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The impact of state-owned capital on labor cost stickiness in private firms: Evidence from China

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ABSTRACT

Cost stickiness is common in enterprise production and can significantly affect internal resource allocation. Past studies suggest that cost stickiness is more prominent in state-owned enterprises (SOEs). However, these studies have not addressed the impact of state-owned capital (SOC) on the cost stickiness of private enterprises. This study examined the effect of SOC on labor cost stickiness in private firms, employing data from China's private listed firms from 2010 to 2019. Empirical results show that SOC participation in private firms concurrently increased adjustment costs and decreased financing constraints. SOC also significantly exacerbated labor cost stickiness. This relationship was more evident among ordinary employees, competitive industries, and China's central and western regions. The findings demonstrate that SOC participation can harm corporate productivity in the short term but can benefit corporate innovation in the long term.

1. Introduction

Cost management is considered a critical determinant of a company's production efficiency. Several Chinese enterprises have struggled to operate after experiencing the impacts of the global economic downturn and the COVID-19 pandemic, resulting in a wave of "pay cuts" and "layoffs" (Nicola et al., 2020). Firms and policymakers are increasingly focusing on cost adjustment, which is evident in micro behaviors in corporate governance (Ibrahim et al., 2022). Typically, firms adjust their costs in line with revenue changes (Noreen, 1991). However, firms' cost adjustments exhibit significant stickiness, with costs being less responsive to sales decline than sales increase (Anderson et al., 2003). It's when revenues increase, costs increase more than they decrease when revenues decline. This is similar to the concept of price stickiness in economics (Hamermesh and Pfann, 1996).

Cost stickiness is an important manifestation of a firm's inefficient

resource allocation (Cannon, 2014). The proportion of firms' labor costs to total operating expenses has been increasing with the gradual decline of demographic dividends (Meng, 2023). In general, Chinese firms exhibit a greater amount of cost stickiness compared with American firms. Although SOEs exhibit greater labor cost stickiness (Gu et al., 2020; Prabowo et al., 2018), small- and medium-sized enterprises (SMEs) are gradually developing the same problem. On the one hand, private enterprises are essential components of the national economy, contributing more than 80% of urban labor employment.¹ On the other hand, private firms urgently need to highlight their cost advantages through human resource management regarding "ownership discrimination.²"

This study examined the issue of labor cost management efficiency in Chinese listed private firms. We investigated how SOC affects labor cost stickiness in private firms while adopting a new perspective based on Mixed-Ownership Reform (MOR). The justifications for this causality

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¹ General Secretary Xi Jinping raised the following proposal during the private enterprise symposium in November 2018.

² Ownership discrimination refers to discriminatory behavior caused by different ownership of enterprises, such as certain policies or regulations that treat enterprises with different ownership structures differently or certain enterprises being treated unfairly in market transactions due to differences in ownership.

are twofold. First, SOC is essential for achieving political objectives such as expanding social employment and maintaining social stability. Private firms forced into state ownership are required to comply with government control requirements. In such firms, managers may increase the number of employees in the short term and strengthen labor protection in the long term. As a result, firms find it more challenging to lower costs through wage cuts or layoffs when their revenues fall.

Second, China's "ownership discrimination" might make it more challenging and expensive for SMEs to obtain financing. These realistic constraints can force private firms to adjust operating costs more flexibly and efficiently. Thus, private firms may actively choose nationalization for property rights protection or resource acquisition. However, the issue of soft budget constraints could arise even after passive nationalization. Therefore, the financing constraints of private companies can be eased after SOC participation. This subsequently provides favorable conditions for firms to reduce downward adjustment costs.

This study explored the causal relationship between SOC and labor cost stickiness, focusing on Chinese private listed companies. We categorized enterprises as state-owned or non-state-owned based on whether the top ten shareholders hold more than 10% of their shares in stateowned entities. In our theoretical analysis, we hypothesized that the presence of SOC is associated with an increase in redundant labor and exacerbates the cost implications of wage relativity. Furthermore, SOC is associated with an increase in government subsidies and a reduction in tax burdens, which reflects its resource allocation effects. Given the significant differences across regions and industries in China, we also examined the central and western regions, and industry competition.

