (Zingales et al., 2000; Bae et al., 2011). The sudden onset of the COVID-19 epidemic has sparked a great deal of academic interest in human capital, human resilience and wellbeing. Our research on the performance of Chinese listed companies during COVID-19 suggests that investment in human capital can effectively improve firms’ ability to cope with unexpected risks.

Third, Chinese companies in recent years are faced with increasing labour wages and the heavy burden of employee insurance ( Kong et al., 2020; Li et al., 2012; Niselsen and Smyth, 2008; Nyland et al., 2006). The Fifth Plenary Session of the 19th Central Committee of the Communist Party of China in 2020 emphasised that common prosperity is an important feature of Chinese-style modernisation and a common aspiration of all Chinese people. Instruments to achieve this such as income and employee insurance have once again attracted attention.[[4]](#footnote-4) In this context, Chinese listed firms will face greater labour costs than before. Our paper contributes to the literature by providing evidence that employee welfare effectively increases firm productivity and highlights the importance of the moderating effects of firms’ managerial ability and regional healthcare development.

The reminder of this paper is organized as follows. In Section 2, we review the related literature and establish hypotheses on the relationship between employee medical welfare and firm productivity. Section 3 outlines the sample and variables, and Section 4 presents the main empirical results and tests to deal with endogeneity concerns. We present further tests relating to channels and mechanisms in Section 5. Section 6 provides additional tests in terms of firm performance during COVID-19 and other robustness tests. Section 7 proposes some further directions for study. Finally, Section 8 concludes the study.

1. **Related literature and hypothesis development**
   1. Employee treatment and firm performance

According to stakeholder theory, a friendly firm-employee environment and high standards of employee welfare may improve firm performance. Previous literature summarises several reasons for this. First, improved working conditions promote employee motivation (Ben-Nasr & Ghouma, 2018). Good employee treatment including income and benefits will increase employees' goodwill and trust in the company (Parks & Steelman, 2008). Second, employee wellness programmes, which help to improve employees' physical health, including exercise and work breaks, strengthen their physical fitness and therefore result in greater work efficiency (Zoller, 2004; Gubler et al., 2016; Pouliakas & Theodossiou, 2013; Calzolari & Nardotto, 2017; Vallgarda, 2012). Third, a high level of employee satisfaction with the firm can effectively reduces the probability of strikes (Newman, 1980). Finally, better treatment of employees often helps companies to develop a good corporate image and reputation in society. (Brammer et al., 2006).

Edmans et al. (2014) show that employee protection is associated with positive abnormal returns in firms in the US and UK. Verwijmeren and Derwall (2010) show that firms that treat their employees well significantly reduce their risk of bankruptcy through lower debt ratios and better credit ratings. Gupta and Krishnamurti (2020) argue that employee wellbeing is one of the main sources of productivity improvements in modern firms. High standards of employee treatment can attract and retain skilled employees and increase their loyalty, especially nowadays when human capital is increasingly a key competitive factor for firm success (Pfeffer, 1994; Bae et al., 2011). In addition, Zingales (2000) finds that the retention of highly skilled employees is a key factor in pursuing R&D activities. If firms can develop a failure-tolerant environment and enhance trust in their employees, it can partially offset the negative effects of innovation risk and encourage employees to participate in the innovation process, promoting both innovation quantity and quality, as measured by patent applications and patent citations (Chen et al., 2016).

In contrast to stakeholder theory, agency theory suggests that higher employee benefits and improved workplace environments can be seen as a targeted strategy by management to cover up misconduct behaviours (Hemingway & McLaggen, 2004; Prior et al., 2008). Employees as beneficiaries are less likely to become potential whistleblowers, since such actions would be at the expense of their own interests (Dyck et al., 2010; Bowen et al., 2010). Ben-Nasr and Ghouma (2018) present evidence that high levels of employee benefits help managers to conceal bad news, which leads to a higher stock price crash risk.

Another example of the impact of employee treatment is in relation to firms’ mergers and acquisitions (M&A) performance. Several studies have shown that labour is a cost or barrier during M&A. Dessaint et al. (2017) show that the number of takeover deals fell by almost 15% and the profits fell by almost 30% when there is a large expenditure on employee protection. John et al. (2015) find that acquirers with strong labour rights receive lower announcement returns from acquisitions. They infer employees in deal firms may suffer wage losses or reputational damage if a company fails in its acquisition, and therefore employees may prefer risk-reducing deals, even if they are not optimal. In addition, unions at acquirer firms may not approve M&A deals with target firms when they involve negotiated concessions on workforce restructuring, compensation, benefits and entitlements. From the target firm's perspective, Pagano and Volpin (2005) show that, consistent with agency theory, in order to protect their personal interests, entrenched managers can use a strong employee base based on employee-friendly treatment to thwart takeover threats, reduce the likelihood of deal completion and reduce post-acquisition returns of deals.

* 1. Employee medical insurance

As early as 1961, Schulz points out that the cost of labour health care is an element of human capital investment. Healthy human capital needs to be acquired through medical treatment and health care, and employer-provided health insurance ensures to a certain extent that workers can make the most of the human capital they have when they are energetic and healthy. Schultz (1990) emphasises that investing in employees' health has two implications: first, the reduction in sickness and the extension of the life cycle provides workers with more time to be healthy; second, healthy bodies promote workers' pursuit of a better life, making it more rewarding for them to increase their labour productivity, which is consistent with growth theory.

Much of the literature suggests that firm specific investment in employee insurance can alleviate employees' worries in life and effectively motivate employees, resulting in a positive effect on firm efficiency and productivity. (Serfling, 2016; David, 2007; Alimov, 2015). Second, the increase in benefits increases the cost of dismissal. In order to reduce the risk of dismissal, employees are more motivated to work (Lee and Torm, 2017; Ben-Nasr and Ghouma, 2018; Bae et al., 2011). More importantly, the health insurance market in China is not well developed and many employees rely heavily on the welfare coverage provided by their employers, which induces workers to undertake more skills training. The increase in expenditure on human capital of the firm contributes to higher productivity and performance (Heider, 2015; Koeniger, 2005. Hannan, 2005). Based on the above arguments, and consistent with stakeholder theory and growth theory, we propose the following hypothesis:

**Hypothesis 1.** **Employee medical welfare has a positive impact on firm productivity.**

On the other hand, some studies show that the increase in employee insurance welfare is a constraint for firm productivity. (David et al., 2007; Krishnan et al., 2014; Dyreng and Maydew, 2018). First, the increase in insurance costs, known as the ‘employment tax’, has a constraining effect on investment in innovation, and machine and equipment replacement, increasing the pressure on cash and hindering firms' growth prospects (Acharya et al., 2013; Bai et al., 2020; Botero et al., 2004). Second, excessive friendly treatment towards employees induces 'welfare sickness', which breeds laziness and a decline in employees' work effort (Akerlof and Yellen, 1990). Third, since wages are a partial substitute for medical insurance, some employees may prefer to convert benefits directly into cash. Higher medical insurance contribution rates affect their own intertemporal consumption choices, limiting their current consumption and reducing work motivation (Shalev, 2013; Dou, 2016). Therefore, we propose the following hypothesis:

**Hypothesis 2. Employee medical welfare have a negative impact on firm productivity.**

1. **Data and variables**
   1. Data

Our sample includes all non-financial Chinese listed firms on the A-share market from 2011 to 2020. We collect data from a variety of sources. First, we construct our independent variable, employee medical welfare (EWR), from the Winds database. Other employee information such as compensation and employee numbers are also retrieved from Winds. Second, we obtain information on executives’ compensation, firm-level financial and corporate governance data, air quality index (AQI), stock returns of firms and industry information from the Chinese Stock Market and Accounting Research Database (CSMAR). Third, we get information on regional green areas, GDP and medical facilities from the National Bureau of Statistics of China. Fourth, we download the employee treatment score from Hexun[[5]](#footnote-5) database, a leading CSR scoring system in China (Wang et al., 2021), which is widely used in Chinese CSR studies. Finally, we use the Resset database in China for other data such as employee education information.

The detailed definitions of all variables in this study are shown in Appendix Table A1. We exclude firms from the financial services industry and those with missing financial information. All continuous variables are winsorized at the 1st and 99th percentiles to mitigate outlier effects on our results. Our final sample consists of 16,537 firm-year observations.

* 1. Variable definitions
     1. Total factor productivity (TFP)

The total factor productivity (TFP) is a widely used proxy for firm-level productivity. It can be viewed as the efficacy of firm’s transformation of total inputs into outcomes (Dai et al., 2017; Tian and Yu, 2012). To construct the variable, we follow Faleye et al. (2013) and Giannetti et al. (2015) and assume the firm’s outputs is generated by the Cobb-Douglas production function of the form:

*Yit=ALit αKitβ ,* (1)

where *Yit* is net sales for firm i in period *t*, *Lit* is the number of employees, *Kit*, is net property, plant, and equipment, for firm i during year t, and *A*, *a*, and *β* are parameters. We next employ residuals from our estimation of the natural log transformation of (1) over all firms as a measure of firm-level total factor productivity, using the following equation:

*y* = *ait* + *αlit* + *βkit* + *εit .* (2)

following Dai et al. (2017), we then estimate Eq. (2) based on industries and years and calculate the final TFP of a firm.

* + 1. Employee medical welfare (EMW)

Our main explanatory variable is employee medical welfare (*LnEMW*), which is measured as the natural logarithm of medical insurance expenditure per employee obtained from the Winds database. For robustness, similar to Kong et al. (2020), we also employ the adjusted employee medical welfare (*LnEMWadjusted*) as another independent variable. To calculate adjusted employee medical welfare we take the firm’s employee medical insurance expenditure and divide by the median expenditure of a given industry and year. We then take the natural logarithm of the adjusted value, following Kong et al. (2020).

* + 1. Control variables

Following prior studies (e.g. Faleye et al., 2013; Bai et al., 2011; Gubler et al., 2018; Krekel et al., 2019; Kong et al., 2020; Det al., 2017), our regression models includes a number of firm characteristics that may affect firm productivity. These include *Firm Size, Firm Age, Leverage, SA index, Tobin’s Q, ROA, SOE, Employee Compensation, Board Independence, Board Size,* and *Concentration.* Furthermore, we include the province’s annual GDP growth (*GDP Growth*) to control for external economic conditions. All details and calculations of control variables are provided in Appendix A1.

