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Evidence from a survey of 1,182 company executives in China

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Abstract

COVID-19's sudden outbreak and the subsequent lockdown imposed by the government substantially changed China's business environment. In a survey of 1,182 company executives in China, state-owned enterprises (SOEs) reported less business reductions under COVID-19. This paper examines if SOEs' superior performance was resulted from government support rather than innate ability to cope with COVID-19. While firm-level government support is unobservable, the outbreak saw companies responding with various salary and personnel measures, which give us information to construct a proxy for the government-support effect. After controlling for the government-support effect, we find that SOEs performed significantly worse in the pandemic period.

JEL classification: D22; H70; P31

Keywords: COVID-19; State-owned enterprises; Firm characteristics; Survey data; China

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1 Introduction

COVID-19's sudden outbreak in China, and the subsequent drastic measures taken by the Chinese government to stop its spread, substantially changed China's business environment. From January 23 (when Wuhan was locked down) to February 12, more than 200 Chinese cities (including 26 provincial capitals and sub-provincial cities) implemented strict quarantine regulations. As production and spending were frozen by the lockdown/quarantine measures, China's gross domestic product (GDP) plummeted 6.8% in the first three months of the year compared with a year earlier, its first such drop since the National Bureau of Statistics of China began publishing quarterly GDP data in 1992.

In this paper, we use data from an online survey of 1,182 company executives in China, which was conducted from April 2 to 9. With business operations in China severely impacted by the sudden outbreak of COVID-19, the survey data provides valuable first-hand information on how companies in China responded to the COVID-19 shock. In particular, facing the unprecedented situation, companies took actions which would seldom be observed in normal times. For example, when asked what HR (human resources) measures already taken in the first quarter, 199 survey participants (16.8%) reported "laid off workers", 138 (11.7%) reported "cut salaries across company", and 18 (1.5%) reported "raised salary or raised hiring". Such seldom-observed variations in firm behavior provide a unique opportunity for the research presented in this paper.

This paper examines how state-owned enterprises (SOEs) fared under the COVID-19 shock compared with non-state-owned enterprises (NSOEs). There are extensive studies in the literature on firm behavior under public and private ownership. In a principal-agent framework, Sappington and Stiglitz (1987) modeled public and private firms as delegated production arrangements in which the government retains some authority to intervene directly, with the main difference lying in the transactions costs faced by the government when attempting to intervene in the delegated production activities. In their modeling, the government has greater ease to intervene under public ownership, but its promise not to intervene is more credible under private ownership. Applying this theory, we would expect more government assistance for SOEs than NSOEs but more active adaption of NSOEs than SOEs in the pandemic period.

Megginson and Netter (2001) provided a comprehensive survey on privatization and concluded that "(research) now supports the proposition that privately owned firms are more efficient and more profitable than otherwise-comparable state-owned firms" (p. 380). However, the empirical evidence on the performance of Chinese SOEs relative to NSOEs is mixed.[1] Some studies show that SOE productivity has been improved (Groves et al., 1994; Cornelli and Li, 1997), others show that the reform is far from successful (Lin et al., 1998). In a study of China's privatization experience over the period 1994-1997, Sun et al. (2002) found an inverted U-shape relationship between state ownership and firm performance in a sample of China's listed companies with firm performance measured by the market-to-book ratio of equity. They explained this result by claiming "too much government holding of SOE shares means too much control and interference in the economic operations of SOEs; too little government holding means too little support from the government to pull the SOEs out from their difficulties" (p. 23). Viewing this empirical result in the theory of Sappington and Stiglitz (1987), the inverted U-shape relationship can be understood as resulted from the tradeoff between the beneficial effect enjoyed by SOEs in government support (which raises their financial performance) and the detrimental effect associated with the inefficiency of SOEs (which lowers their financial performance).[2]

This paper argues that, without removing the effect of ownership-related government support on firm performance, the estimated results would fail to show the effect associated with ownership-based firm behavior. The difficulty lies in the fact that we do not observe government support to enterprises. Thanks to the sudden and gigantic COVID-19 shock, we observe companies taking drastic actions, which reveals information about underlying factors including government support. In this paper, we utilize such information to construct a proxy for the ownership-related government support effect. By controlling for the ownership-related government support effect on firm performance, we are able to estimate the effect associated with the ownership-based firm behavior.

[1] Yu (2013) provided a summary of 14 studies, all using data of Chinese firms to estimate the relationship between state ownership and firm performance. Among them, 8 found a nonlinear relationship (inverted U-shaped, U-shaped, or convex), 3 found a negative relationship, 2 found a positive relationship, and 1 found no relationship.