Supply-side reform is a significant economic policy introduced by China in 2015. Its objectives include adjusting the economic structure, optimizing the allocation of resources, and enhancing the quality and quantity of economic growth. By facilitating the optimal allocation of resources, this reform helps private enterprises reduce their dependence on government relations. Thereby, we further investigated whether supply-side reform mitigates the exacerbating effects of state-owned capital injection on the labor cost stickiness of private enterprises. Finally, we also analyzed the economic impact of labor cost stickiness, including firms' productivity and innovation in both the short and long term.

The study contributes to the literature in three main aspects. First, we provide a unique perspective for enterprise resource allocation by exploring enterprise labor cost adjustment efficiency through the implementation of MOR policy. SOC is the primary type of capital in MOR, yet it has received little scholarly attention. Although the literature addresses the positive effects of SOC for private enterprises (Brandt et al., 2012; Chen et al., 2021), few studies have discussed its adverse effects. The present study reveals the significant adverse economic impact of SOC on most private companies by focusing on SOC as a driver of labor cost adjustment.

Second, this paper offers significant insights into cost stickiness by examining the influence of corporate ownership structure. While studies have differentiated labor stickiness between state-owned and private enterprises based on corporate ownership structure (Hall, 2016; Prabowo et al., 2018; Xu et al., 2023), they have overlooked the impact of SOC on labor cost stickiness in private enterprises. This study provides a broader perspective regarding the overall economic effects of "reverse mixed ownership" while considering the advantages and disadvantages of SOC in private enterprises.

Third, this study explored the positive economic implications of labor cost stickiness in enterprises, elucidating the impact of corporate ownership structure on cost stickiness. Most studies perceive labor cost stickiness as an inefficient factor of enterprise resource adjustment that exerts negative economic effects on firms (Agarwal, 2022; Costa and Habib, 2023; Weiss, 2010). We delineated the positive impact after examining the long- and short-term detrimental effects of labor cost stickiness on enterprise labor productivity and total factor productivity. We found that labor cost stickiness based on SOC can promote firm innovation, thereby augmenting the economic analysis of cost stickiness.

The rest of this paper is organized as follows. Section 2 discusses China's institutional background and the relevant literature and develops our hypotheses. Section 3 presents the research methodology, including model specification and data description. Section 4 reports the empirical results. Section 5 provides further analysis results. Section 6 presents the conclusions.

2. Institutional background and theoretical analysis

2.1. Institutional background

The Third Plenary Session of the 18th Central Committee passed the "Decision of the Central Committee of the Communist Party of China on Several Major Issues Concerning Comprehensively Deepening Reform" in November 2013. The decision outlined three strategies for actively promoting mixed ownership. First, the decision emphasized the introduction of non-SOEs to participate in SOC reform. Second, it encouraged SOC participation in non-SOEs through various means. Finally, it aimed to explore the implementation of employee shareholding in mixedownership enterprises.

The implementation of mixed ownership is a crucial reform of China's fundamental economic system. It is aimed at allowing the market to play a decisive role in resource allocation, promoting productivity, and leveraging governmental functions more effectively. MOR involves a two-way flow; it allows for private-owned capital (POC) to be invested in SOEs and SOC to be invested in private enterprises (i.e., reverse mixed ownership). Both forms of MOR entail the restructuring of enterprise capital while facilitating "effective coordination" between the market economy and the government to maximize productivity. MOR contributes to maximizing China's market economy because it harnesses the strengths of both types of enterprises while offsetting their weaknesses. Privatizing SOEs is pivotal to MOR as SOEs are a cornerstone of China's economy. Notably, in September 2015, the "Guiding Opinions of the CPC Central Committee and the State Council on Deepening the Reform of State-owned Enterprises" identified SOE reform as the first strategic goal in China's new era of economic development. The positive impact of SOE mixed-ownership reform in China has received substantial scholarly attention, indicating broad consensus regarding its significance.

