Assessing the asymmetric cost behavior in China

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Abstract

Purpose – A country's institutional environment influences every facet of its business. This paper aims to identify institutional factors (state ownership, government attention on employment and employees' educational background) that affect the asymmetric cost behavior in China.

Design/methodology/approach – Using 2,570 listed firms' data between 2002 and 2015, we use empirical models to explore the effects of state ownership, government attention on employment and employees' educational background on the asymmetric cost behavior in China.

Findings – This study found that the asymmetric cost behavior of central state-owned enterprises (CSOEs) is greater than local state-owned enterprises (LSOEs). Meanwhile, the empirical results show that government attention on employment is reflected in five-year government plans, and employees' educational backgrounds are positively associated with asymmetric cost behavior.

Originality/value – This study contributes to the economic theory of sticky costs, institutional theory and asymmetric cost behavior literature by providing evidence that shows how government intervention and employee educational background limit the flexibility of corporate cost adjustments. Additionally, this study provides guidance to policymakers by showing how government long-term plans affect firm-level resource adjustment decisions.

Keywords Asymmetric cost behavior, Government intervention, Skilled labor

Paper type Research paper

1. Introduction

This study investigates how institutional features in China affect companies' deliberate resource adjustment decisions. We specifically focus on state ownership, government attention on employment, and employees' educational background to evaluate how these institutional factors influence Chinese companies' cost structure. Asymmetric cost behavior theorizes and predicts that selling, general, and administrative (SG&A) costs increase more in response to sales increase than the costs decrease coincident with sales decline by the equivalent volume (Anderson *et al.*, 2003). This asymmetric cost behavior results from managers' leverage between adjustment costs (such as severance payments

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incurred from compensating dismissed employees, training new staff, or disposal of underutilized assets) and benefits saved from cost shrinkage and payments (Anderson *et al.*, 2003), incentives to achieve earnings targets (Kama and Weiss, 2013), self-interest maximization (Roychowdhury, 2006), employment protection environment (Banker *et al.*, 2013), and financial constraints (Chen and Ma, 2021).

As costs constitute a foundational determinant of earnings, a comprehensive grasp of cost behavior has the potential to yield valuable insights into various facets of financial accounting. These encompass areas such as the assessment of earnings quality, the prediction of earnings, the detection of earnings manipulation, and the accuracy of analysts' earnings forecasts—all of which hinge on the understanding or projection of earnings over time. Asymmetric cost behavior represents a novel perspective on the concept of cost behavior, which underscores the explicit recognition of deliberate managerial decisions in shaping short-term cost behavior. In addition to earnings and empire-building incentives identified by prior literature, we speculate China's central and local governments' deep bonding with CSOEs and LSOEs as well as the government attention to employment and employees' educational background are potential drivers of asymmetric cost behavior. Understanding government intervention and cost adjustments in Chinese companies can aid information users and policymakers in gaining a better grasp of resource allocation, earnings management, earnings forecasts, and the determinants of decision-making within Chinese companies.

Our study proposes that state ownership, government attention to employment, and employees' educational background are three additional factors that strengthen the asymmetric cost behavior in China. In our sample, about 43% of Chinese listed companies are state-owned enterprises (SOEs). About one-third of these SOEs are central state-owned enterprises (CSOEs); and the rest of the SOEs are local state-owned enterprises (LSOEs). Understanding and comparing cost adjustments between central state-owned enterprises (CSOEs) and local state-owned enterprises (LSOEs) in China is crucial as it sheds light on the dynamics of China's state-owned sector and its implications for the overall economy. Specifically, CSOEs play distinct roles as large SOEs operating in sectors vital to the nation's economy and homeland security. The size of CSOEs has a substantial influence on China's economy, with their total assets reaching approximately $1tn by the end of 2002. CSOEs have limited authority over the disposal of state-owned assets and offer stable job positions and generous compensation. Additionally, CSOEs are under stricter supervision. Prior studies have presented mixed evidence on the operational efficiency of SOEs, but little evidence has been provided regarding the distinction between CSOEs and LSOEs. Our study aims to bridge this gap and assist policymakers and financial information users in gaining a better understanding of the differences between CSOEs and LSOEs concerning the flexibility, limitations, and goals of resource adjustments.