[2] According to the property rights theory (Martin and Parker, 1997; Villalonga, 2000), because property rights are not clearly defined in SOEs, they have a low profit-seeking incentive and hence low efficiency.

While SOEs receive more government support than NSOEs, they also have more burdens imposed by the government (Bai et al., 2006; Song et al., 2011; Zhang et al., 2002). For example, SOEs are obliged to hire excess labor (Chong et al., 2011; Cooper et al., 2015; Berkowitz et al., 2017) and are often used as instruments of macroeconomic policy and industry regulations (Bai et al., 2000). In previous studies, some examined firm-government relationship from the cost perspective (policy burdens on SOEs, e.g. Jian et al., 2020), some others from the benefit perspective (ownership-based resources for SOEs, e.g. Ren et al., 2019). In this paper, we do not distinguish the cost side and the benefit side of the firm-government relationship. The proxy we construct should be interpreted as measuring the net government support effect after considering the cost related to government imposed burdens.

The remainder of the paper is organized as follows. Section 2 describes the data. Section 3 lays out the empirical approach. Section 4 reports the results. Section 5 concludes.

2 Data description

Data for this research is drawn from an online survey of company executives in China launched at the beginning of April, conducted by a research team of China Europe International Business School (CEIBS) led by one of this paper's authors.[3] The survey data captured the sharp and immediate responses of companies in China to the COVID-19 shock since the pandemic impacted the Chinese economy most severely in February and March.[4] As the survey was distributed mainly via CEIBS channels, 98.6% (1,166) respondents are CEIBS alumni/students, among whom two-thirds are Executive MBAs (EMBAs). It is worth noting that over 97% of CEIBS EMBA students/alumni hold top/senior management positions in their companies, which ensures the reliability of the survey data.[5]

[3]The CEIBS China Business Survey has been conducted annually since 2011. All reports are publicly available at https://www.ceibs.edu/faculty/research/research-reports. For details of the COVID-19 survey, see Xu et al. (2020).

[4]The lockdown in Wuhan was two days before the official start of the Chinese New Year holiday on January 25, which was an eleven-day long period when the Chinese economy entered a pause mode. Most companies in China felt the impact of COVID-19 after the holiday's official end on February 2.

[5]CEIBS has one of the largest part-time EMBA programs in the world, with annual enrollment about 700. As shown in the official website (https://www.ceibs.edu/emba/students), the average age of CEIBS EMBA participants is 39.4, average working experience is 15.8 years, and average management experience 11.5 years.

In this paper, we examine if SOEs and NSOEs showed significant differences during the COVID-19 period. In our sample of 1,182 companies, 113 (9.6%) are SOEs, 735 (62.2%) are Chinese private enterprises, and 290 (24.5%) are foreign/overseas-owned enterprises in China or joint ventures with more than 50% foreign/overseas ownership.[6] The ownership distribution of our sample is consistent with that of the population: 1.8% of the total number of corporate enterprises in China are SOEs, 89.5% are Chinese private enterprises, and 1.2% are foreign/overseas enterprises (from China's National Bureau of Statistics in 2017). In terms of total current assets in 2017, the share of industrial SOEs is 3.1%, the share of Chinese industrial NSOEs is 72.9%, and the share of foreign/overseas industrial enterprises is 24.0%. SOEs remain a significant employer of workers in China. In 2017, 14.3% of urban workers were employed by SOEs, 31.4% by Chinese private enterprises, 22.0% self-employed, and 6.0% by foreign/overseas enterprises.

The survey contains three indicators on company's assessment of COVID-19's impact on their business operations: (1) Estimated reduction of business activities in China in the first quarter; (2) Expected recovery of business activities by end of June; (3) Estimated adjustment of 2020 target revenue. Table 1 provides a comparison of these three indicators between the SOE sample and the NSOE sample.