SOC investment in private enterprises, as another important form of MOR, are less to be considered. Private enterprises constitute the lifeline of the Chinese economy, accounting for more than 80% of urban labor employment.³ Moreover, the smaller scale and flexible operational methods of private enterprises facilitate their realization of economic effects under market conditions. However, private enterprises face objective challenges such as financing and labor supply difficulties. This prevents them from taking full advantage of economies of scale, leading to their withdrawal from the market. MOR aims to enhance enterprise productivity while achieving optimal internal resource allocation. Increased investment from state shareholders can address existing issues in private companies. Therefore, SOC can help promote the healthy development of the national economy and build up the entire economy.

However, inadequate motivation and limited enthusiasm to engage in MOR are prevalent issues among private enterprises. During a discussion at the 2014 Boao Forum for Asia, an on-site survey indicated that nearly 70% of entrepreneurs were unsure about their involvement in MOR.⁴ The data in Fig. 1 indicate a substantial yearly increase in SOC holdings in private enterprises following the implementation of the

³ On November 1, 2018, General Secretary Xi Jinping proposed at the National Symposium on Private Enterprises.

⁴ This content is sourced from a report in the First Financial Daily on April 10, 2014.



Fig. 1. Number and ratio of non-SOEs participating in MOR. Note: This figure shows the participation of non-SOEs in MOR. The histogram indicates the number of enterprises participating in MOR from 2003 to 2021. The line chart depicts the ratio of enterprises participating in MOR to the total number of enterprises to eliminate the influence of new enterprises.

MOR policy. Nevertheless, the proportion of private enterprises participating in the reform began declining annually after one year of initial growth. This trend could be attributed to social responsibilities associated with state-owned shares and the mixed reform style of "give and take". These factors could impede the efforts of private companies in improving productivity and obtaining economic benefits through state capital investment, thereby limiting the progress achieved in resource allocation optimization.

Based on the above, the influential role of SOC in the private economy has not been fully explored. The government and enterprises must have a clear understanding of the limitations of SOC to minimize its adverse effects on private companies. This will facilitate the full implementation of MOR, and thus promote the adjustment of SOC layout and structural optimization for the long-term goal of MOR.

2.2. Literature review

This study considers several strands of literature. Labor cost stickiness indicates that labor costs decrease to a smaller extent when sales decrease compared with the extent to which they increase when sales increase (Anderson et al., 2003; Dierynck et al., 2012). First, our study contributes to the growing empirical literature on the factors influencing labor cost stickiness. Some studies have indicated that the adjustment costs are the main channel that influences labor cost stickiness, where the costs of downward adjustments are usually greater than those of upward adjustments, resulting in excessive costs for reducing input resources (Cooper and Haltiwanger, 2006; Goux et al., 2001). Other studies suggest managerial incentives as the primary channel, wherein managers strengthen cost stickiness when their compensation is linked to reported profits or stock prices (Diervnck et al., 2012; Kama and Weiss, 2013). Other studies consider demand expectations as central, suggesting that an optimistic future or rising demand makes managers more willing to retain underutilized resources in periods of declining sales (Banker et al., 2011; Cannon, 2014; Hartlieb, 2021). Studies also suggest that demand uncertainty (Holzhacker et al., 2015), financial distress (Jin and Wu, 2021), and managerial judgment (Chen et al., 2022) are essential factors influencing cost stickiness. The present study provides new evidence demonstrating the positive relationship between firm ownership structure and cost stickiness by using policy shock to assess nationalization in private firms. We have extended the existing cost stickiness framework to consider firm ownership structures as drivers of adjustment cost.

Second, our results align with previous findings that labor employment rates and firm ownership structures significantly affect cost stickiness (e.g., Banker et al., 2013; Golden et al., 2020; Josep et al., 2023; Rouxelin et al., 2018). However, most of these studies do not explicitly state the channels through which firm ownership structures affect firms' labor cost stickiness. Instead, they indicate that firms' nationalization increases cost stickiness. This is because managers of SOEs are motivated to pursue social and political goals, such as avoiding large-scale layoffs and reducing unemployment rates, often at the expense of minority shareholders' interests (Chen et al., 2008; Hall, 2016; Prabowo et al., 2018). Our findings regarding nationalization in private firms leading to increased labor cost stickiness should not be considered at the level of individual politicians. Instead, our findings imply that state intervention, primarily through labor cost and capital resources, influences private firms' stickiness through two channels.