* + 1. Sample distribution

Table 1 shows the sample distribution across years, provinces and industries.

Insert Table 1 here

Panel A shows the yearly distribution of the annual average employee medical welfare expenditure. From 2011 to 2019, we can notice a clear increasing trend, which indicates the gradual development of China's employee protection system. It is worth noting that compared to 2013, EMW in 2014 declined, due to the amendment of the China Labor Contract Law which took effect in 2013.[[6]](#footnote-6) This law led to a significant increase in the number of firms in our sample as more companies began to pay insurance for their employees. More importantly, the EMW in 2020 was 4,682.20RMB, a decrease of almost 10% compared to 2019. This indicates the COVID-19 pandemic had a significant impact on the performance of listed firms in China, as well as on the welfare of their employees in 2020. In Panel B, we can see that the differences in industrial distribution and economic development between regions affect the level of employee benefits. For key regions with a concentration of new industries, medical benefits are higher (e.g. Beijing and Shanghai). Panel C reports the average employee medical welfare distribution at the industry level using the one-digit CSRC industry code. The medical treatment of employees reflects significant differences between industries. The higher employee benefits are mainly concentrated in the energy and high-tech industries First, industries like electricity, gas and water are mostly state-owned companies (SOEs), which have higher employee welfare standards compared with non-SOEs (Rein, 1997; Zhou, 2004). Second, scientific research and services industries have a large number of highly educated and highly skilled people. Companies often raise their treatment standards to attract employees to work for them, which is consistent with efficiency wage theory (Kong et al., 2020).

* + 1. Descriptive statistics

Table 2 reports the summary statistics of our sample. The EMW ranges from 400.94 to 17,532. The mean and median of EMW are only 4,425 and 3,173, with a standard deviation of 3,173. This result demonstrates that firm expenditure on employee medical welfare varies a lot and still needs improvement. The average TFP is 0.015 in our sample, which is better than same method proxy of 0 in Giannetti et al. (2014) and -0.012 in Dai et al. (2017). It reveals a gradual increase in the productivity of Chinese listed firms. In terms of control variables, the average firm size is 22.384, average leverage ratio is 42.6%, and average ROA is 5.1%. The average board size is 9[[7]](#footnote-7) members and nearly 38% of whom are acted as independent directors. This composition structure complies with China Securities Regulatory Commission (CSRC) standards. The largest shareholder (*Concentration*) holds about 34.2% of firm stocks. To sum up, the distribution of the control variables in our sample is similar to previous Chinese studies (e.g. Wang et al., 2021; Yu and Chi, 2021; Bristy et al., 2022).

Insert Table 2 here

Table 3 shows the correlation matrix for independent variables. Most of the correlations reported are between -0.30 and 0.30. The highest correlation is between *SA* and *Firm Age* at 0.872. It is consistent with a previous paper (Kong et al., 2020) and reasonable, because the financial constraint is highly related to firm age according to Hadlock and Pierce (2010). We also run the VIF test and the mean VIF of our sample is 2.08 (results can be provided on request). Overall, the correlations and VIF results do not indicate any serious multicollinearity problems.

Insert Table 3 here

1. **Main results**
   1. Baseline model

We conduct the following regression to investigate the influence of employee medical welfare on firm productivity in our baseline model:

*Firm productivity* = 𝛼 + 𝛽1Ln*EMW*+ 𝛽2*Firm Size* + 𝛽3*Firm Age* + 𝛽4*Leverage* + 𝛽5*SA+* 𝛽6*Tobin’s Q* + 𝛽7*ROA* + 𝛽8*SOE* + 𝛽9*Compensation* + 𝛽10*Board Independence* + 𝛽11*Board Size + 𝛽12Concentration + 𝛽13GDP Growth* + 𝜀 (3)

The key independent variable is the natural logarithm of medical insurance expenditure per employee (*lnEMW*). We also introduce the adjusted employee medical welfare, which is the natural logarithm of employee medical insurance expenditure divided by the median expenditure of a given industry and year (*lnEMWadjusted*). The measurement of firm productivity is total factor productivity (*TFP*). We also include a set of control variables that may affect the firm productivity, which are *Firm Size, Firm Age, Leverage, SA index, Tobin’s Q, ROA, SOE, Employee Compensation, Board Independence, Board Size, Concentration,* and *GDP Growth*. We include both industry fixed effects and firm fixed effects in our regressions for robustness.

Table 4 shows the baseline results of Eq. (4). In all the model specifications, the coefficients of *LnEMW* and *LnEMWadjusted* are positive and significant, meaning that employee medical welfare is positively associated with TFP, which supports Hypothesis 1, that employee welfare contributes to high firm level productivity, consistent with stakeholder theory and growth theory. In addition, consistent with previous studies, we find a significant positive association between higher debt (*Leverage*) and productivity. Also, firms with higher employee compensation have higher levels of productivity (Dai et al., 2017; Giannetti et al., 2015)

Insert Table 4 here

* 1. Does welfare always matter

Although not enough attention has been paid to financial research on the relationship of employee benefits to firm performance, existing literature presents some arguments against the use of benefits. For example, Akerlof and Yellen (1990) argue that high standard can breed laziness in employees. In addition, when the excessive insurance payment ratio conflicts with the equilibrium point of current profits, this cost is passed on to employees, in the form of more work tasks and appraisal targets, to the detriment of their productivity (Hamaaki and Iwamoto, 2008).

To provide further evidence for our baseline results, we develop the U-curve test by introducing the square term of employee medical welfare (EMW2). Table 5 reports the results of the test. We introduce both industry and firm fixed effects and find an inverse U-curve between employee medical welfare and TFP, which indicates that employee welfare is a cost or burden for firms after a certain point, when the welfare starts damaging firm productivity. However, by calculating the turning point[[8]](#footnote-8), we find the point is around 13,000, which is well outside the range of our sample, as only about 3% of total observations lie after the turning point, which means that employee medical welfare still contributes to high productivity for Chinese firms. However, this test proves that there is indeed a dual role for employee benefits in terms of their impact on firm efficiency. Therefore, the balance of investment in employee treatment needs to be always carefully considered by management.

Insert Table 5 here

* 1. Endogeneity

Our baseline results may be affected by endogeneity issues. First, potential omitted variables may affect both employee medical welfare and firm productivity. Second, causality problems may exist as firm with higher productivity may have higher employee welfare standards. To address these issues, we use instrumental variables and a two-stage least square (2SLS) regression. We employ two instrumental variables. The first instrumental variable, air quality index (*AQI)* is the natural logarithm of the average daily AOI (the concentration level of six atmospheric pollutants, namely, SO2, NO2, PM10, PM2.5, CO, and O3) of a given year and city, following Wang et al. (2021). The higher the AQI, the heavier the air pollution the city has. Wang et al. (2021) find that air pollution significantly enhances employee treatment. The second instrumental variable is *Green*, measured as the average green area per capita of a given year and province, which is obtained from the National Bureau of Statistics of China.

For robustness, we use both *EMW* and adjusted *EMW*. We first regress *lnEMW* and *lnEMWadjusted* on our two instrumental variables, which are *AQI* and *Green*. As expected, *AQI* is negatively related to both *EMW* and adjusted *EMW,* and the coefficients are statistically significant at the 1% level. The result shows that heavy environmental pollution increases a firm’s burden in terms of employee medical expenditure. In terms of *Green*, we find more green space releases the burden of health insurance expenditure. The first stage F statistics are 660.458 and 657.538 for *lnEMW* and *lnEMWadjusted* respectively, which are significantly larger than the critical value of 10 suggested by Staiger and Stock (1994), indicating that our instrumental variables are not weak. Anderson LM statistic of the Anderson canonical correlations test is significant at the 1% level, suggesting that the model is not under-identified. The second stage results are shown in columns (3) to (6) of Table 6. We use both industry fixed effects and firm fixed effects, following Dai et al. (2017). The coefficients of *lnEMW* and *lnEMWadjusted* all remain significantly positive, which is consistent with the baseline results.

Overall, our 2SLS IV analysis results support our baseline finding that employee medical welfare is significantly positively related to firm productivity.

Insert Table 6 here

1. **Further tests**
   1. Subsample analysis

We perform several subsample analyses to examines the channels through which employee medical welfare affects firm productivity.

5.1.1 Ownership

First, we expect employee medical welfare to have different impacts on productivity in SOEs and non-SOEs. Compared with employees in non-SOEs, SOEs offer better job benefits and welfare for their employees such as housing, education and allowances (Rein, 1997; Jiang and Kim, 2015; Zhou, 2004). Therefore, we suggest medical welfare is likely to be more attractive to employees in non-SOEs. Based on the previous discussion of Akerlof and Yellen(1990), excessive benefits can lead to employee laziness and greed. In addition, in order to keep society stable, Chinese SOEs experience great political pressure from central government to pursue employment and other noneconomic objectives (Bai et al., 2006; Liao et al., 2009), so they always face over-employment. Therefore, we divide our sample into SOEs and non-SOEs based on the ultimate controller of the firm. We rerun our baseline regressions and the results in Table 7 Panel A provide evidence that employee medical welfare has a strong impact on firm productivity in non-SOEs, while coefficients are negative but not significant in the case of SOEs.

5.1.2 Skilled employee ratios

Existing literature using the efficiency wage channel suggests that employee compensation helps firms retain and attract talented employees and stimulate firm performance, for example in the area of innovation (Kong et al., 2020). But medical welfare is different from compensation or bonus incentives, as it provides guarantees and security in terms of health life. The special condition in China is people with greater work ability and social capital in China have more connections to access better health care resources compare with people without strong social power (Zhou et al., 2014). Also Pan et al. (2013) argues that the positive effects of health insurance are greater for people with less education in China. We therefore infer that medical insurance is less of an incentive and less of a practical protection for highly skilled employees than for low skilled workers. Thus, we should expect a stronger impact of employee medical welfare on productivity in firms with a low percentage of high skilled employees than firms with a high percentage of high skilled employees. We collect employee education information from Winds and Resset and define skilled labour as employees who have a bachelor’s degree or higher. We divide our sample into two groups based on whether the number of skilled employees in a firm is higher than the median level of skilled employees within the same year and the same industry or not, following Kong et al., (2020) and Dai et al. (2017). The empirical results are shown in Table 7 Panel B, and support the argument that employee medical welfare increases productivity only in firms with more low skilled employees, as they value the welfare more highly.