In addition, listed companies are required to follow the national five-year plans and respond to periodic government targets (such as stabilizing the employment rate and booming education and technology industry development) to obtain financial assistance from governments or state-owned banks. Ignoring the effect of state governments' plans on corporate resource adjustments would distort our understanding of accounting information and firm performance. We conjecture that greater government attention on employment, as represented in five-year plans, brings additional job opportunities (Schramm, 2015) and better employment protection. Accordingly, we posit that government attention on employment slows down the downside resource adjustments, leading to a greater degree of cost stickiness [1].

Another institutional factor studied in this paper is the availability of skilled labor, which constitutes the majority of adjustment costs such as wages, hiring costs, firing costs, and

training costs (Dierynck *et al.*, 2012). The availability of skilled labor is a key competitive factor for companies, affecting their ability to substitute workers easily. In this study, we use the academic degree of employees as a proxy for labor-related adjustment costs and hypothesize that managers are more likely to slow down the reduction of employees with bachelor's degrees or higher in comparison to employees who have lower academic degrees, raising the degree of cost stickiness.

We modified the model of Banker and Byzalov (2014) by adding additional measures for state ownership and government attention on employment and employee educational background. Specifically, we define a company as a COEs (LSOEs), if it is controlled by the State Asset Regulatory Commission (local governments). Meanwhile, we use the log-change of "employment" and "job position" in Chinese five-year plans to measure government attention on employment, and use the log-ratio of employees with college or higher degrees to total sales revenue to measure employees' educational background. Using sample of Chinese listed firms from 2002 to 2015 to, we provide empirical evidence showing that (1) SG&A costs of CSOEs are stickier than that of LSOEs; (2) greater government attention on employment in five-year plans leads to a greater degree of cost stickiness; and (3) a higher proportion of employees with bachelor's or higher academic degrees is associated with a higher level of cost stickiness. This study contributes to the cost stickiness literature in at least four ways. First, we extend asymmetric cost behavior literature by testing additional institutional environment factors that enhance the level of cost stickiness. Prior literature (Banker *et al.*, 2013) found that a strict legal environment provides better employment protection and enhances the level of cost stickiness. Building on this study, we provide evidence for three additional institutional factors (state ownership, government attention on employment, and employees' educational background) that strengthen the asymmetric cost behavior. Second, this study enriches the government intervention literature by distinguishing state ownership into CSOEs and LSOEs and using it as a proxy for different levels of government intervention. This extends prior discussions between SOEs and non-SOEs and emphasizes the role of the central government. Third, this study highlights the influence of government long-term plans on firms' resource adjustment decisions. Government long-term plans reflect the government's goals, plans, attentions, and priorities. To our best knowledge, this study is the first paper testing the effects of government long-term plans on corporate cost structure. Finally, our study contributes to prior literature about adjustment costs of skilled labor (Dierynck *et al.*, 2012) by using employees' educational background as a proxy for the adjustment costs of skilled labor. The empirical results validate that companies are more likely to maintain skilled labor when sales decrease.

This study proceeds as follows: Section 2 reviews the related literature and describes the development of the hypotheses; Section 3 demonstrates the methodology and research design; Section 4 describes the empirical results; and Section 5 concludes this study.

2. Hypotheses development

2.1 The origin and economic theory of cost stickiness

Sticky costs represent asymmetric cost behavior, demonstrating that costs increase when sales increase is greater than costs decrease for the equivalent amount of sales decrease (Anderson *et al.*, 2003). This asymmetric cost behavior is caused by the optional resource commitment decisions considering adjustment costs. To make optimal resource commitment decisions, managers leverage the potential savings from resource adjustments, taking into account adjustment costs. This concept is often referred to as the "economic theory of sticky costs" (Banker *et al.*, 2013). In addition, managerial expectations for future sales are identified