Third, this paper contributes to the extensive literature on the economic effects of SOC in private firms. As SOC and POC belong to MOR, they differ only in terms of reform direction. Most studies focus on the positive effect of POC on SOEs (Chen et al., 2021). However, the impact of SOC remains unclear. Some studies indicate that SOC investment in private enterprises increases labor productivity (Song, 2023) and reduces stock price uncertainty (Sun, 2023). However, other studies suggest that SOC reduces a firm's production efficiency (Kong et al., 2023). SOC helps alleviate local labor market burdens but leads to increased leverage (Huang et al. (2021), which can exacerbate agency issues between controlling and minority shareholders (Bou-baker et al., 2014; Gompers et al., 2010). In particular, government-controlled shareholders are motivated to pursue socio-political goals, such as avoiding large-scale layoffs, at the expense of minority shareholders' interests. The findings of the present study indicate that SOC increases private firm labor cost stickiness, thereby aggravating the adverse effects of MOR. Focusing on SOC as a driver of labor cost adjustment, we uncover its significant economic impact on most private enterprises.

2.3. Theoretical framework

Divergent economic impacts of SOC on private enterprises primarily stem from inherent differences in the attributes of SOC and POC. The primary objective of state-owned participating shareholders is to alleviate policy pressure. In contrast, private shareholders seek development opportunities and economic resources. SOC helps address labor scale and financing constraints in private enterprises. However, it also establishes a relationship of "gift exchange" between the government and enterprises. While state shareholders transfer policy burdens to private enterprises, they also provide additional resource support as compensation. However, this support may increase labor adjustment costs and capital resources, exacerbating the issue of labor cost stickiness in private enterprises. Therefore, this study explains the impact of SOC participation in private enterprises on labor cost management through two pathways: cost and resource effects.

2.3.1. Cost effects

SOC encompasses both political and economic objectives. SOEs possess ownership advantages while shouldering significant social policy burdens (Lin et al., 1998). They are reluctant to lay off employees or reduce wages even in challenging situations. However, the enhanced labor security and superior employee benefits of SOEs can result in higher labor costs, reduced operational efficiency, and increased cost

stickiness. In practical terms, private firms serve as effective employers; they contribute to local tax revenues and enjoy preferential treatment from local governments. Government agencies can foster a beneficial relationship with businesses by involving SOC in private firms while making strides in addressing social employment challenges. Liang and Feng (2010) suggest that politically connected private firms employ a larger workforce and incur higher salary costs compared with firms without such connections.

The cost adjustment of private firms before SOC participation can be relatively effective. Private firms expand proactively when revenues increase and contract decisively when revenues decrease. Labor cost expenditure is closely related to revenue. However, when SOC participates in private firms, state shareholders may transfer or even impose the burden of social employment. SOC reduces the negative relationship between adjustment costs and revenue for private enterprises. When firm revenues increase, private-owned enterprises with state investment may not be able to promptly meet the demand for labor. When revenues decrease, the employment rate and other standards for labor continue to be maintained even with decreasing labor demand. Thus, the workforce is retained. Moreover, when operational performance is constrained, the layoff and salary reduction behaviors of private firms are constrained by the political attributes of state shareholders. Comparing the labor cost adjustment of private firms before and after SOC participation indicates that the cost effect generated by SOC will increase labor cost stickiness.

2.2.2. Resource effects

Financing costs play a crucial role in a firm's overall cost structure. Firms facing significant financing constraints are subject to higher external financing costs. Thus, they experience limitations in adjusting allocated resources during periods of business growth and also incur greater opportunity costs when retaining surplus resources during periods of business decline. Firms experiencing greater financing constraints have weaker cost stickiness (Chen and Ma, 2021). Moreover, Liang (2015) demonstrates that a higher debt burden dampens the positive impact of managerial overconfidence on cost stickiness.