5.1.3 R&D intensity

Third, many studies show that R&D-intensive firms have more skilled labour (Chen et al., 2016; Ouimet and Zarutskie, 2014), so we further divide our sample into two sub-samples based on the sample median of R&D intensity at the industry level, following Kong et al. (2020). We run the baseline regression for each subsample. Panel C of Table 7 reports the regression results. We find a stronger impact of employee medical welfare on firm productivity in low R&D intensive firms, which is consistent with our previous findings that medical insurance is more important for low-skilled employees, as they do not have enough alternative options to cover medical treatment in their daily life.

Insert Table 7 here

5.2 Potential mechanisms

We investigate two potential mechanisms through which employee medical welfare affects firm productivity, namely managerial ability and medical facilities.

5.2.1 Managerial ability

The ongoing debate in recent years about employee treatment has been primarily from the perspective of cost. In fact, investment in employees has always raised concerns among managers because people are complex and unpredictable. The expected payback on investment in employees is more complex than the expected return of investment in machinery and equipment. Therefore, we believe that managerial efficiency affects welfare’s effect on motivating employees. Strong management skills enable employees to reap the rewards of their effort, while poor management skills can breed the abuse of welfare by employees.

Thus, we develop a managerial ability index to measure managerial ability of a firm. Managerial ability index (MA) is the measure of managerial ability based on the efficiency with which managers generate revenues and was first introduced by Demerjian et al. (2012). In the first step, data envelopment analysis (DEA) is used to estimate relative firm efficiency by evaluating their inputs relative to their output. The output is net sales. The inputs include cost of goods sold (*COGS*); selling and administrative expenses (*SG&A*); property, plant and equipment (*PPE*); operating lease (*OpsLease*); goodwill (*Goodwill*); and other intangible assets (*OtherIntan*). DEA forms an efficient frontier and firm efficiency is estimated based on the following optimization:

(4)

where firm efficiency, , takes the value between zero and one. Firms operating on the efficient frontier have a of one. A smaller value of indicates lower firm efficiency. As is also influenced by both firm-specific factors as well as management characteristics, the firm-specific factors are removed from the firm efficiency measure in the second step. The regression model is shown below:

(5)

where *ln(Total Assets)* is the natural logarithm of total assets of firm *i* in year *t*; *MarketShare* is the percentage of sales in a firm *i* in year *t*; *PositiveFreeCF* is a dummy variable equal to 1 if firm *i* has a non-negative free cash flow in year *t* and 0 otherwise; *Ln(Age)* is the natural logarithm of firm age since establishment in year *t*; *BusinessSegmentConcertration* is the ratio of the sum of squared segment sales to squared total sales for firm *i* in year *t*; *ForeignCurrencyIndicator* is a dummy variable equal to 1 if firm *i* has foreign operations in year *t* and 0 otherwise. The residual of Eq. (5) captures managerial ability.

Following Demerjian (2012, 2013), we calculate the managerial ability scores of firms and partition the sample into two subsamples based on the sample median of the MA index of a firm. The results are displayed in Table 8 Panel A. We find employee medical welfare only has a positive effect when firms have higher managerial ability, indicating that higher efficiency in the management team makes employee treatment produce positive outcomes, while less ability makes firms’ investment in employees a significant cost.

5.2.2 Economic development and medical facilities

In general, access to healthcare and medical treatment is a key factor in determining whether medical welfare positively affects employee health and thus improves productivity (Weinick et al., 2000; Newacheck et al., 2002). We collect provincial level GDP and population information from National Bureau of Statistics of China (NBSC) and divide our sample into two subsamples based on median of GDP per capita in the year, following Yin et al. (2018). The results are shown in Panel B of Table 8. We find that the productivity boost from employee health insurance occurs in regions with good economic development, where quality medical resources are concentrated Yin et al.(2018). We further collect information on hospital beds per 10,000 people from NBSC as a proxy of the regional medical facilities level, following Hu and Huang (2004). We create the interaction term between *LnEMW* and *BED* in our model following the same method used in Wang et al. (2021). The results in Panel C of Table 8 show that the coefficient on the interaction term between LnEMW and BED is positive and significant. Overall, the empirical tests in both Panel B and Panel C of Table 8 indicate that employee medical welfare improves firm productivity when local economic conditions and facilities are well developed.

Insert Table 8 here

1. **Robustness tests**
   1. Employee medical welfare and firm performance during COVID-19

One of the key motivations for this study is the heightened concern for health and safety caused by the sudden outbreak of the COVID-19. We believe that the important impact of employee medical welfare is not only in terms of firm productivity, but also in terms of firm resilience under great uncertainty.

Therefore, we conduct an analysis of employee medical welfare and firm stock performance and growth opportunities during COVID-19. Follow Shan and Tang (2022), Broadstock et al. (2021) and Yang and Yang (2021), we construct an event study and estimate cumulative abnormal returns (CARs) for 3-, 5-, and 11-trading day windows around the Wuhan lockdown on 23 January 2020. The earliest appearance of patients with the onset of the outbreak in Wuhan has been traced back to 8 December 2019 and the outbreak gradually gained attention[[9]](#footnote-9). To ensure that the estimation window is not affected by the COVID-19 pandemic in Wuhan, we choose an estimation window of 1 February to 30 November 2019 to ensure a reasonable calculation of the CARs. We control for a series of firm level characteristics following Broadstock et al. (2021). We also control for the employee treatment score from the Hexun database, as Broadstock et al. (2021) find the social score (including employees) of the ESG index is negative related to firm stock performance in COVID-19.

Table 9 reports the results of the event study. We find employee medical welfare in 2019 is positively and significantly related to market adjusted return on 3 February 2020 (the first trading day after the Wuhan lockdown) and CARs with different estimation windows for 3-, 5-, 11-trading days. We also find that the Hexun employee treatment score is negatively related to stock returns on 3 February and CAR[-1,1], which is consistent with previous findings (Broadstock et al., 2021), as employee-friendly firms may furlough staff during the crisis to steer the socially responsible resulting in high-cost pressures. We further explore the importance of medical welfare by employing Tobin’s Q and find that firms with higher employee medical welfare expenditure had better firm growth opportunities during the years 2020 and 2021 when COVID-19 was spreading in China.

Insert Table 9 here

* 1. Alternative measurements of firm productivity

In our baseline regression in Eq. (1), we use the total factor productivity as the proxy of firm productivity. Following past papers (Faleye et al., 2013; Dai et al., 2017; Krekel et al., 2019; Kale et al., 2019), we introduce sales per employee, net profits per employee and the forward value of TFP as alternative proxies for productivity. Using these different dependent variables, we repeat the main regression in Eq. (1). The results in Table 10 are mostly consistent with our original results.

Insert Table 10 here

1. **Future work plan**

Section 7 discusses some potential plan of future work. First, in addition to 2SLS-IV test, we may further develop extra PSM and DID tests following Chinese labor market studies (e.g., Kong et al., 2020; Liu and Zhou, 2019) to better solve for the endogeneity concern in our sample. Second, we will develop more robustness tests in Section 6. For example, we will add some variables of employee welfare (e.g., pension, housing fund etc.) if data are available and accessible, as additional independent variables (controls). Third, we plan to add SOE dummy and Political Connection dummy in the second step of Managerial Ability calculation in Panel A of Table 8, as SOEs and CEO political connection have very important roles in Chinese market that needed to be considered when calculating the managerial efficiency. At last, we will extend our research by exploring what happens to the observations (firms) after the inflection point as predicted in Table 4 of our inverse U-curve test of employee medical welfare and firm productivity.

1. **Conclusion**

This study investigates the impact of employee medical welfare on firm productivity. Using data from 2011-2020, we find employee medical welfare significantly increases firm productivity. After solving issues with endogeneity, this relationship remains same. Moreover, this effect is more pronounced for non-state-owned firms, and firms with more low-skilled employees and low R&D intensity. Accordingly, SOEs experience more political pressure to keep noneconomic objectives, they always face over-employment which result in less efficient labor investment. Also low-skilled employees without strong social capital connecting to better medical treatment reply on the medical insurance offered by the firm. We further show that managerial ability and local medical development levels are two potential mechanisms through which employee medical welfare affects productivity.

In addition, to best of our knowledge, we conduct the first study of employee medical welfare and firm performance during COVID-19 in China. We find that firms with higher employee medical welfare in 2019 have better stock performance when COVID-19 virus suddenly spreads in early 2020. Also firms providing better employee medical welfare show strong growth prospects in the year of 2020 and 2021. Our results are robust to a variety of model specifications and alternative measures. Overall, we show that human capital investment is a crucial factor in current firms and employee welfare can effectively increase firm resiliency in face of great uncertainty.