[Table 1 about here]

The top part of Table 1 displays the comparison in first-quarter business reductions (denoted by FBR) measured in five levels from "Huge reduction ($\geq 80\%$)" ($FBR = 5$) to "Small reduction ($< 20\%$)" ($FBR = 1$). Based on a t-test, the hypothesis that "SOE sample mean (FBR) $<$ NSOE sample mean (FBR)" is accepted (p-value $= 0.014$). Similar results are obtained (shown in middle parts of Table 1) for expected business recovery by end of June (denoted by REC) and estimated adjustment of 2020 revenue target (denoted by REV). The hypothesis that "SOE sample mean (REC) $>$ NSOE sample mean (REC)" is accepted (p-value $= 0.006$), and the hypothesis that "SOE sample mean (REV) $<$ NSOE sample mean (REV)" is accepted (p-value $= 0.004$). Thus, in all three dimensions, SOEs fared better than NSOEs. The bottom part of Table 1 shows a comparison between the SOE sample and the NSOE sample in terms of the HR

[6]We checked the data and found no two observations showing the same answers to the survey questions on firm characteristics, so we consider it a sample of 1,182 companies.

decisions that companies had already taken in the first quarter (denoted by HR), measured in seven levels in descending order of harshness to employees from "Laid off workers" ($HR = 1$) to "Raised salary or hiring" ($HR = 7$). In our empirical estimation, we utilize this HR data, which exhibits variations seldom observed in normal times. The survey also provides data on firm's industry (20 industries classified with 10 in manufacturing and 10 in services), firm's rating of government support to the industry, share of firm's revenue generated from China, firm size measured by number of employees, and firm's client type (sell to individuals, to firms, or to both). We use these data as control variables in our regression analysis.

3 Empirical approach

In this section, we first lay out an illustrative model. Consider company i seeking profit π_i. We specify the following reduced-form equation for company i's expected profit:

$$E(\pi_i) = f(\mathbf{S}_i, \mathbf{G}_i, \mathbf{X}_i), \tag{1}$$

where we distinguish between variables of ownership-based firm behavior ($\mathbf{S}_i$), variables of ownership-related government policies ($\mathbf{G}_i$), and other firm characteristics variables ($\mathbf{X}_i$).

Our survey data provides two measures that correspond to expected profit $E(\pi_i)$. The first one is "Expected recovery by end of June" (REC_i), and the second one is "Estimated adjustment of 2020 revenue target" (REV_i). The survey classifies firms into (1) Chinese state-owned or state-holding company ($SOE_i = 1$); (2) Chinese private or private-holding company; (3) Wholly foreign-owned enterprise; (4) Joint venture with both Chinese and foreign share-holding; (5) Others. In our analysis, we combine all non-SOE type enterprises into one NSOE category ($SOE_i = 0$).[7] Ideally, we would like to estimate:

$$R_i = \Sigma_j \beta_j + \alpha_1 SOE_i + \alpha_g G_i + \sum_k (\alpha_k \mathbf{X}_{ki}) + \epsilon_i, \tag{2}$$

where R_i (either REC_i or REV_i) is the dependent variable, $\Sigma_j \beta_j$ are industry fixed effects ($j = 2, 3, ..., 19$), G_i measures government assistance firm i received or expected to receive during

[7] When distinctive dummy variables were assigned to different non-state ownership types, the regression results (available from the authors upon request) showed no statistically significant differences between the estimated coefficients of these dummy variables.

the pandemic period, α denotes coefficients, $\mathbf{X}_{ki}$ are all potential exogenous factors, and ϵ_i is an error term. By estimating equation (2), we would get an unbiased estimate of α_1 (estimated effect specific to SOEs) with firm-level government assistance (G_i) controlled for.

The key to this estimation is to find measures of firm-level government assistance (G_i). The survey asked participants to rate Chinese government's support to their industry under COVID-19 (first quarter) on a scale from 0 (lowest support) to 10 (highest support). Based on this data, we construct variable GI. Not surprisingly, the hypothesis that "SOE sample mean (GI) > NSOE sample mean (GI)" is accepted in a t-test (p-value = 0.000). The average rating of SOEs is 6.76 as opposed to 5.62 of NSOEs. Although the survey question was about government support to the *industry*, the rating from participants of the same industry varies significantly.[8] Thus, we consider GI_i a variable capturing part of government assistance to the $firm$. For our estimation, we specify the following regression equation:

$$R_i = \Sigma_j \beta_j + \alpha_1 SOE_i + \alpha_2 SIZ_i + \alpha_3 CLT_i + \alpha_4 GI_i + \alpha_5 GF_i + \sum_k (\alpha_k \mathbf{X}_{ki}) + \epsilon_i, \qquad (3)$$

where SIZ_i is firm size, CLT_i is firm's client type, GF_i is firm-specific government assistance not captured by GI_i and not related to firm size/client type, and $\mathbf{X}_{ki}$ denotes all other firm-specific factors ($k = 6, 7, ..., K$). To get an unbiased estimate of α_1, we need to meet two conditions: (i) there are measures of GF (firm-level government support) and $\mathbf{X}_k$ (all other firm-specific factors); (ii) there is no correlation between the explanatory variables and the error term.