SOC transfers part of the policy burden through participation in private firms, requiring prior policy protection and government subsidies as guarantees. The soft budget constraint issue for non-SOEs is even more severe than that for SOEs. SOC participation can directly increase government subsidies while expanding tax incentives for non-SOEs; it can also help them overcome institutional constraints and indirectly obtain greater access to credit resources. Thus, the resource effects of SOC can alleviate the financing constraints faced by private firms. This enables firms to develop greater confidence and capacity to implement cost adjustments when revenue increases and to overcome financial difficulties when revenue decreases.

Based on this overview, this study argues that SOC affects the labor cost stickiness of private firms through two channels: increasing adjustment costs and reducing financing constraints. The corresponding logical framework is illustrated in Fig. 2. The policy tasks and national image of SOC increase employee costs for private firms and make it more challenging for these firms to lay off workers. However, direct or indirect resource supply can alleviate the financial pressure on private firms while ensuring their commitment to a downward adjustment of resources. Therefore, we propose the following main hypothesis.

H1. SOC in private firms exacerbates labor cost stickiness compared with purely private-owned firms.

3. Research methodology

3.1. Empirical model

volume changes. The specific form of the model is as follows:

 $\Delta lnLaborcost_{it} = \alpha_0 + \alpha_1 \Delta lnRevenue_{it} + \alpha_2 \Delta lnRevenue_{it} \times Dec_{it} + \varepsilon_{it}$ (1)

where *i* denotes firm and *t* represents year. $\Delta lnLaborcost$ ($\Delta lnRevenue$) represents the natural logarithm of the ratio of a firm's end-of-period labor costs⁵ to its beginning-of-period labor costs (operating revenue). *Dec* is a dummy variable that takes a value of 1 if the final operating revenue value is less than the initial value, indicating a decrease in business volume; otherwise, it takes a value of 0, indicating an increase in business volume. The interaction term indicates labor cost stickiness (Fig. 3). We expect α_1 to be significantly positive and α_2 to be significantly negative, signifying that labor costs adjust to a lesser extent when a firm's business volume decreases compared to when it increases.

Furthermore, we examined the impact of SOC on labor cost stickiness in private firms. Following Ma et al. (2021), we augmented (1) by introducing an indicator variable for SOC and other control variables to construct (2). The specific calculation is given as follows:

$$\Delta \ln Laborcost_{it} = \beta_0 + \beta_1 \Delta \ln Revenue_{it} + \beta_2 \Delta \ln Revenue_{it} \times Dec_{it} + \beta_3 \Delta \ln Revenue_{it} \times Dec_{it} \times SOMS_{it} + \beta_4 \sum \Delta \ln Revenue \times Dec \times EV + \beta_5 \Delta \ln Revenue_{it} \times SOMS_{it} + \beta_6 \sum \Delta \ln Revenue \times EV + \beta_6 SOMS_{it} + \beta_7 \sum EV + \sum Year + \sum Ind + \varepsilon_{it}$$
(2)

where the *SOMS* dummy indicates whether private firms have stateowned majority shareholders⁶ and the three-dimensional interaction term ($\Delta lnRevenue \times Dec \times SOMS$) indicates the moderating effect of SOC on labor cost stickiness. We focus on the estimated parameter β_3 . A significant negative value of β_3 indicates that SOC participation exacerbates labor cost stickiness, supporting H1. Additionally, we controlled for other economic variables (*EV*) that influence cost stickiness, including successive decrease, GDP growth rate, asset intensity, and employee intensity. Simultaneously, we added five two-dimensional interaction terms. Model (2) also incorporates year and industry fixedeffects to control for common trends.