as another cause of asymmetric cost behavior (Banker *et al.*, 2014). Managers with optimistic expectations of sales often accelerate cost increases in response to rising sales and slow down cost reduction in response to falling sales, strengthening asymmetric cost behavior. In contrast, managers with pessimistic expectations of sales are reluctant to add additional resources when sales increase and are more likely to dispose of idle resources when sales decrease, weakening asymmetric cost behavior. Additionally, managers who intend to achieve "empire building" and maximize resources under their control are less likely to shrink resources when sales decrease (Anderson *et al.*, 2003). On the contrary, managers who have incentives to avoid loss or reach earnings targets are more likely to reduce underutilized resources, raising the degree of cost stickiness (Kama and Weiss, 2013). In addition, stricter employment protection is associated with a higher degree of cost stickiness. Stricter employment protection represents greater labor-related adjustment costs (such as firing costs) faced by companies (Banker *et al.*, 2013). To avoid incurring adjustment costs that accompany resource reduction, companies operating in a stricter employment protection environment tend to retain underutilized resources when sales decrease, which reinforces asymmetric cost behavior.

2.2 State ownership

China boasts a substantial number of state-owned enterprises (SOEs) spanning various sectors, including energy, telecommunications, and finance. These companies play a pivotal role in China's economy. State ownership in China confers specific advantages upon SOEs, including tax benefits (Faccio, 2010), direct financial support from banks (Dinc, 2005), easy access to capital (Cheng *et al.*, 2018), a lower cost of equity capital (Feng *et al.*, 2020), reduced cost of debt (Chaney *et al.*, 2011), and protection against delisting (Jian and Wong, 2010) or financial distress (Faccio, 2006). However, SOEs' hierarchical structure decreases operational efficiency. For instance, economic theories suggest that SOEs primarily serve public goods, which could be prone to overconsumption and associated policy burdens. Consequently, SOEs commonly face agency problems arising from the divergence of interests between their controlling shareholder (the state) and minority shareholders. Due to government intervention, SOEs are expected to fulfill the social and political objectives of governments at the expense of firms, resulting in decreased firm values (Shleifer and Vishny, 2002). Moreover, government control gives rise to a series of issues, such as excessive compensation for managers, overstaffing, inefficient resource allocation, and government pet projects, all of which lower the efficiency of companies. This phenomenon is often referred to as the "grabbing hand" theory (Shleifer and Vishny, 2002). Additionally, the hierarchical structure inherent in SOEs often leads to heightened information asymmetry between decision-makers (the state) and the individuals responsible for daily operations (managers). These factors collectively contribute to the economic conclusion of diminished operational efficiency. Furthermore, the government intervenes in corporate decisions through various means, such as appointing politically connected CEOs and board members and retaining the authority to make final decisions regarding mergers, acquisitions, asset disposal, and share allocation (Fan *et al.*, 2007). Empirical evidence provided by Bu *et al.* (2015) suggests that government intervention results in a higher degree of cost stickiness for SOEs compared to non-state-owned enterprises (non-SOEs). We build upon their study by conducting a further comparison of cost stickiness between CSOEs and LSOEs.

CSOEs are significant state-owned enterprises operating in sectors deemed critical to the nation's economic well-being and national security, including industries such as infrastructure construction and the extraction of natural resources. The magnitude of CSOEs exerts a profound impact on China's economic landscape. The State Asset Regulatory

Authority, serving as the ultimate proprietor of CSOEs, directly communicates with the State Council. LSOEs are smaller SOEs in less important sectors, controlled by local governments. CSOEs offer better job security and magnanimous compensation. However, the operational efficiency of CSOEs can be influenced by limitations on the disposal of sensitive assets, responsibilities related to providing public goods, stricter supervision from the central government, and more complex reporting processes. For example, as the government seeks to fulfill its political objectives through initial public offerings (IPOs), SOEs often experience underpricing compared to non-SOEs (Jones *et al.*, 1999), and CSOEs, in particular, face a greater degree of underpricing (Chen *et al.*, 2015). Furthermore, CSOEs benefit from lower financing costs. Bonds issued by CSOEs receive higher credit ratings, and the yields on CSOEs' bonds are approximately 16 basis points lower than those issued by LSOEs (Livingston *et al.*, 2018).