**Tables**

**Table 1. Sample Distributions**

This table presents the mean of average employee medical welfare(EMW) and adjusted EMW by year, province and industry separately. Shanxi\* refers to the province of Shanxi whose capital city is Xi'an.

|  |  |  |
| --- | --- | --- |
|  | EMW | EMWadjusted |
| **Panel A.** |  |  |
| Employee medical welfare across years |  |  |
| **Year** |  |  |
| *2011* | 3271.411 | 1.387 |
| *2012* | 3569.575 | 1.250 |
| *2013* | 4045.851 | 1.261 |
| *2014* | 3592.999 | 1.219 |
| *2015* | 3917.852 | 1.200 |
| *2016* | 4201.884 | 1.195 |
| *2017* | 4540.932 | 1.216 |
| *2018* | 4943.040 | 1.181 |
| *2019* | 5124.773 | 1.218 |
| *2020* | 4682.197 | 1.232 |
| **Panel B.** |  |  |
| Employee medical welfare across provinces |  |  |
| **Province** |  |  |
| *Anhui* | 3608.849 | 1.034 |
| *Beijing* | 7132.189 | 1.770 |
| *Fujian* | 3003.110 | 0.817 |
| *Gansu* | 3509.385 | 1.042 |
| *Guangdong* | 2984.951 | 0.824 |
| *Guangxi* | 4406.945 | 1.177 |
| *Guizhou* | 4264.892 | 1.251 |
| *Hainan* | 4189.091 | 1.073 |
| *Hebei* | 4549.824 | 1.323 |
| *Henan* | 3299.480 | 0.955 |
| *Heilongjiang* | 4582.140 | 1.367 |
| *Hubei* | 4216.962 | 1.151 |
| *Hunan* | 3382.688 | 0.997 |
| *Jilin* | 4498.082 | 1.238 |
| *Jiangsu* | 3998.192 | 1.19 |
| *Jiangxi* | 3162.893 | 0.95 |
| *Liaoning* | 5129.681 | 1.373 |
| *Neimenggu* | 4686.167 | 1.454 |
| *Ningxia* | 3955.785 | 1.135 |
| *Qinghai* | 4191.295 | 1.207 |
| *Shandong* | 3894.435 | 1.160 |
| *Shanxi* | 4085.554 | 1.070 |
| *Shanxi\** | 4156.936 | 1.190 |
| *Shanghai* | 7103.080 | 1.864 |
| *Sichuan* | 3956.766 | 1.097 |
| *Tianjin* | 7674.894 | 1.949 |
| *Xizang* | 5090.221 | 1.401 |
| *Xinjiang* | 5013.157 | 1.506 |
| *Yunnan* | 5526.717 | 1.599 |
| *Zhejiang* | 3814.693 | 1.085 |
| *Chongqing* | 6113.213 | 1.535 |
| **Panel C.** |  |  |
| Employee medical welfare across industries |  |  |
| **Industry** |  |  |
| *Agriculture, Forestry, Animal Husbandry, and Fishery* | 2606.686 | 1.061 |
| *Mining* | 5670.039 | 1.163 |
| *Manufacturing* | 3562.490 | 1.209 |
| *Electricity, Gas and Water* | 7302.882 | 1.232 |
| *Construction* | 5355.786 | 1.224 |
| *Wholesale and Resale Trade* | 4899.794 | 1.298 |
| *Transportation* | 6085.947 | 1.129 |
| *Accommodation and Catering* | 4695.177 | 1.025 |
| *Information Technology* | 5963.622 | 1.177 |
| *Real estate* | 6414.178 | 1.195 |
| *Leasing and Business Services* | 5522.616 | 1.240 |
| *Scientific Research and Services* | 6497.360 | 1.130 |
| *Public Facilities Management* | 4266.961 | 1.207 |
| *Education* | 5384.953 | 1.026 |
| *Health and Social Service* | 3655.073 | 1.104 |
| *Culture, Sports and Entertainment* | 6355.531 | 1.138 |
| *Comprehensive* | 4864.569 | 1.453 |

**Table 2. Summary statistics**

This table presents summary statistics for main variables in our samples. All variables are defined in Appendix A1.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **(1)** | **(2)** | **(3)** | **(4)** | **(5)** | **(6)** |
| **VARIABLES** | **Obs.** | **Mean** | **Std. Dev.** | **Min** | **Median** | **Max** |
| *TFP* | 16,537 | 0.015 | 0.287 | -3.078 | 0.000 | 2.235 |
| *EMW* | 16,537 | 4,425 | 3,173 | 400.943 | 3,489.973 | 17,532 |
| *LnEMW* | 16,537 | 8.167 | 0.693 | 5.994 | 8.158 | 9.772 |
| *LnEMWadjusted* | 16,537 | 0.005 | 0.632 | -2.867 | 0.000 | 2.295 |
| *Firm Size* | 16,537 | 22.384 | 1.266 | 19.972 | 22.217 | 26.305 |
| *Firm Age* | 16,537 | 2.868 | 0.313 | 1.946 | 2.890 | 3.466 |
| *Leverage* | 16,537 | 0.426 | 0.196 | 0.059 | 0.419 | 0.862 |
| *SA* | 16,537 | -3.825 | 0.235 | -4.393 | -3.830 | -3.122 |
| *Tobin’s Q* | 16,537 | 2.068 | 1.323 | 0.851 | 1.640 | 8.446 |
| *ROA* | 16,537 | 0.051 | 0.043 | -0.016 | 0.040 | 0.213 |
| *SOE* | 16,537 | 0.360 | 0.480 | 0.000 | 0.000 | 1.000 |
| *Compensation* | 16,537 | 1.129 | 0.533 | 0.229 | 1.000 | 6.965 |
| *Board Independence* | 16,537 | 0.376 | 0.056 | 0.200 | 0.364 | 0.750 |
| *Board Size* | 16,537 | 2.129 | 0.200 | 1.386 | 2.197 | 2.890 |
| *Concentration* | 16,537 | 0.342 | 0.146 | 0.088 | 0.321 | 0.748 |
| *GDP Growth* | 16,537 | 0.080 | 0.053 | -0.250 | 0.084 | 0.299 |
| *SPE* | 16,537 | 1,655,358 | 2,148,794 | 179,689 | 974,808 | 14,747,006 |
| *LnSPE* | 16,537 | 13.896 | 0.842 | 12.099 | 13.790 | 16.507 |
| *NPE* | 16,537 | 135,060 | 206,475 | 1,991 | 69,440 | 1,375,843 |
| *LnNPE* | 16,537 | 11.071 | 1.275 | 7.596 | 11.148 | 14.135 |
| *AQI* | 15,742 | 4.360 | 0.263 | 1.386 | 4.370 | 5.951 |
| *Green* | 15,742 | 14.076 | 2.897 | 5.850 | 14.280 | 21.050 |
| *Managerial Ability* | 15,540 | -0.003 | 0.163 | -0.327 | -0.030 | 0.396 |
| *Bed* | 16,537 | 54.304 | 9.344 | 27.150 | 54.720 | 79.500 |

**Table 3. Correlation matrix**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** |
| ***1 EMW*** | 1 |  |  |  |  |  |  |  |  |  |  |  |  |
| ***2 Firm Size*** | 0.2556 | 1 |  |  |  |  |  |  |  |  |  |  |  |
| ***3 Firm Age*** | 0.1477 | 0.1112 | 1 |  |  |  |  |  |  |  |  |  |  |
| ***4 Leverage*** | 0.0945 | 0.5434 | 0.1318 | 1 |  |  |  |  |  |  |  |  |  |
| ***5 Concentration*** | 0.1241 | 0.211 | -0.0922 | 0.0905 | 1 |  |  |  |  |  |  |  |  |
| ***6 SA*** | -0.0585 | 0.0894 | -0.8724 | -0.0201 | 0.1452 | 1 |  |  |  |  |  |  |  |
| ***7 Tobin's Q*** | -0.0704 | -0.4181 | -0.0627 | -0.3321 | -0.0924 | 0.0563 | 1 |  |  |  |  |  |  |
| ***8 ROA*** | -0.0538 | -0.0958 | -0.0652 | -0.3762 | 0.0623 | 0.0196 | 0.332 | 1 |  |  |  |  |  |
| ***9 SOE*** | 0.3211 | 0.3332 | 0.1455 | 0.2711 | 0.2605 | -0.0611 | -0.1725 | -0.1831 | 1 |  |  |  |  |
| ***10 Compensation*** | 0.5314 | 0.1957 | 0.0098 | 0.0499 | 0.0841 | 0.0492 | 0.0305 | 0.0645 | 0.1679 | 1 |  |  |  |
| ***11 Board Independence*** | 0.0095 | 0.0094 | -0.0245 | -0.0033 | 0.0482 | 0.0562 | 0.0409 | 0.0006 | -0.0471 | 0.0308 | 1 |  |  |
| ***12 Board Size*** | 0.0883 | 0.2592 | 0.0478 | 0.1548 | 0.0337 | 0.0024 | -0.1346 | -0.0448 | 0.2558 | 0.0313 | -0.5367 | 1 |  |
| ***13 GDP Growth*** | -0.0528 | -0.029 | -0.1076 | 0.0231 | 0.0131 | 0.1005 | -0.0255 | 0.0055 | 0.0171 | 0.0122 | -0.0040 | 0.0303 | 1 |

This table displays the correlation statistics of main variables. All variables are defined in the Appendix. The VIF is also tested, and results show that there is no multicollinearity issue in our model.

**Table 4. Baseline Results**

The sample consists of 16,537 firm-year observations between 2011 and 2020. The dependent variable is the firm’s total factor productivity (*TFP*). *EMW* is the natural logarithm of the average employee medical expenditure in that year. EMWadjusted is the natural logarithm of the relative medical welfare per employee adjusted by industry in the same year. All control variables are defined in the Appendix A1. Numbers in parentheses represent *t*-value. The symbols \*\*\*, \*\*, and\* denote significance level at the 1%, 5%, and 10% levels, respectively

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | (1) | (2) | (3) | (4) |
| VARIABLES | *TFP* | *TFP* | *TFP* | *TFP* |
| *LnEMW* | 0.027\*\*\* |  | 0.018\*\*\* |  |
|  | (4.171) |  | (3.261) |  |
| *LnEMWadjusted* |  | 0.026\*\*\* |  | 0.012\*\* |
|  |  | (3.976) |  | (2.181) |
| *Firm Size* | -0.031\*\*\* | -0.031\*\*\* | -0.045\*\*\* | -0.044\*\*\* |
|  | (-7.156) | (-7.145) | (-8.092) | (-8.016) |
| *Firm Age* | 0.001 | 0.001 | 0.014 | 0.013 |
|  | (0.039) | (0.046) | (0.325) | (0.315) |
| *Leverage* | 0.205\*\*\* | 0.205\*\*\* | 0.108\*\*\* | 0.108\*\*\* |
|  | (7.838) | (7.825) | (5.058) | (5.032) |
| *SA* | 0.017 | 0.018 | 0.061 | 0.060 |
|  | (0.477) | (0.485) | (1.553) | (1.530) |
| *Tobin’s Q* | -0.004 | -0.004 | 0.004\* | 0.004\* |
|  | (-1.270) | (-1.267) | (1.825) | (1.830) |
| *ROA* | 2.628\*\*\* | 2.626\*\*\* | 1.937\*\*\* | 1.935\*\*\* |
|  | (25.408) | (25.403) | (30.727) | (30.674) |
| *SOE* | 0.012 | 0.012 | -0.009 | -0.008 |
|  | (1.277) | (1.327) | (-0.653) | (-0.609) |
| *Compensation* | 0.078\*\*\* | 0.078\*\*\* | 0.090\*\*\* | 0.092\*\*\* |
|  | (9.819) | (9.862) | (14.547) | (14.685) |
| *Board Independence* | -0.107 | -0.107 | 0.180\*\*\* | 0.181\*\*\* |
|  | (-1.523) | (-1.524) | (3.055) | (3.059) |
| *Board Size* | 0.031 | 0.031 | 0.015 | 0.015 |
|  | (1.395) | (1.395) | (0.716) | (0.732) |
| *Concentration* | 0.021 | 0.021 | -0.015 | -0.014 |
|  | (0.728) | (0.736) | (-0.455) | (-0.426) |
| *GDP Growth* | -0.020 | -0.021 | -0.023 | -0.023 |
|  | (-0.333) | (-0.347) | (-0.562) | (-0.572) |
| Constant | 0.179 | 0.387\*\*\* | 0.682\*\*\* | 0.806\*\*\* |
|  | (1.168) | (2.612) | (3.063) | (3.681) |
|  |  |  |  |  |
| Observations | 16,537 | 16,537 | 16,537 | 16,537 |
| Adjusted R2 | 0.162 | 0.162 | 0.575 | 0.575 |
| Industry FE | Yes | Yes | No | No |
| Firm FE | No | No | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |

**Table 5. Robustness test - Does welfare always matter (evidence from U-curve test)**

This table presents OLS regression results for the U-curve effects of employee medical welfare on firm productivity. The dependent variable is the firm’s total factor productivity. The independent variables are employee medical welfare and its square value. All control variables are defined in the Appendix A1. Numbers in parentheses represent *t*-value. The symbols \*\*\*, \*\*, and\* denote significance level at the 1%, 5%, and 10% levels, respectively.

|  |  |  |
| --- | --- | --- |
|  | (1) | (2) |
| VARIABLES | *TFP* | *TFP* |
| *U-curve turning point* | 12,000 | 13,289 |
| *EMW* | 0.120\*\*\* | 0.101\*\*\* |
|  | (3.357) | (3.376) |
| *EMW2* | -0.050\*\* | -0.038\*\* |
|  | (-2.350) | (-2.386) |
| *Firm size* | -0.031\*\*\* | -0.044\*\*\* |
|  | (-7.191) | (-8.022) |
| *Firm age* | 0.002 | 0.016 |
|  | (0.076) | (0.374) |
| *Leverage* | 0.205\*\*\* | 0.109\*\*\* |
|  | (7.822) | (5.073) |
| *SA* | 0.019 | 0.058 |
|  | (0.524) | (1.485) |
| *Tobin’s Q* | -0.005 | 0.004\* |
|  | (-1.304) | (1.852) |
| *ROA* | 2.627\*\*\* | 1.941\*\*\* |
|  | (25.344) | (30.739) |
| *SOE* | 0.012 | -0.009 |
|  | (1.294) | (-0.650) |
| *Compensation* | 0.079\*\*\* | 0.088\*\*\* |
|  | (9.318) | (13.352) |
| *Board independence* | -0.108 | 0.181\*\*\* |
|  | (-1.534) | (3.068) |
| *Board size* | 0.031 | 0.015 |
|  | (1.426) | (0.734) |
| *Concentration* | 0.020 | -0.015 |
|  | (0.706) | (-0.471) |
| *GDP Growth* | -0.021 | -0.023 |
|  | (-0.349) | (-0.557) |
| Constant | 0.365\*\* | 0.775\*\*\* |
|  | (2.472) | (3.531) |
|  |  |  |
| Observations | 16,537 | 16,537 |
| Adjusted R2 | 0.162 | 0.575 |
| Industry FE | Yes | No |
| Firm FE | No | Yes |
| Year FE | Yes | Yes |
| Observations after turning point | 622 | 447 |

**Table 6. Instrumental variable regression**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | First stage | |  | Second stage | |  |
|  | (1) | (2) | (3) | (4) | (5) | (6) |
| VARIABLES | *LnEMW* | *LnEMWadjusted* | *TFP* | *TFP* | *TFP* | *TFP* |
| *AQI* | 0.420\*\*\* | 0.418\*\*\* |  |  |  |  |
|  | (13.816) | (13.822) |  |  |  |  |
| *Green* | -0.029\*\*\* | -0.029\*\*\* |  |  |  |  |
|  | (-11.288) | (-11.329) |  |  |  |  |
| *LnEMW* |  |  | 0.073\*\*\* |  | 0.067\*\* |  |
|  |  |  | (2.706) |  | (2.519) |  |
| *LnEMWadjusted* |  |  |  | 0.073\*\*\* |  | 0.069\*\* |
|  |  |  |  | (2.707) |  | (2.544) |
| *Firm Size* | 0.016\*\* | 0.015\* | -0.032\*\*\* | -0.032\*\*\* | -0.032\*\*\* | -0.030\*\*\* |
|  | (2.015) | (1.850) | (-7.173) | (-7.162) | (-6.921) | (-6.674) |
| *Firm Age* | 0.052 | 0.050 | 0.002 | 0.002 | 0.018 | 0.026 |
|  | (1.043) | (1.002) | (0.084) | (0.089) | (0.668) | (0.954) |
| *Leverage* | -0.238\*\*\* | -0.233\*\*\* | 0.220\*\*\* | 0.220\*\*\* | 0.235\*\*\* | 0.239\*\*\* |
|  | (-5.278) | (-5.212) | (7.670) | (7.671) | (8.745) | (8.756) |
| *SA* | 0.024 | 0.020 | 0.019 | 0.019 | 0.033 | 0.041 |
|  | (0.374) | (0.303) | (0.508) | (0.516) | (0.911) | (1.103) |
| *Tobin’s Q* | 0.015\*\*\* | 0.015\*\*\* | -0.005 | -0.005 | -0.007\*\* | -0.007\*\* |
|  | (3.001) | (3.006) | (-1.500) | (-1.499) | (-1.960) | (-1.968) |
| *ROA* | -1.060\*\*\* | -1.045\*\*\* | 2.696\*\*\* | 2.695\*\*\* | 2.646\*\*\* | 2.638\*\*\* |
|  | (-6.923) | (-6.845) | (23.404) | (23.412) | (22.951) | (23.089) |
| *SOE* | 0.238\*\*\* | 0.233\*\*\* | -0.003 | -0.003 | -0.004 | 0.001 |
|  | (12.946) | (12.758) | (-0.237) | (-0.215) | (-0.288) | (0.093) |
| *Compensation* | 0.642\*\*\* | 0.645\*\*\* | 0.048\*\* | 0.048\*\* | 0.053\*\*\* | 0.048\*\* |
|  | (31.141) | (31.286) | (2.502) | (2.467) | (2.922) | (2.471) |
| *Board Independence* | 0.121 | 0.128 | -0.085 | -0.086 | -0.100 | -0.100 |
|  | (0.896) | (0.955) | (-1.175) | (-1.183) | (-1.386) | (-1.386) |
| *Board Size* | 0.115\*\*\* | 0.120\*\*\* | 0.030 | 0.030 | 0.023 | 0.023 |
|  | (2.661) | (2.783) | (1.317) | (1.299) | (1.005) | (0.979) |
| *Concentration* | 0.187\*\*\* | 0.186\*\*\* | 0.006 | 0.006 | 0.019 | 0.022 |
|  | (3.763) | (3.762) | (0.191) | (0.194) | (0.642) | (0.763) |
| *GDP Growth* | -0.301\*\*\* | -0.303\*\*\* | -0.007 | -0.007 | -0.024 | -0.012 |
|  | (-3.373) | (-3.408) | (-0.118) | (-0.114) | (-0.372) | (-0.182) |
| Constant | 4.892\*\*\* | -2.809\*\*\* | -0.047 | 0.488\*\*\* | -0.041 | 0.425\*\*\* |
|  | (16.547) | (-9.539) | (-0.220) | (3.031) | (-0.190) | (2.721) |
|  |  |  |  |  |  |  |
| Observations | 15,742 | 15,742 | 15,742 | 15,742 | 15,742 | 15,742 |
| Adjusted R2 | 0.549 | 0.462 | 0.157 | 0.156 | 0.150 | 0.150 |
| Industry FE | Yes | Yes | Yes | Yes | No | No |
| Firm FE | No | No | No | No | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Cragg-Donald Wald F value  (for Weak identification test) | 660.458\*\*\* | 657.538\*\*\* |  |  |  |  |
| Anderson LM statistic  (for Under identification test) | 258.097\*\*\* | 258.487\*\*\* |  |  |  |  |
| Hansen J statistic p value  (for Over identification test) |  |  | 0.683 | 0.681 | 0.629 | 0.731 |

This table reports the results of the 2SLS regression with instrumental variables. *EMW* is the natural logarithm of the average employee medical expenditure in that year. EMWadjusted is the natural logarithm of the relative medical welfare per employee adjusted by industry in the same year. AQI is ambient air pollution measured as the natural logarithm of the average daily AQI of a given year and city following Wang et al. (2021). Green is the average green area per capita of a given year and province. In the second stage, the dependent variable is firm’s total factor productivity. All variables are defined in Appendix A1. Numbers in parentheses represent *t*-value. The symbols \*\*\*, \*\*, and\* denote significance level at the 1%, 5%, and 10% levels, respectively.

**Table 7. Subsample analysis**

This table reports results of subsample tests. We first show the results of SOE and Non-SOE firms in Panel A. Panel B reports the results based on the employee skills. In Panel C, we spilt the sample based on the R&D intensity of a firm. Firm and year fixed effects are used in the regression. All variables are defined in the Appendix A1. Numbers in parentheses represent *t*-value. The symbols \*\*\*, \*\*, and\* denote significance level at the 1%, 5%, and 10% levels, respectively.