Unmeasured firm-specific government support (GF) is not observable, but certain decisions made under the sudden and massive COVID-19 shock may reveal the impact of such government support. HR decision can be thought of as the decision that packages all types of government support and associated burdens. Government assistance comes in many forms; explicit ones (such as direct subsidy and lower loan rate) and implicit ones (such as expected future support and more purchase orders); existing ones and expected ones. For example, SOEs are known to maintain workforce and act as a safety net (Chong et al., 2011; Cooper et al., 2015; Berkowitz et al., 2017). Chong et al. (2011) found that on average 78% of the SOEs downsized their

[8]Standard deviation within industry is on average 2.57, with the logistics, transportation & storage industry exhibiting the largest variations and the business & professional services industry the most uniform. Among the 20 industries, the highest average rating is 6.85 in the medical & pharmaceutical products industry, and the lowest is 4.07 in the education industry.

labor force prior to privatization in a sample of 84 countries, implying the big role played by SOEs in supporting the government's employment goal. Thus, the firm-government relationship is a crucial driver behind personnel decisions. A more supportive HR decision signals closer ties with the state and possibly more assistance, whereas a harsher HR decision signals less net government support.

Since HR action reveals the underlying firm-government relationship, it is subject to the endogeneity issue of being possibly determined at the same time as expected performance. To mitigate the measurement errors and the potential endogeneity of HR as an explanatory variable, we use a two-stage estimation approach. In the first stage, we run a regression with HR as the dependent variable:

$$HR_i = \Sigma_j \gamma_j + \delta_s SOE_i + \delta_g GI_i + \delta_m MCH_i + \sum_k (\delta_k \mathbf{X}_{ki}) + \eta_i, \tag{4}$$

where $\Sigma_j \gamma_j$ are industry fixed effects ($j = 1, 2, ..., 19$), δ denotes coefficients, and η_i is an error term. $\mathbf{X}_k$ is a set of variables that affect firm's HR decision, which includes SIZ (firm size), CLT (firm's client type), and FBR (the underlying factors impacting firm performance as reflected in first-quarter business reduction). Variable MCH is constructed from the survey question "share of company's 2019 revenue generated from business operations in China" (five levels), which we use as an instrument variable to alleviate the potential endogeneity problem. In our survey data, MCH is positively correlated with HR (Pearson correlation coefficient = 0.062; p-value = 0.038), and is not correlated with REC (Pearson correlation coefficient = -0.025; p-value = 0.412). As the COVID-19 situation was much severer in China than abroad in the first quarter, companies with a higher share of revenue generated from China were more pressed to take quick and drastic HR measures; this explains the high correlation found in our data between the China-revenue-share variable MCH and the HR measure variable HR. However, entering March, the severity of the COVID-19 situation fell in China but raised significantly outside China, and consequently the degree of recovery expected by end of June and the degree of adjustment of revenue target estimated for the year became insensitive to the share of revenue generated from China or from outside China; this explains the lack of correlation in our data between the China-revenue-share variable MCH and the expected recovery/revenue variable

R. These two statistical features allows the China-revenue-share variable MCH to serve as an instrument variable for our estimation and correct for the correlation between HR decisions and expected future performance.

From estimating (4), we obtain the predicted value of HR (denoted by $\hat{HR}$), which we use as a proxy for unmeasured firm-specific government support (GF) in the following second-stage regression:

$$R_i = \Sigma_j \beta_j + \alpha_1 SOE_i + \alpha_2 SIZ_i + \alpha_3 CLT_i + \alpha_4 GI_i + \alpha_5 \hat{HR}_i + \epsilon_i. \quad (5)$$

To summarize, our study adopts a two-stage estimation approach. In the first stage, we estimate equation (4) to get an estimate of the unobserved determinants of firm's HR decisions under COVID-19, and we consider it as a proxy for the underlying firm-government relationship. In the second stage, we estimate equation (5) by controlling for the proxied firm-government relationship effect. With our industry-level government support measure (GI) capturing part of firm-specific government support effect, adding the proxy variable ($\hat{HR}$) helps control for the part of firm-specific government support effect not captured by GI. In this way, we hope to obtain a better estimate of the coefficient on SOE, which we interpret as associated with ownership-related firm behavior. Admittedly we are not able to resolve the omitted variable issue as $\hat{HR}$ does not capture the unmeasured underlying government support effect, and also the endogeneity and measurement error issue as this procedure relies on the assumption that HR decisions do not determine firm's expected performance. While applying this two-stage estimation approach helps reduce the concerns of these two issues, our estimation does not solve these two issues partly due to the lack of data for constructing a better proxy for the firm-government relationship effect.