As demonstrated in the study of Banker *et al.* (2013), a stricter employment protection environment leads to increased firing costs, which constitute a significant portion of downward adjustment costs. As these downward adjustment costs rise, companies tend to retain underutilized resources to avoid incurring such costs. They make optimal decisions by considering the trade-off between the adjustment costs related to firing and hiring marginal workers and the net present value of cash flows generated by an employee during their tenure with the firm. Using the employment protection legislation (EPL) index of each country (developed by the OECD-IDB database) as a proxy for firing costs, Banker *et al.* (2013) find that stricter country-level EPL provisions are associated with a greater degree of cost stickiness. We leverage this literature in developing our hypothesis. With the support of the central government, CSOEs operate within crucial sectors like nuclear energy, aerospace, electricity, railway, and telecommunications. Many of these sectors require employees with specialized skills and higher educational backgrounds, which are associated with higher firing costs. Furthermore, CSOEs are tasked with fulfilling government plans, such as ensuring an adequate supply of natural resources and food, stabilizing the prices of these supplies, creating job opportunities, and fostering national economic development. These factors increase the likelihood of CSOEs retaining unused resources. With substantial financial support, employment positions at CSOEs are generally taken as life-long positions in China, implicitly resulting in higher adjustment costs. Furthermore, CSOEs are subject to more stringent supervision and oversight by central government departments, such as the National Audit Office, compared to LSOEs. This heightened government scrutiny leads to stricter enforcement of laws and regulations, which in turn provides greater protections for employees and restricts managers' flexibility in asset disposal. Following the study of Banker *et al.* (2013), we hypothesize that the asymmetric cost behavior of CSOEs is greater than that of LSOEs, as CSOEs face higher adjustment costs:

H1. SG&A costs of CSOEs are stickier than those of LSOEs in China.

2.3 China's five-year plans

China's five-year plans are one of the most important long-term plans in China. China's government has been making five-year plans since 1952 and there are 13 five-year plans in total between 1952 and 2020. Five-year plans clarify government targets and budgetary policies for the next five years based on the social and economic situations of that period. It affects all of the key economic institutions, such as the People's Bank of China, and provincial and rural institutions. Accordingly, local governments make their yearly plans and develop strategies based on the five-year plans. They are also required to regularly report their progress on completing the five-year plans. Companies and banks will also adjust their plans and strategies based on five-year plans in China (The Economist, 2015).

With the development of the economy, China's government has continually adjusted the priorities of long-term targets. It started turning its attention from poverty issues to employment welfare since the 10th five-year plan. Specifically, the words "employment" and "job position" have shown up more frequently. These words showed up 7 times in the 9th five-year plan, 13 times in the 10th five-year plan, and 46 times in the 12th five-year plan. For example, the goals of the 10th five-year plan include "increase the number of urban employees and control registered urban unemployment rates at 5% level". The 11th five-year plan aims to "create 45 million new jobs for urban residents in five years; transfer 45 million rural labors to non-agriculture sectors in five years; and keep the urban registered unemployment rate under 5%." To achieve government targets, substantive resources will be allocated to targeted industries and areas demonstrated in the five-year plans (Chen *et al.*, 2017). For example, as the government shows greater attention to employment (mentioned "employment" and "work positions" 46 times) in the 12th five-year plan (for the period 2011–2015), the central government invested 43.6 billion RMB in employment assistance and job creation in 2011 (The National People's Congress of the People's Republic of China, 2011). After local governments receive financial support from the central government, they will decide the amount of compensation they would offer for each newly created position based on the living expense of the local area to encourage companies to create new employee positions.

In addition to financial support, greater government attention on employment also means stricter government supervision over the implementation of related regulations, which creates a stricter employment protection environment. As demonstrated in Banker, Byzalov, and Chen's study (2013), a stricter employment protection environment incurred higher firing costs, which slowed down the downward resource adjustments and enhanced the degree of cost stickiness. We leverage this study both in formulating our empirical predictions and in identifying the appropriate empirical measures of government attention on employment. We hypothesize that greater government attention to employment would provide a stricter legal environment and better legal protections to employees, thereby increasing the firing costs and the level of cost stickiness.

H2. Greater government attention to employment as reflected in China's five-year plans is associated with a greater degree of cost stickiness.