**Panel A: SOE vs Non-SOE**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **SOE** | **Non-SOE** | **SOE** | **Non-SOE** |
|  | (1) | (2) | (3) | (4) |
| VARIABLES | *TFP* | *TFP* | *TFP* | *TFP* |
| *LnEMW* | -0.001 | 0.032\*\*\* |  |  |
|  | (-0.111) | (4.356) |  |  |
| *LnEMWadjusted* |  |  | 0.000 | 0.020\*\*\* |
|  |  |  | (0.043) | (2.716) |
| *Firm Size* | -0.045\*\*\* | -0.055\*\*\* | -0.045\*\*\* | -0.054\*\*\* |
|  | (-4.342) | (-7.994) | (-4.321) | (-7.863) |
| *Firm Age* | 0.056 | -0.021 | 0.056 | -0.023 |
|  | (0.749) | (-0.389) | (0.748) | (-0.420) |
| *Leverage* | 0.127\*\*\* | 0.111\*\*\* | 0.128\*\*\* | 0.110\*\*\* |
|  | (3.232) | (4.273) | (3.234) | (4.209) |
| *SA* | 0.066 | 0.040 | 0.066 | 0.040 |
|  | (0.987) | (0.760) | (0.987) | (0.764) |
| *Tobin’s Q* | -0.002 | 0.006\*\* | -0.002 | 0.006\*\* |
|  | (-0.379) | (2.397) | (-0.383) | (2.379) |
| *ROA* | 1.859\*\*\* | 1.974\*\*\* | 1.860\*\*\* | 1.971\*\*\* |
|  | (14.867) | (26.909) | (14.865) | (26.833) |
| *Compensation* | 0.078\*\*\* | 0.088\*\*\* | 0.078\*\*\* | 0.094\*\*\* |
|  | (8.319) | (10.493) | (8.130) | (11.008) |
| *Board Independence* | 0.096 | 0.285\*\*\* | 0.096 | 0.287\*\*\* |
|  | (1.139) | (3.424) | (1.139) | (3.455) |
| *Board Size* | 0.003 | 0.008 | 0.003 | 0.009 |
|  | (0.096) | (0.291) | (0.093) | (0.319) |
| *Concentration* | 0.109\*\* | -0.072\* | 0.108\*\* | -0.072 |
|  | (2.028) | (-1.658) | (2.022) | (-1.645) |
| *GDP Growth* | -0.086 | 0.020 | -0.086 | 0.020 |
|  | (-1.473) | (0.346) | (-1.472) | (0.351) |
| **Table 7** *(continued)* |  |  |  |  |
|  | **SOE** | **Non-SOE** | **SOE** | **Non-SOE** |
|  | (1) | (2) | (3) | (4) |
| VARIABLES | *TFP* | *TFP* | *TFP* | *TFP* |
| Constant | 0.841\* | 0.742\*\*\* | 0.832\* | 0.965\*\*\* |
|  | (1.901) | (2.684) | (1.907) | (3.553) |
|  |  |  |  |  |
| Observations | 5,951 | 10,586 | 5,951 | 10,586 |
| Adjusted R2 | 0.565 | 0.593 | 0.565 | 0.593 |
| Firm FE | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |

**Panel B: Skilled employee ratio**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **High** | **Low** | **High** | **Low** |
|  | (1) | (2) | (3) | (4) |
| VARIABLES | *TFP* | *TFP* | *TFP* | *TFP* |
| *LnEMW* | -0.004 | 0.040\*\*\* |  |  |
|  | (-0.429) | (5.163) |  |  |
| *LnEMWadjusted* |  |  | -0.010 | 0.035\*\*\* |
|  |  |  | (-1.223) | (4.540) |
| *Firm size* | -0.071\*\*\* | -0.047\*\*\* | -0.071\*\*\* | -0.046\*\*\* |
|  | (-7.540) | (-5.965) | (-7.575) | (-5.747) |
| *Firm age* | 0.025 | 0.070 | 0.024 | 0.068 |
|  | (0.374) | (1.173) | (0.358) | (1.145) |
| *Leverage* | 0.157\*\*\* | 0.111\*\*\* | 0.157\*\*\* | 0.111\*\*\* |
|  | (4.553) | (3.754) | (4.551) | (3.732) |
| *SA* | 0.172\*\*\* | -0.035 | 0.172\*\*\* | -0.032 |
|  | (2.829) | (-0.551) | (2.828) | (-0.514) |
| *Tobin’s Q* | 0.004 | 0.002 | 0.004 | 0.002 |
|  | (1.378) | (0.626) | (1.381) | (0.602) |
| *ROA* | 1.872\*\*\* | 2.011\*\*\* | 1.865\*\*\* | 2.010\*\*\* |
|  | (19.286) | (23.845) | (19.220) | (23.820) |
| *SOE* | -0.013 | 0.005 | -0.014 | 0.007 |
|  | (-0.606) | (0.252) | (-0.633) | (0.335) |
| *Compensation* | 0.090\*\*\* | 0.119\*\*\* | 0.093\*\*\* | 0.119\*\*\* |
|  | (10.833) | (10.055) | (11.033) | (9.963) |
| *Board Independence* | 0.049 | 0.197\*\* | 0.049 | 0.197\*\* |
|  | (0.540) | (2.455) | (0.546) | (2.450) |
| *Board Size* | 0.010 | 0.012 | 0.009 | 0.011 |
|  | (0.305) | (0.420) | (0.299) | (0.407) |
| *Concentration* | 0.020 | -0.000 | 0.019 | 0.001 |
|  | (0.355) | (-0.009) | (0.340) | (0.033) |
| *GDP Growth* | -0.038 | -0.012 | -0.038 | -0.012 |
|  | (-0.663) | (-0.203) | (-0.665) | (-0.213) |
| Constant | 1.832\*\*\* | 0.040 | 1.813\*\*\* | 0.323 |
|  | (5.054) | (0.126) | (5.091) | (1.026) |
|  |  |  |  |  |
| Observations | 8,244 | 8,233 | 8,244 | 8,233 |
| Adjusted R2 | 0.596 | 0.615 | 0.596 | 0.614 |
| Firm FE | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |

**Panel C: R&D intensity**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **High** | **Low** | **High** | **Low** |
|  | (1) | (2) | (3) | (4) |
| VARIABLES | *TFP* | *TFP* | *TFP* | *TFP* |
| *LnEMW* | -0.001 | 0.025\*\*\* |  |  |
|  | (-0.175) | (3.105) |  |  |
| *LnEMWadjusted* |  |  | -0.008 | 0.022\*\*\* |
|  |  |  | (-1.077) | (2.827) |
| *Firm size* | -0.066\*\*\* | -0.044\*\*\* | -0.067\*\*\* | -0.043\*\*\* |
|  | (-8.028) | (-5.081) | (-8.075) | (-4.999) |
| *Firm age* | 0.038 | 0.118\* | 0.038 | 0.116\* |
|  | (0.677) | (1.763) | (0.676) | (1.737) |
| *Leverage* | 0.129\*\*\* | 0.060\* | 0.129\*\*\* | 0.060\* |
|  | (4.189) | (1.870) | (4.188) | (1.884) |
| *SA* | -0.055 | -0.193\*\*\* | -0.054 | -0.194\*\*\* |
|  | (-0.849) | (-2.931) | (-0.828) | (-2.952) |
| *Tobin’s Q* | 0.005\* | 0.006 | 0.005\* | 0.006 |
|  | (1.859) | (1.614) | (1.869) | (1.617) |
| *ROA* | 1.546\*\*\* | 2.010\*\*\* | 1.540\*\*\* | 2.010\*\*\* |
|  | (20.655) | (19.711) | (20.587) | (19.705) |
| *SOE* | 0.016 | -0.031 | 0.016 | -0.030 |
|  | (0.787) | (-1.516) | (0.788) | (-1.504) |
| *Compensation* | 0.102\*\*\* | 0.069\*\*\* | 0.106\*\*\* | 0.070\*\*\* |
|  | (11.817) | (7.388) | (12.061) | (7.335) |
| *Board Independence* | 0.183\*\* | 0.100 | 0.185\*\* | 0.098 |
|  | (2.334) | (1.186) | (2.365) | (1.156) |
| *Board Size* | 0.042 | 0.017 | 0.043 | 0.017 |
|  | (1.602) | (0.553) | (1.622) | (0.543) |
| *Concentration* | 0.070 | -0.093\* | 0.070 | -0.090\* |
|  | (1.472) | (-1.777) | (1.461) | (-1.721) |
| *GDP Growth* | 0.027 | 0.034 | 0.027 | 0.034 |
|  | (0.507) | (0.597) | (0.516) | (0.593) |
| Constant | 0.765\*\* | -0.499 | 0.764\*\* | -0.323 |
|  | (2.401) | (-1.365) | (2.436) | (-0.899) |
|  |  |  |  |  |
| Observations | 7,122 | 7,113 | 7,122 | 7,113 |
| Adjusted R2 | 0.685 | 0.635 | 0.685 | 0.635 |
| Firm FE | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |

**Table 8. Potential Mechanism**

This table investigates the underlying potential mechanisms using subsample analysis and the interaction terms following Wang et al. (2021). Panel A presents coefficients from regressions of the effect of employee medical welfare and firm productivity by dividing the sample into two subsamples based on the managerial ability index. The managerial ability is calculated using data envelopment analysis, introduced by Demerjian et al. (2012). Panel B presents the results by divided the sample based on the regional economic development level. Panel C shows the results of medical development level. All variables are defined in the Appendix A1. Numbers in parentheses represent *t*-value. The symbols \*\*\*, \*\*, and\* denote significance level at the 1%, 5%, and 10% levels, respectively.