4 Estimation results

Table 2 provides a description of the variables used in our regression estimation. As the survey asks multiple-choice questions, the dependent variables (REC, REV and HR) and some explanatory variables (SIZ, GI, MCH, and FBR) are ordinal variables. We also construct several dummy variables as explanatory variables (SOE and CLT).

[Table 2 about here]

Table 3 reports results from six regressions with expected business recovery by end of June (REC) as the dependent variable. In the survey question, there are five choices corresponding to five equally-divided percentage ranges. Based on the answers, we construct REC as a five-level ordinal variable, with "$REC = 1$" indicating "Smallest expected recovery (less than 20%)" and "$REC = 5$" indicates "Largest expected recovery (80% or more)". Since the survey was conducted on April 2-9, a company's REC level reflected the first-quarter impact it felt and the second-quarter situation it expected to face with regard to the COVID-19 shock.

[Table 3 about here]

Early in the data section, we performed t-tests on sample differences between SOEs and NSOEs and found that SOEs on average suffered less business reduction in the first quarter, expected better business recovery by end of June, and estimated less downward adjustment of their 2020 revenue target. In Table 3, regression (3.1) shows an estimated coefficient on SOE which is positive and statistically significant at the 5% level. As the regression includes industry fixed effects (20 industries), this result adds evidence supporting the observation that SOEs in our sample on average fared better than NSOEs in the pandemic time.

In regression (3.2), we add two firm characteristic variables (SIZ and CLT). The results show that the estimated coefficients of the two variables all have expected signs. First, the larger the firm size (SIZ), the better the expected recovery; this is explained by the fact that larger firms tend to be more able to cope with the pandemic situation. Second, firms with other firms as clients ($CLT = 1$ for "B2B only") expected better recovery than firms with (at least partly) individuals as clients ($CLT = 0$ for "B2C only" and "B2C&B2B"); this can be explained by the fact that the pandemic tends to make business recovery more difficult for firms serving individuals than for firms serving other firms.[9] Once these firm characteristics are controlled for, we find that the estimated efficient on SOE becomes statistically indifferent from zero. For SOEs and NSOEs of same industry, same client type, and similar size, they expected the same

[9]When we add a dummy variable for "B2C&B2B" to the regression, the estimated coefficient on CLT ("B2B only") is 0.304 (p-value=0.017) and that on the "B2C&B2B" dummy variable is 0.218 (p-value=0.098).

level of business recovery. Thus, the higher expected recovery of SOEs shown in regression (3.1) can be explained largely by the fact that the SOEs in our sample have on average a much larger firm size (SIZ has mean values of 4.45 for SOEs and 3.71 for NSOEs).[10]

In equation (3.3) we include GI (government support to the industry reported by firm). The estimated coefficient on GI is positive (as expected) and is significant at the 1% level. Since firm's rating of government support to its industry was based on its own situation, inclusion of GI controls for part of firm-specific government support. We find that the estimated coefficient on SOE remains statistically insignificant with this partial control of firm-specific government support effects.

In regression (3.4) we add HR measures taken by companies in the first quarter (HR) as an explanatory variable. Value of HR is in descending order of harshness of HR measures taken: Laid off workers ($HR = 1$); Cut salaries across the company ($HR = 2$); Cut salaries of staffs only ($HR = 3$); Cut salaries of senior executives only ($HR = 4$); No salary cut ($HR = 5$); No layoffs ($HR = 6$); Raised salary or raised hiring ($HR = 7$).[11] As shown in Table 2, there exist significant sample differences between the HR measures taken by SOEs and NSOEs. The estimated coefficient on HR is positive and statistically significant; firms taking harsher HR measures (lower HR) are the ones expecting less recovery (lower REC). Different degrees of harshness in HR measures reflected the underlying firm-specific forces including firm-government relationship. Thus, inclusion of HR helps control these unmeasured firm-specific effects.

To mitigate the measurement errors and the potential endogeneity of HR as an explanatory variable, we use a two-stage estimation approach. In the first stage, we run regression (4.1) and find that the estimated coefficients of all the explanatory variables are statistically significant and with expected signs.[12] Regression (4.1) reports a sufficiently large F-statistic (= 19.25), which suggests that MCH is an acceptable instrument variable (Staiger and Stock, 1997).

[10]The share of B2B firms is lower in the SOE sample (0.50) than in the NSOE sample (0.56), but the difference is statistically insignificant.

[11]Our survey questionnaire used a different order of these choices to avoid the so-called order effects in survey research.