2.4 Effects of employees' educational level on sticky costs

Many resources are neither fixed nor variable, such as skilled labor or training costs (Anderson *et al.*, 2003). Balakrishnan and Gruca (2008) found that adjustment costs are higher in departments with core competencies, such as direct patient care, than in other departments associated with support services, such as the administrative department. They argued that core departments need specialized support from skilled employees (such as technicians, physicians, and nurses), and these human assets are difficult to adjust in the short term following a fluctuation in demand. Meanwhile, these core departments need support from sophisticated equipment, such as intensive care units and operating rooms, which is difficult to reduce quickly. However, the low-skilled employees of support departments, such as laundry and dietetics, are less expensive to adjust. Additionally, in contrast to low-skilled workers, who face a higher risk of displacement by machines following the adoption of AI (Acemoglu and Restrepo, 2018), highly skilled employees exhibit greater resilience to the changes brought about by this technological transformation (Wang and Qiu, 2023). Valuing the contribution of skilled labor, companies offer generous compensations to attract and retain skilled workers, such are more profitable retirement plans (Kuiate and Noland, 2019).

Adjustment costs are associated with employment fluctuations (Rouxelin *et al.*, 2018). Companies are less likely to fire skilled labors as they are connected with higher hiring and firing costs than manual labor occupations (Golden *et al.*, 2020), which inncreases cost stickiness (Banker *et al.*, 2013). Supporting this notion, Prabowo *et al.* (2018) offer empirical evidence indicating that State-owned enterprises (SOEs), typically operating in strategic sectors requiring a higher caliber of labor, tend to exhibit increased cost rigidity. We draw upon similar insights to formulate our predictions. Given that skilled labor is expected to entail higher firing and hiring costs and undergo less frequent adjustments (Anderson, 1993), we hypothesize that a higher proportion of skilled labor would reinforce asymmetric cost behavior. Although assessing skill levels directly can be challenging, we adopt a more specific approach by utilizing the level of education, a widely used proxy in econometric literature (Lee, 2010). By employing the proportion of employees with higher educational degrees as a proxy for skilled labor, we introduce our third hypothesis as follows:

H3. A higher proportion of employees with college or higher education degrees is associated with a higher level of cost stickiness.

3. Research methodology

3.1 Sample selection and descriptive data

We use data from CSMAR for non-financial firms from 2000 to 2015 [2]. We deflate all financial data using country-specific GDP deflators [3] to control inflation. We discard invalid observations with missing or non-positive values for sales and SG&A costs in the current year and two preceding years. We also discard invalid observations if SG&A costs are higher than the contemporary sales revenue. We winsorize 1% outliers in each tail for continuous financial variables included in the regression models. The final sample includes 22,626 observations for 2,570 Chinese firms. To test hypothesis 1, we use the classifications of corporate ownership characteristics from WIND Infor [4]. WIND classified a company as CSOE if its largest shareholder is SASAC. WIND classified a company as LSOE if its largest shareholder is one of the local governments. Other companies are classified as non-SOEs. We download the Chinese five-year plans from the News of the Communist Party of China website to examine hypothesis 2. For hypothesis 3, we collect the education degrees of employees of Chinese companies from WIND Infor. Since the educational degrees of employees of Chinese companies were not available prior to 2011, the sample for the last hypothesis includes 10,672 observations from 2011 to 2015. The variable definitions are presented in table 1 (available online at: https://drive.google.com/drive/folders/1TREx-ftp-7m0PO347vMPJWls2zago1NP). The sample selection is presented in table 2 (available online at: https://drive.google.com/drive/folders/1TREx-ftp-7m0PO347vMPJWls2zago1NP). The univariate sample statistics, correlation matrix, and the distribution of CSOEs, LSOEs, and non-SOEs are tabulated in table 3 (available online at: https://drive.google.com/drive/folders/1TREx-ftp-7m0PO347vMPJWls2zago1NP), table 4 (available online at: https://drive.google.com/drive/folders/1TREx-ftp-7m0PO347vMPJWls2zago1NP), and table 9 (available online at: https://drive.google.com/drive/folders/1TREx-ftp-7m0PO347vMPJWls2zago1NP). During the sample period, 33.8% of Chinese firms went through sales decreases. Of the 2,570 listed Chinese firms included in this study, about half of them (43%) are finally controlled by the Chinese government, while around one-third of these state-owned enterprises are owned by the central government, and the rest of them are owned by local governments.