**Panel A: Managerial ability**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **High** | **Low** | **High** | **Low** |
|  | (1) | (2) | (3) | (4) |
| VARIABLES | *TFP* | *TFP* | *TFP* | *TFP* |
| *LnEMW* | 0.035\*\*\* | 0.011 |  |  |
|  | (4.430) | (1.387) |  |  |
| *LnEMWadjusted* |  |  | 0.022\*\*\* | 0.010 |
|  |  |  | (2.774) | (1.291) |
| *Firm size* | -0.065\*\*\* | -0.050\*\*\* | -0.064\*\*\* | -0.050\*\*\* |
|  | (-7.801) | (-6.065) | (-7.610) | (-6.033) |
| *Firm age* | -0.003 | -0.008 | -0.003 | -0.009 |
|  | (-0.049) | (-0.142) | (-0.049) | (-0.155) |
| *Leverage* | 0.088\*\*\* | 0.076\*\* | 0.088\*\*\* | 0.077\*\* |
|  | (2.693) | (2.501) | (2.705) | (2.509) |
| *SA* | 0.095 | 0.060 | 0.086 | 0.061 |
|  | (1.543) | (0.971) | (1.398) | (0.992) |
| *Tobin’s Q* | 0.006\* | 0.002 | 0.006\* | 0.002 |
|  | (1.916) | (0.775) | (1.938) | (0.773) |
| *ROA* | 1.490\*\*\* | 1.640\*\*\* | 1.489\*\*\* | 1.640\*\*\* |
|  | (15.964) | (16.822) | (15.928) | (16.818) |
| *SOE* | -0.000 | -0.023 | 0.002 | -0.023 |
|  | (-0.014) | (-1.250) | (0.100) | (-1.255) |
| *Compensation* | 0.058\*\*\* | 0.111\*\*\* | 0.063\*\*\* | 0.111\*\*\* |
|  | (6.296) | (11.849) | (6.667) | (11.722) |
| *Board Independence* | 0.220\*\* | 0.102 | 0.226\*\* | 0.103 |
|  | (2.443) | (1.286) | (2.505) | (1.288) |
| *Board Size* | 0.035 | 0.020 | 0.037 | 0.020 |
|  | (1.092) | (0.738) | (1.161) | (0.742) |
| *Concentration* | 0.022 | -0.050 | 0.024 | -0.049 |
|  | (0.448) | (-1.059) | (0.491) | (-1.035) |
| *GDP Growth* | -0.113\*\* | 0.020 | -0.112\* | 0.019 |
|  | (-1.966) | (0.350) | (-1.941) | (0.349) |
| Constant | 1.242\*\*\* | 0.917\*\*\* | 1.434\*\*\* | 1.005\*\*\* |
|  | (3.535) | (2.784) | (4.107) | (3.125) |
|  |  |  |  |  |
| Observations | 7,770 | 7,770 | 7,770 | 7,770 |
| Adjusted R2 | 0.626 | 0.615 | 0.625 | 0.615 |
| Firm FE | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |

**Panel B: Economic development**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **High** | **Low** | **High** | **Low** |
|  | (1) | (2) | (3) | (4) |
| VARIABLES | *TFP* | *TFP* | *TFP* | *TFP* |
| *LnEMW* | 0.029\*\*\* | -0.007 |  |  |
|  | (4.216) | (-0.733) |  |  |
| *LnEMWadjusted* |  |  | 0.024\*\*\* | -0.014 |
|  |  |  | (3.485) | (-1.535) |
| *Firm size* | -0.039\*\*\* | -0.055\*\*\* | -0.039\*\*\* | -0.056\*\*\* |
|  | (-5.182) | (-6.195) | (-5.089) | (-6.271) |
| *Firm age* | 0.038 | -0.025 | 0.037 | -0.026 |
|  | (0.716) | (-0.329) | (0.709) | (-0.345) |
| *Leverage* | 0.130\*\*\* | 0.064\* | 0.131\*\*\* | 0.063\* |
|  | (4.717) | (1.841) | (4.736) | (1.822) |
| *SA* | 0.108\*\* | -0.038 | 0.107\*\* | -0.037 |
|  | (2.175) | (-0.570) | (2.167) | (-0.552) |
| *Tobin’s Q* | 0.005\* | 0.003 | 0.005\* | 0.003 |
|  | (1.765) | (0.866) | (1.763) | (0.864) |
| *ROA* | 1.804\*\*\* | 2.098\*\*\* | 1.801\*\*\* | 2.095\*\*\* |
|  | (22.236) | (20.743) | (22.192) | (20.708) |
| *SOE* | -0.015 | 0.000 | -0.014 | 0.000 |
|  | (-0.753) | (0.004) | (-0.707) | (0.005) |
| *Compensation* | 0.072\*\*\* | 0.131\*\*\* | 0.073\*\*\* | 0.135\*\*\* |
|  | (9.635) | (11.725) | (9.710) | (11.885) |
| *Board Independence* | 0.172\*\* | 0.213\*\* | 0.171\*\* | 0.213\*\* |
|  | (2.214) | (2.334) | (2.207) | (2.331) |
| *Board Size* | -0.039 | 0.086\*\*\* | -0.039 | 0.087\*\*\* |
|  | (-1.424) | (2.722) | (-1.437) | (2.737) |
| *Concentration* | -0.035 | 0.045 | -0.035 | 0.045 |
|  | (-0.788) | (0.879) | (-0.808) | (0.876) |
| *GDP Growth* | 0.026 | -0.023 | 0.028 | -0.023 |
|  | (0.216) | (-0.437) | (0.236) | (-0.447) |
| Constant | 0.710\*\* | 0.619 | 0.920\*\*\* | 0.587 |
|  | (2.508) | (1.642) | (3.301) | (1.584) |
|  |  |  |  |  |
| Observations | 9,780 | 6,757 | 9,780 | 6,757 |
| Adjusted R2 | 0.561 | 0.609 | 0.561 | 0.609 |
| Firm FE | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |

**Panel C: Medical facilities**

|  |  |  |  |
| --- | --- | --- | --- |
|  | (1) | (2) | (3) |
| VARIABLES | *TFP* | *TFP* | *TFP* |
| *LnEMW* | 0.027\*\*\* | -0.133 | -0.103 |
|  | (4.171) | (-1.427) | (-1.553) |
| *BED* |  | -0.278 | -0.199 |
|  |  | (-1.468) | (-1.428) |
| *LnEMW\*BED* |  | 0.040\* | 0.031\* |
|  |  | (1.686) | (1.825) |
| *Firm Size* | -0.031\*\*\* | -0.031\*\*\* | -0.044\*\*\* |
|  | (-7.156) | (-7.180) | (-7.928) |
| *Firm Age* | 0.001 | 0.000 | 0.018 |
|  | (0.039) | (0.012) | (0.416) |
| *Leverage* | 0.205\*\*\* | 0.205\*\*\* | 0.109\*\*\* |
|  | (7.838) | (7.824) | (5.104) |
| *SA* | 0.017 | 0.016 | 0.055 |
|  | (0.477) | (0.447) | (1.402) |
| *Tobin’s Q* | -0.004 | -0.004 | 0.004\* |
|  | (-1.270) | (-1.273) | (1.876) |
| *ROA* | 2.628\*\*\* | 2.633\*\*\* | 1.936\*\*\* |
|  | (25.408) | (25.456) | (30.689) |
| *SOE* | 0.012 | 0.011 | -0.008 |
|  | (1.277) | (1.202) | (-0.570) |
| *Compensation* | 0.078\*\*\* | 0.079\*\*\* | 0.090\*\*\* |
|  | (9.819) | (9.986) | (14.503) |
| *Board Independence* | -0.107 | -0.105 | 0.180\*\*\* |
|  | (-1.523) | (-1.495) | (3.055) |
| *Board Size* | 0.031 | 0.031 | 0.015 |
|  | (1.395) | (1.408) | (0.735) |
| *Concentration* | 0.021 | 0.021 | -0.019 |
|  | (0.728) | (0.753) | (-0.591) |
| *GDP Growth* | -0.020 | -0.013 | -0.022 |
|  | (-0.333) | (-0.215) | (-0.546) |
| Constant | 0.179 | 1.295\* | 1.422\*\* |
|  | (1.168) | (1.739) | (2.553) |
|  |  |  |  |
| Observations | 16,537 | 16,537 | 16,537 |
| Adjusted R-squared | 0.162 | 0.163 | 0.575 |
| Industry FE | Yes | Yes | No |
| Firm FE | No | No | Yes |
| Year FE | Yes | Yes | Yes |

**Table 9. Employee medical performance under uncertainty (evidence from COVID-19)**

This table provides the results on relationship between employee medical welfare and stock market reaction during the COVID-19 outbreak period. Return on Feb 3rd is the market adjusted return on the 3rd of February 2020 (the first trading day after Wuhan lockdown). CAR[-1,1], CAR[-2,2] and CAR[-5,5] refer to three-, five- and eleven-day cumulative abnormal stock returns centering on Feb 3rd, 2020. EMWadjusted is the natural logarithm of the relative medical welfare per employee adjusted by industry in the same year. We control for firm level characteristic following Broadstock et al. (2021). All variables are defined in the Appendix A1. Numbers in parentheses represent *t*-value. The symbols \*\*\*, \*\*, and\* denote significance level at the 1%, 5%, and 10% levels, respectively.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | (1) | (2) | (3) | (4) | (5) | (6) |
| VARIABLES | *Return on Feb 3rd* | *CAR [-5,5]* | *CAR [-1,1]* | *CAR [-2,2]* | *Tobin’s Q2020* | *Tobin’s Q2021* |
| *LnEMWadjusted2019* | 0.003\*\*\* | 0.009\*\* | 0.010\*\*\* | 0.009\*\*\* | 0.173\*\*\* |  |
|  | (2.650) | (2.065) | (3.749) | (2.993) | (3.259) |  |
| *LnEMWadjuseted2020* |  |  |  |  |  | 0.163\*\*\* |
|  |  |  |  |  |  | (3.201) |
| *Firm size* | 0.002\*\* | 0.008\*\*\* | 0.011\*\*\* | 0.011\*\*\* | -0.269\*\*\* | -0.315\*\*\* |
|  | (2.333) | (3.472) | (7.483) | (6.422) | (-9.817) | (-10.528) |
| *Firm age* | 0.003 | 0.001 | 0.002 | 0.000 | -0.136 | -0.146 |
|  | (0.939) | (0.155) | (0.385) | (0.051) | (-1.222) | (-1.231) |
| *Leverage* | -0.002 | -0.010 | -0.011 | -0.011 | -0.170 | -0.558\*\*\* |
|  | (-0.336) | (-0.564) | (-0.997) | (-0.868) | (-0.856) | (-2.633) |
| *ROA* | 0.021 | 0.131\*\* | 0.219\*\*\* | 0.169\*\*\* | 11.916\*\*\* | 11.108\*\*\* |
|  | (1.126) | (2.246) | (5.620) | (3.801) | (10.679) | (9.040) |
| *SOE* | -0.003 | -0.023\*\*\* | -0.016\*\*\* | -0.021\*\*\* | -0.021 | -0.021 |
|  | (-1.627) | (-3.522) | (-3.941) | (-4.488) | (-0.298) | (-0.270) |
| *Hexun* | -0.003\*\*\* | 0.001 | -0.003\*\* | -0.002 | 0.121\*\*\* | 0.118\*\*\* |
|  | (-4.279) | (0.633) | (-2.035) | (-1.043) | (4.418) | (3.949) |
| Constant | -0.047\*\*\* | -0.174\*\*\* | -0.269\*\*\* | -0.255\*\*\* | 7.739\*\*\* | 9.194\*\*\* |
|  | (-3.243) | (-3.163) | (-8.175) | (-6.546) | (12.276) | (12.826) |
|  |  |  |  |  |  |  |
| Observations | 2,592 | 2,592 | 2,592 | 2,592 | 2,151 | 2,456 |
| Adjusted R2 | 0.067 | 0.067 | 0.093 | 0.077 | 0.286 | 0.244 |
| Industry FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |

**Table 10. Robustness test - alternative measurements of firm productivity**

This table shows the results of robustness test by introducing other dependent variables. The other dependent variables are the natural logarithm of sales per employee (*SPE*), the natural logarithm of net profits per employee (*NPE*), and the one-year forward value of total factor productivity (*TFPt+1*). *EMW* is the natural logarithm of the average employee medical expenditure in that year. EMW-adjusted is the natural logarithm of the relative medical welfare per employee adjusted by industry in the same year. All variables are defined in the Appendix A1. Numbers in parentheses represent *t*-value. The symbols \*\*\*, \*\*, and\* denote significance level at the 1%, 5%, and 10% levels, respectively.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | (1) | (2) | (3) | (4) | (5) | (6) |
| VARIABLES | *LnSPE* | *LnNPE* | *TFPt+1* | *LnSPE* | *LnNPE* | *TFPt+1* |
| *LnEMW* | 0.144\*\*\* | 0.148\*\*\* | 0.020\*\*\* |  |  |  |
|  | (7.429) | (6.334) | (2.600) |  |  |  |
| *LnEMWadjusted* |  |  |  | 0.137\*\*\* | 0.140\*\*\* | 0.019\*\* |
|  |  |  |  | (7.113) | (6.006) | (2.435) |
| *Firm Size* | 0.104\*\*\* | 0.142\*\*\* | -0.030\*\*\* | 0.104\*\*\* | 0.142\*\*\* | -0.030\*\*\* |
|  | (9.226) | (9.858) | (-5.919) | (9.244) | (9.875) | (-5.912) |
| *Firm Age* | 0.042 | -0.022 | 0.009 | 0.043 | -0.021 | 0.009 |
|  | (0.619) | (-0.260) | (0.297) | (0.634) | (-0.247) | (0.300) |
| *Leverage* | 0.754\*\*\* | -0.923\*\*\* | 0.212\*\*\* | 0.752\*\*\* | -0.925\*\*\* | 0.211\*\*\* |
|  | (10.908) | (-10.905) | (6.979) | (10.876) | (-10.933) | (6.967) |
| *SA* | 0.040 | 0.006 | 0.028 | 0.042 | 0.007 | 0.028 |
|  | (0.443) | (0.049) | (0.670) | (0.460) | (0.064) | (0.674) |
| *Tobin’s Q* | -0.053\*\*\* | -0.060\*\*\* | -0.006 | -0.053\*\*\* | -0.060\*\*\* | -0.006 |
|  | (-7.515) | (-6.106) | (-1.480) | (-7.510) | (-6.102) | (-1.478) |
| *ROA* | 2.091\*\*\* | 17.195\*\*\* | 2.153\*\*\* | 2.082\*\*\* | 17.184\*\*\* | 2.152\*\*\* |
|  | (9.961) | (52.398) | (19.246) | (9.924) | (52.367) | (19.238) |
| *SOE* | -0.068\*\*\* | -0.274\*\*\* | 0.013 | -0.066\*\* | -0.271\*\*\* | 0.013 |
|  | (-2.610) | (-8.748) | (1.198) | (-2.513) | (-8.659) | (1.237) |
| *Compensation* | 0.516\*\*\* | 0.542\*\*\* | 0.065\*\*\* | 0.520\*\*\* | 0.547\*\*\* | 0.066\*\*\* |
|  | (21.207) | (17.621) | (7.163) | (21.277) | (17.699) | (7.210) |
| *Board Independence* | -0.389\*\* | -0.576\*\* | -0.130 | -0.390\*\* | -0.577\*\* | -0.130 |
|  | (-2.001) | (-2.409) | (-1.624) | (-2.004) | (-2.412) | (-1.622) |
| *Board Size* | -0.273\*\*\* | -0.304\*\*\* | 0.016 | -0.273\*\*\* | -0.304\*\*\* | 0.016 |
|  | (-4.548) | (-4.111) | (0.674) | (-4.547) | (-4.110) | (0.673) |
| *Concentration* | -0.075 | -0.107 | 0.009 | -0.074 | -0.106 | 0.009 |
|  | (-1.010) | (-1.206) | (0.288) | (-0.995) | (-1.191) | (0.296) |
| *GDP Growth* | -0.162 | -0.163 | -0.083 | -0.166 | -0.168 | -0.083 |
|  | (-1.145) | (-0.857) | (-1.284) | (-1.175) | (-0.884) | (-1.296) |
| Constant | 10.226\*\*\* | 6.597\*\*\* | 0.330\* | 11.326\*\*\* | 7.725\*\*\* | 0.482\*\*\* |
|  | (25.763) | (14.054) | (1.825) | (30.068) | (17.332) | (2.768) |
|  |  |  |  |  |  |  |
| Observations | 16,537 | 16,537 | 11,632 | 16,537 | 16,537 | 11,632 |
| Adjusted R2 | 0.481 | 0.602 | 0.112 | 0.480 | 0.602 | 0.112 |
| Industry FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |

**Appendix.**

**Table A1. Variable definitions**

|  |  |
| --- | --- |
| Variable | Definition |
| *TFP* | We employ residuals from estimation of the natural log transformation of Cobb-Douglas function and obtain the measure as firm-level total factor productivity following Giannetti et al. (2015). |
| *SPE* | Sales per employee, which is the natural logarithm of sales per employee following Krekel et al.(2019). |
| *NPE* | Net profits per employee, which is the natural logarithm of net profits per employee following Faleye et al. (2013). |
| *LnEMW* | Employee medical welfare, which is the natural logarithm of medical insurance expenditure per employee. |
| *LnEMWadjusted* | The adjusted employee medical welfare, which is the natural logarithm of employee medical insurance expenditure divided by the median expenditure of a given industry and year. |
| *Firm Size* | The natural logarithm of total assets of a firm. |
| *Firm Age* | The natural logarithm of listing age of a firm. |
| *Leverage* | Total debt divided by total assets. |
| *SA* | Financial constraint index computed as in Hadlock and Pierce (2010). The SA index is calculated as *-0.737 \* Ln(Assets) + 0.043 \* Ln(Assets)2 – 0.04 \* Firm Age*. The higher SA score, the lower financial constraint firm faces. |
| *Tobin’s Q* | The ratio of market value and book value of total assets. |
| *ROA* | Return on assets, measured as net income divided by total assets. |
| *SOE* | Dummy variable equals to 1 if the firm is state-owned, and 0 otherwise. |
| *Compensation* | Employee compensation, measured as the average employee compensation divided by the median compensation of a given industry and year, following Kong et al. (2020). |
| *Board Independence* | The percentage of the independent director to the total number of directors in the board. |
| *Board Size* | The natural logarithm of the total number of directors in the board. |
| *Concentration* | Top one shareholding, which is the largest proportion of shareholding. |
| *GDP Growth* | The annal GDP growth rate in a province during the fiscal year. |
| *AQI* | Air pollution index, which is the natural logarithm of the average daily AOI (the concentration level of six atmospheric pollutants, namely, SO2, NO2, PM10, PM2.5, CO, and O3) of a given year and city following Wang et al. (2021). The higher AQI, the heavier air pollution city has. |
| *Green* | The average green area per capita of a given year and province. |
| *Skilled Employee ratio* | The proportion of skilled labor, which is the number of employees who have a bachelor’s degree or higher divided by the total number of employees in a firm following Kong et al. (2020). |
| *R&D intensity* | The ratio of R&D expenditure to total assets following Lin et al. (2006). |
| *Managerial Ability* | The proxy of ability of managerial team, which is constructed following Demerjian et al. (2012, 2013). |
| *Bed* | The natural logarithm of number of beds in medical institutions per 10,000 persons in a given province and year following Hu and Huang (2004). |
| *Return on Feb 3rd* | The market adjusted return on the 3rd of February, the first trading day after Wuhan lockdown on the Jan 23rd, 2020. |
| *CAR [-1,1]* | The cumulative abnormal return over the 1- trading day window around the Wuhan lockdown. |
| *CAR [-2,2]* | The cumulative abnormal return over the 2- trading day window around the Wuhan lockdown. |
| *CAR [-5,5]* | The cumulative abnormal return over the 5- trading day window around the Wuhan lockdown. |
| *Hexun* | The employee treatment index obtained from HEXUN CSR database following Cheng et al. (2020). |

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2. <http://www.greatplacetowork.com/best-companies/about-applying-to-best-companies-lists/about-the-process> [↑](#footnote-ref-2)
3. https://baike.baidu.com/item/%E4%B8%AD%E5%9B%BD%E4%BC%81%E4%B8%9A%E7%A4%BE%E4%BF%9D%E7%99%BD%E7%9A%AE%E4%B9%A6/18516159?fr=aladdin [↑](#footnote-ref-3)
4. https://www.12371.cn/special/19jwzqh/ [↑](#footnote-ref-4)
5. Employee treatment score can be retrieved from Hexun official website http://stockdata.stock.hexun.com [↑](#footnote-ref-5)
6. http://www.mohrss.gov.cn/SYrlzyhshbzb/zcfg/flfg/fl/201605/t20160509\_239643.html [↑](#footnote-ref-6)
7. The number is calculated as e2.129 = 8.406 [↑](#footnote-ref-7)
8. For quadratic function, the turning point = (−1/2) (coeff- (EMW)/coeff- (EMW2)) [↑](#footnote-ref-8)
9. https://zhidao.baidu.com/question/2125808114240339507.html [↑](#footnote-ref-9)