[12]Note that HR is in descending order of harshness, or in ascending order of leniency. Our estimated results indicate that less harsh HR measured were taken by SOEs, smaller firms, and B2B firms. More lenient HR measures were taken by firms with higher China-revenue-share (MCH), firms giving higher rating ro government support to their industry (GI), and firms who suffered less business reduction in the first quarter (FBR).

From regression (4.1) we obtain the predicted value $\hat{HR}$ and use it as an explanatory variable in the regression on expected business recovery. The results, shown in regression (3.5) of Table 3, indicate a positive estimated coefficient on $\hat{HR}$ that is statistically significant at the 1% level. When $\hat{HR}$ is controlled for, the estimated coefficient on SOE becomes *negative* and statistically significant at the 1% level. Notice that the estimated coefficient on GI becomes statistically insignificant, suggesting that its effect has been absorbed by the estimated effect of $\hat{HR}$.[13]

Our main finding from the two-stage estimation is that, unlike initially appeared (in regressions (3.1) to (3.4)), SOEs had *lower* expected business recovery (REC) than NSOEs once a sufficient amount of unmeasured firm-specific factors (captured by $\hat{HR}$) are controlled for. In an oversimplified scenario where government policy is the dominant underlying factor behind $\hat{HR}$, a positive estimated coefficient on $\hat{HR}$ indicates the effect of more government support to SOEs improving their expected recovery from the pandemic shock, and a negative estimated coefficient on SOE indicates the effect derived from SOEs' innate behavior lowering their expected recovery from the pandemic shock. While this interpretation is admittedly an over-stretch of our estimation results, it is a useful first attempt to separate the effect of the innate behavior of SOEs from the government-support effect in empirical research that compares SOEs and NSOEs. After applying various robustness tests, we find that this result holds. Regression (3.6) shows results from dropping financial firms.[14] Regressions in Table 5 show results from using REV (estimated adjustment of 2020 revenue target) as the dependent variable, with regression (5.6) also using only the non-financial-firm sample. In all these regressions, we find that SOEs on average had worse performance than NSOEs when government support measures (GI and $\hat{HR}$) are controlled for.

[13]The B2B dummy variable (CLT) is marginally significant and negative, suggesting that its effect has been (overly) absorbed by the estimated effect of $\hat{HR}$. The Pearson correlation coefficient between CLT and $\hat{H}$ is 0.322 with p-value = 0.000.

[14]In our survey sample, 154 firms (13.0%) are in the financial services industry, out of which 47 are SOEs. A major characteristic of China's financial system is the high level of state ownership and control (Gordon and Li, 2003). The five largest Chinese commercial banks are majority-owned by the central government and there are significant government stakes in many of the other banks. Further, the government intervenes far more actively in banking decisions than in the West, for example, the central bank often sets target levels for loan volumes and the government can exert considerable influence to push loans to particular firms, sectors, or regions. Due to its reputation of having a "soft" budget constraint, low efficiency, and being less market-driven, we drop the financial services firms in our sample to perform a robustness test of our findings. The non-financial-firm sample features 1,017 firms, among which 66 are SOEs, 53.4% in manufacturing and 46.6% in non-financial services.

5 Summary and Conclusion

SOEs and NSOEs differ in multiple dimensions, which fall into two broad categories. The first category is firm-government relationship. In general, SOEs receive more support from the government but bear more burdens imposed by the government. The second category is firm behavior. In general, SOEs are less driven by market signals. For studies aiming at finding if SOEs and NSOEs behave differently, it is crucial to distinguish between influences from these two categories. In the literature, many studies estimated the SOE-NSOE difference using financial performance measures, and the results were largely mixed. As a company's financial performance depends both on its reaction to market signals and on its relationship with the government, it is hardly surprising to find mixed results on the SOE-NSOE difference in financial performance as the influences from the two broad categories may cancel each other, yielding a net effect that is negative, zero or positive, depending on the given scenario.

Firm-level government policy data is hard to come by. Without controlling for firm-specific government support, one cannot interpret the observed/estimated SOE-NSOE performance difference as necessarily reflecting their ownership-based behavioral difference. This paper is an attempt to tackle this issue. We use data from an online survey of 1,182 company executives in China conducted in early April. It is widely known that China was most severely hit by the COVID-19 shock in the first quarter of 2020. The shock was sudden and massive, causing companies in China to take measures that would not be observed in normal times. We believe that the drastic measures taken by companies in response to the COVID-19 shock contain information on underlying firm-specific influences including the influence of government policies. We use a two-stage estimation approach to first extract the information, and then utilize it for estimating the SOE-NSOE difference associated with their ownership-based behavioral difference.