3.2 Empirical models

To examine hypothesis 1, we extended the empirical model identified by Banker and Byzalov (2014) and applied dummy variables of $CSOE_{i,t}$ and $LSOE_{i,t}$ to distinguish central-state-owned enterprises and local-government-owned enterprises. The extended model is:

$$\begin{aligned}\Delta ln\, SGA_{i,t} = {} & \beta_0 + (\beta_1 + \varphi_1 CSOE_{i,t} + \sigma_1 LSOE_{i,t} + \gamma_1 AINT_{i,t} + \zeta_1 GDP_t \\ & + \theta_1 EINT_{i,t})\Delta ln\, REV_{i,t} + (\beta_2 + \varphi_2 CSOE_{i,t} + \sigma_2 LSOE_{i,t} + \eta_1 SUC_{i,t} \\ & + \gamma_2 AINT_{i,t} + \zeta_2 GDP_t + \theta_2 EINT_{i,t})\, DEC_{i,t}\Delta ln\, REV_{i,t} + \varphi_3 CSOE_{i,t} \\ & + \sigma_3 LSOE_{i,t} + \eta_2 SUC_{i,t} + \gamma_3 AINT_{i,t} + \zeta_3 GDP_t + \theta_3 EINT_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (1)$$

Where $\Delta ln\, SGA_{i,t}$ is the log-change in selling, general, and administrative costs, $\Delta ln\, REV_{i,t}$ is the log-change in sales revenue, $DEC_{i,t}$ is the decrease dummy that equals one when sales decrease in year t and zero otherwise, $\varepsilon_{i,t}$ is the error term with a mean of zero and independent to explanatory variables. We also add control variables identified in the study of Anderson *et al.* (2003) and later studies. $CSOE_{1,t}$ is the government ownership dummy that takes one for central-state owned enterprises and zero otherwise, $LSOE_{1,t}$ is the government ownership dummy that takes one for local-state owned enterprises and zero otherwise, $AINT_{i,t}$, GDP_t, $SUC_{i,t}$, and $EINT_{i,t}$ are control variables from model (1), $\varepsilon_{1,t}$ is the error term, and $\varepsilon_{i,t}$ is the error term with a mean of zero and independent to explanatory variables. Following Banker *et al.* (2013) and Kama and Weiss (2013), the random shocks may be correlated within firms and cross-firms in this hierarchical linear model. We cluster observations by firm (Petersen, 2009) for all regression models to provide standard errors that are robust to autocorrelation and heteroscedasticity [5]. The first hypothesis implies that (1) $\varphi_2 < 0$ and $\sigma_2 < 0$, and (2) $\varphi_2 < \sigma_2$.

To test hypothesis 2, we add an interaction variable between the proxy of government attention to employment reported on the five-year plan and resource adjustment measurements. The estimated regression model is:

$$\begin{aligned}\Delta ln\, SGA_{i,t} = {} & \beta_0 + (\beta_1 + \mu_1 Plan_i + \varphi_1 CSOE_{i,t} + \sigma_1 LSOE_{i,t} + \gamma_1 AINT_{i,t} + \zeta_1 GDP_t \\ & + \theta_1 EINT_{i,t})\Delta ln\, REV_{i,t} + (\beta_2 + \mu_2 Plan_i + \varphi_2\, CSOE_{i,t} + \sigma_2 LSOE_{i,t} \\ & + \eta_1 SUC_{i,t} + \gamma_2 AINT_{i,t} + \zeta_2 GDP_t + \theta_2 EINT_{i,t})\, DEC_{i,t}\Delta ln\, REV_{i,t} + \mu_3 Plan_1 \\ & + \varphi_3 CSOE_{i,t} + \sigma_3 LSOE_{i,t} + \eta_2 SUC_{i,t} + \gamma_3 AINT_{i,t} + \zeta_3 GDP_t + \theta_3 EINT_{i,t} \\ & + \varepsilon_{i,t} \end{aligned} \quad (2)$$

Where $Plan_i$ is the log-change of numbers of "employment" and "job position" in the Chinese five-year plans. Hypothesis three implied $\mu_2 < 0$.