The main finding of this paper is that, despite the seemingly superior performance of SOEs over NSOEs as shown in the raw data as well as in some preliminary regressions, SOEs on average performed significantly worse than NSOEs once we control for a sufficient amount of underlying differences in government support (which is captured by firm's rating of government support to their industry and the predicted degree of harshness in personnel actions taken by firms

which proxies for some unmeasured firm-specific effects). This result is found robust when the estimation is applied to the non-financial-firm sample and an alternative performance measure.

Our study is limited in several aspects. First, with survey data, the variables are ordinal measured with integer values; thus they are rather crude compared with continuous variables. Second, despite the care taken in constructing the proxy for unobserved firm-specific government policy factors, we cannot be certain if it captures the underlying firm-government relationship that is crucial for the identification of the ownership-based firm behavior effect; correlation between the SOE dummy variable and the proxy variable may contaminate the identification of their distinctive effects. Last but not least, limited by the small number of questions and the anonymity nature of the survey, our estimation is subject to the omitted variable issue. Given these limitations, our results should be interpreted with caution. Nevertheless, our study is useful in drawing the distinction between firm performance derived from firm-government relationship and firm performance derived from ownership-based firm behavior, which sets the right direction for future research.

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Table 1

COVID-19's Impact and Company Responses: SOEs vs. NSOEs

Level	Impact on first-quarter business activities (FBR) (in ascending order of business reduction)	SOE sample	NSOE sample
1	Small reduction (<20%)	37.5%(N=42)	26.6%(N=283)
2	Medium reduction (20-39%)	25.9%(N=29)	25.1%(N=267)
3	Large reduction (40-59%)	15.2%(N=17)	18.7%(N=199)
4	Extra-large reduction (60-79%)	6.3%(N=7)	11.8%(N=125)
5	Huge reduction (≥80%)	11.6%(N=13)	12.5%(N=133)
Level	Expected recovery by end of June 2020 (REC) (in ascending order of expected recovery)	SOE sample	NSOE sample
1	Small recovery (<20%)	3.5%(N=4)	6.5%(N=70)
2	Medium recovery (20-39%)	4.4%(N=5)	7.6%(N=81)
3	Large recovery (40-59%)	12.4%(N=14)	12.1%(N=129)
4	Extra-large recovery (60-79%)	15.9%(N=18)	23.4% (N=250)
5	Huge recovery (≥80%)	57.5%(N=65)	43.0% (N=460)
Level	Estimated adjustment of 2020 revenue target (REV) (in descending order of downward adjustment)	SOE sample	NSOE sample
1	Large downward adjustment (≥20%)	23.9%(N=27)	33.7%(N=360)
2	Medium downward adjustment (10-19%)	15.0%(N=17)	20.0%(N=214)
3	Small downward adjustment (3-9%)	8.0%(N=9)	8.4%(N=90)
4	Little/no adjustment (<3%)	46.9%(N=53)	31.1%(N=332)
5	Small upward adjustment (3-9%)	1.8%(N=2)	1.2%(N=13)
6	Medium/large upward adjustment (≥10%)	4.4%(N=5)	5.1%(N=55)
Level	Salary/personnel actions already taken (HR) (in descending order of harshness to employees)	SOE sample	NSOE sample
1	Laid off workers	3.5%(N=4)	18.2%(N=195)
2	Cut salaries across the company	4.4%(N=5)	12.4%(N=133)
3	Cut salaries of staff only	0.0%(N=0)	0.7%(N=8)
4	Cut salaries of senior executives only	6.2%(N=7)	11.4%(N=122)
5	No salary cut	67.3%(N=76)	53.4%(N=571)
6	No layoffs	87.6%(N=99)	64.7%(N=692)
7	Raised salary or raised hiring	0.9% (N=1)	1.6%(N=17)

Table 2
Description of Variables

Variable	Description	Type and value	Mean	Stdev
FBR	Business reduction in first quarter	Ordinal variable (5 levels) Smallest (=1) to Largest (=5).	2.53	1.36
REC	Expected recovery by end of June	Ordinal variable (5 levels): Smallest (=1) to Largest (=5).	3.99	1.24
REV	Adjustment of 2020 revenue target	Ordinal variable (6 levels) Large downward (=1) to Medium/large upward (=6).	2.60	1.50
SOE	Firm ownership (SOE vs. NSOE)	Dummy variable: $SOE = 1$ for SOEs; $SOE = 0$ for NSOEs.	0.10	0.29
SIZ	Firm size (number of employees)	Ordinal variable (7 levels) Smallest (=1) to Largest (=7).	3.78	1.41
CLT	Firm's client type	Dummy variable: $CLT = 1$ if B2B only; $CLT = 0$ otherwise.	0.55	0.50
GI	Government support to industry	Ordinal variable (10 levels) Lowest (=0) to Highest (=10).	5.72	2.63
HR	HR measures taken in first quarter (in descending order of harshness)	Ordinal variable (7 levels) Laid off workers (=1) Sizable increase in hiring (=7).	3.60	1.43
MCH	Share of 2019 revenue from China	Ordinal variable (5 levels) Highest (=1) to Lowest (=5).	2.33	1.48

Table 3 Expected Business Recovery by end of June

	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)	(3.6)
SOE	0.284**	0.159	0.058	-0.046	-0.696***	-0.996***
	(0.121)	(0.123)	(0.129)	(0.129)	(0.146)	(0.174)
SIZ		0.166***	0.140***	0.141***	0.146***	0.170***
		(0.027)	(0.028)	(0.027)	(0.027)	(0.027)
CLT		0.158*	0.142*	0.116	-0.157*	-0.106
		(0.084)	(0.085)	(0.083)	(0.087)	(0.092)
GI			0.093***	0.084***	-0.004	-0.016
			(0.016)	(0.016)	(0.018)	(0.020)
HR				0.190***		
				(0.028)		
$\hat{HR}$					1.316***	1.279***
					(0.119)	(0.124)
Constant	3.962***	3.256***	2.841***	2.075***	-2.125***	-1.943***
	(0.039)	(0.132)	(0.152)	(0.185)	(0.472)	(0.473)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations (N)	1,088	1,088	1,012	978	931	810
R-squared (R^2)	0.078	0.110	0.152	0.201	0.273	0.288

Notes: The dependent variable is REC. $\hat{HR}$ is the predicted value of HR of the regressions displayed in Table 4, with (3.5) using (4.1) and (3.6) using (4.2). See Table 2 for description of variables. Numbers in parentheses are heteroscedasticity-corrected standard errors. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 4 Human Resources Measures Taken in the First Quarter

	(4.1)	(4.2)
SOE	0.595***	0.700***
	(0.114)	(0.138)
SIZ	-0.068**	-0.066**
	(0.034)	(0.039)
CLT	0.199**	0.149
	(0.097)	(0.108)
GI	0.056***	0.068***
	(0.019)	(0.021)
MCH	0.072**	0.072**
	(0.033)	(0.036)
FBR	-0.239***	-0.238***
	(0.036)	(0.039)
Constant	4.564***	4.460***
	(0.214)	(0.247)
Industry fixed effects	Yes	Yes
Observations (N)	988	862
F-statistic (F)	19.25	16.85
R-squared (R^2)	0.128	0.120

Notes: The dependent variable is HR. See Table 2 for description of variables. Numbers in parentheses are heteroscedasticity-corrected standard errors. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 5 Estimated Adjustment of 2020 Revenue Target

	(5.1)	(5.2)	(5.3)	(5.4)	(5.5)	(5.6)
SOE	0.387***	0.316**	0.232	0.115	-0.415**	-0.763***
	(0.142)	(0.144)	(0.152)	(0.151)	(0.172)	(0.218)
SIZ		0.090***	0.055	0.060*	0.088***	0.123***
		(0.032)	(0.034)	(0.034)	(0.033)	(0.036)
CLT		0.140	0.097	0.028	-0.167	-0.115
		(0.099)	(0.102)	(0.101)	(0.104)	(0.111)
GI			0.091***	0.080***	-0.001	-0.008
			(0.019)	(0.018)	(0.021)	(0.024)
HR				0.198***		
				(0.031)		
$\hat{HR}$					1.216***	1.174***
					(0.138)	(0.147)
Constant	2.613***	2.204***	1.835***	1.048***	-2.902***	-2.817***
	(0.045)	(0.154)	(0.174)	(0.201)	(0.533)	(0.552)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations (N)	1,167	1,167	1,080	1,043	986	860
R-squared (R^2)	0.064	0.071	0.095	0.136	0.183	0.174

Notes: The dependent variable is REV. $\hat{HR}$ is the predicted value of HR of the regressions displayed in Table 4, with (5.5) using (4.1) and (5.6) using (4.2). See Table 2 for description of the other variables. Numbers in parentheses are heteroscedasticity-corrected standard errors. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.