Hypothesis 3 proposes a positive relationship between the educational background of employees and the level of cost stickiness. We add interactions between the educational background of employees ($DEGREE_{i,t}$) and measurements of resource adjustments in both upward and downward directions ($\Delta ln\, REV_{i,t}$ and $DEC_{i,t}\Delta ln\, REV_{i,t}$) [6].

$$\begin{aligned}\Delta ln\, SGA_{i,t} = \beta_0 + \big(\beta_1 + \mu_1 DEGREE_{i,t} + \varphi_1 CSOE_{i,t} + \sigma_1 LSOE_{i,t} + \gamma_1 AINT_{i,t} + \zeta_1 GDP_t \\ + \theta_1 EINT_{i,t}\big)\Delta ln\, REV_{i,t} + (\beta_2 + \mu_2 DEGREE_{i,t} + \varphi_2 CSOE_{i,t} + \sigma_2 LSOE_{i,t} \\ + \eta_1 SUC_{i,t} + \gamma_2 AINT_{i,t} + \zeta_2 GDP_t + \theta_2 EINT_{i,t})\, DEC_{i,t}\Delta ln\, REV_{i,t} \\ + \mu_3 DEGREE_{i,t} + \varphi_3 CSOE_{i,t} + \sigma_3 LSOE_{i,t} + \eta_2 SUC_{i,t} + \gamma_3 AINT_{i,t} \\ + \zeta_3 GDP_t + \theta_3 EINT_{i,t} + \varepsilon_{i,t}\end{aligned} \tag{3}$$

Where $DEGREE_{i,t}$ is the log-ratio of the number of employees with a bachelor or higher degrees to the total number of employees. Hypothesis four implied $\mu_2 < 0$.

4. Empirical results

We tabulate the empirical results of the comparison of cost stickiness between CSOEs and LSOEs in table 5 (available online at: https://drive.google.com/drive/folders/1TREx-ftp-7m0PO347vMPJWls2zago1NP). The coefficients of the control variables (a dummy for successive sales decrease, GDP growth, asset intensity, and employee intensity) of all three regression models have expected signs and are aligned with the findings of Banker and Byzalov (2014), Banker *et al.* (2013), and Bu *et al.* (2015). The estimates (untabled) of the asymmetric cost behavior of all Chinese listed companies included in our sample are similar to the results of Chinese companies demonstrated in the study of Banker and Byzalov (2014). The main estimates for hypothesis 1 imply that CSOEs have greater asymmetric cost behavior than LSOEs, conditional on φ_2 being negative and significant. In support of hypothesis 1, the main parameter of interest (φ_2) of the model (1) is negative and significant at one percent level ($\varphi_2 = -0.207$, $t = -3.02$), indicating that the costs of CSOEs are stickier (table 5, column (b)) than other listed companies in China. The estimated coefficient of σ_2 is insignificant ($\sigma_2 = -0.077$, $t = -1.50$), indicating that the costs of LSOEs are not significantly different from other companies. In an additional analysis, we exclude non-SOEs data and the dummy for LSOEs from the model (1) to compare the cost stickiness between CSOEs and LSOEs. As it is tabulated in table 8 (available online at: https://drive.google.com/drive/folders/1TREx-ftp-7m0PO347vMPJWls2zago1NP), we receive similar results consistent with our expectations, which lends additional support to hypothesis 1. The coefficient of $\Delta ln\, REV_{i,t} DEC_{i,t} CSOE_{i,t}$ is negative and significant at the 1% level, showing that the degree of cost stickiness of CSOEs is greater than that of LSOEs. As a robustness check, we follow the study of Bu *et al.* (2015) and compare the cost stickiness between SOEs and non-SOEs in China. As it is tabulated in table 5 column (b) the coefficient $\Delta ln\, REV_{i,t} DEC_{i,t} SOE_{i,t}$ is -0.113 ($t = -2.49$), similar to the results of the study of Bu *et al.* (2015) (coefficient $= -0.183$, $t = -3.65$). Table 6 (available online at: https://drive.google.com/drive/folders/1TREx-ftp-7m0PO347vMPJWls2zago1NP) tabulates the empirical results of model (2). Hypothesis 2 implies that increased government attention to employment in five-year plans is associated with greater cost stickiness, conditional on μ_2 being negative and significant. In line with our expectations, the parameter of interest (μ_2) is negative and significant ($\mu_2 = -0.081$, $t = -2.83$), indicating that greater government attention on employment, as recorded in the five-year plans, leads to a greater level of cost stickiness, which supports hypothesis 2. Table 7 (available online at: https://drive.google.com/drive/folders/1TREx-ftp-7m0PO347vMPJWls2zago1NP) tabulates the empirical results of model (3). In support of the positive association between educational background on asymmetric cost behavior implied by hypothesis 3, the parameter of interest is negative and significant ($\mu_2 = -0.104$, $t = -2.60$), showing that companies with

a higher proportion of employees with a bachelor's or higher educational degree have a greater degree of asymmetric cost behavior.

In a robustness check, we add industry fixed effects and year fixed effects to all regression models to control for unobserved industry-specific factors and time-varying unobserved national shocks. We assume government attention, requests, responsibilities, short-term plans as well as the availability of skilled labor vary over years and industries, which potentially affect the change of sales to some extent. As the regression without fixed effects assumes a zero correlation between the unobservable and the explanatory variables, controlling the fixed effects of the industry and year can release the strict assumption and provide incremental information relative to our main specification. The results (untabled) are similar to our main estimates. In another specification, we additionally cluster standard errors by province to control unobserved region-specific factors. As different provinces broadly spread out in China, the local resources availability and legal environments, which formed from historical events, geographic features, or other factors, may stay at similar levels for years. Clustering standard errors by province can capture autoregressive shock. The results (untabled) are similar to our main estimates.

5. Conclusion

Focusing on identical institutional environments in China, this paper provides empirical results showing that the cost stickiness of CSOEs are greater than that of LSOEs in China; governments' attention to employment in China's five-year plans is a considerable factor in raising the level of cost stickiness; and a higher proportion of employees with a bachelor's or higher degree leads to a greater level of cost stickiness.

Recognizing the effects of government intervention and government plans on corporate resource adjustments, managers and policymakers can formulate strategies to uphold policies that attract high-skilled labor and address issues such as overstaffing and pet projects, leading to improved resource allocation. Additionally, they can invest in developing the human capital of the workforce within society, thereby nurturing a pool of skilled talent. This would result in a more abundant supply of highly skilled labor, ultimately reducing the recruitment and hiring costs for these talents by firms.

Our research is grounded in a dataset of Chinese public firms, potentially constraining the extent to which our findings can be generalized. The three hypotheses investigate the influence of state ownership, government long-term plans, and the proportion of skilled labor on cost stickiness. These factors may vary significantly among different countries. Managers and Policymakers need to consider the actual political, legal, and economic environment before generalizing the results. Future investigations can delve into whether distinctions at the national level yield noteworthy implications for government intervention and labor market workforce composition.

Notes

1. Following prior literature, the terms "asymmetric cost behavior" and "cost stickiness" are interchangeable.
2. We collect Chinese data from CSMAR instead of Compustat Global because Compustat Global use GVKEY as a company identifier which could not be matched with non-financial data of Chinese companies from other Chinese datasets. The lag values for two preceding years were used to calculate final variables in regressions, so the final sample for regression starts in 2002 rather than in 2000.
3. The annual GDP growth rates and GDP deflators are collected from the World Bank databank.
4. WIND Infor is a professional financial database offering data and information on Chinese stocks, bonds, funds, futures, RMB rates and the economy.
5. Available at: http://dangshi.people.com.cn/GB/151935/204121/

6. Hypotheses 3 and 4 could not be tested in one model because the measurement of government attention on employment recorded in the five-year plan changes for each five years, while data on employee degrees are not available until 2011. That means the sample of the last hypothesis covers only one five-year period.

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