3.2. Sample and data sources

Given the severe impact of the global financial crisis and the COVID-19 pandemic on the real economy, we selected Chinese A-share-listed private firms from 2010 to 2019 as the research sample. After careful screening, 2387 firms with 14,382 valid observations were obtained. The sample selection process is presented in Table 1. Shareholding information of the top ten shareholders was obtained by scraping the annual report texts of listed firms from Juchao(http://www.cninfo.com. cn). These data were subsequently verified and organized manually. Other financial data were derived from the China Stock Market &

This study adopted the classical research paradigm proposed by Anderson et al. (2003), commonly recognized as the ABJ model, to analyze the relationship between labor cost changes and business

⁵ According to the International Labour Organization, labor cost refers to the total remuneration of workers. This includes not only wages and salaries expressed in monetary terms but also benefits manifested in material or non-material forms. The total employee wages represent a significant component of labor costs. Labor cost is equal to the current value of "cash paid to employees and on behalf of employees" in the cash flow statement plus the change in "employee compensation payable" on the balance sheet. It encompasses wages, bonuses, allowances, insurance, and provident fund contributions.

⁶ Following Jiang et al. (2018), we consolidated the holdings of the top ten shareholders with Chinese ownership into a shareholder group. Laeven and Levine (2008) defined a threshold of 10% for major shareholders. Based on the provisions of the "China Company Law," shareholders who individually or collectively held more than 10% of a company's shares may request or convene a shareholders' meeting. We defined SOMS as a shareholder group comprising state-owned shareholders with a combined ownership exceeding 10%. Additionally, we used the state-owned equity ratio (SOER) as an alternative indicator in the robustness analysis.



Fig. 2. Logical framework.



Fig. 3. Schematic of labor cost stickiness.

Note: The normal cost function is a 45-degree line. If a firm's cost changes less than the change in business volume, the slope of the cost function decreases (i. e., cost stickiness). Conversely, if a firm's cost changes more than the change in business volume, the slope of the cost function increases (i.e., cost anti-stickiness).

Table 1

Sample selection.					
Procedure	Change in sample size	Remaining sample count			
Total samples		18756			
Less:Samples of ST/PT/*ST	-697	18059			
Samples from the financial industry	-122	17937			
Samples with missing variable data	-3555	14382			

Accounting Research (CSMAR) database. The economic data were obtained from the National Bureau of Statistics. To eliminate the influence of outliers, we winsorized all continuous variables at the upper and lower 1% levels.

4. Empirical evidence

4.1. Descriptive statistics

Descriptive statistics of the main variables are presented in Table 2. The mean (standard deviation) of the change in labor costs ($\Delta LnLaborcost$) was 0.171 (0.248). The mean (standard deviation) of the change in firm revenue ($\Delta LnRevenue$) was 0.138 (0.352). The results indicate significant differences and considerable fluctuations in labor costs and revenue among private listed firms during the sample period. The mean of *SOMS* was 0.114. This indicates that 11.4% of sample firms possessed state-owned majority shareholders, aligning with previous findings (Hao and Gong, 2017). The proportion of samples with a decrease in business volume (*Dec*) was 27.2%, whereas that of samples with a successive decrease over two years (*Sdec*) was 10.1%. The distribution of rest variables is in Table 2 is within a reasonable range.

4.2. Main findings

Table 3 presents the regression results of Models (1) and (2). Following Gu et al. (2020), *GDP*, *Ai*, and other continuous variables were centered during the regression analysis. We included year fixed-effects (*Year*) and industry fixed-effects (*Ind*) as controls to eliminate the confounding effects of time and industry factors. All regression equations employed clustered robust standard errors at the firm level, and the

Table 2	
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Descriptive statistics.	

Variables	Ν	Mean	S.D.	Min	Max
$\Delta LnLaborcost$	14382	0.171	0.248	-0.472	1.245
$\Delta LnRevenue$	14382	0.138	0.352	-1.023	1.696
SOMS	14382	0.114	0.318	0.000	1.000
Dec	14382	0.272	0.445	0.000	1.000
Sdec	14382	0.101	0.301	0.000	1.000
GDP	14382	0.100	0.031	0.070	0.184
Ai	14382	2.781	2.643	0.423	18.490
Ei	14382	0.015	0.012	0.001	0.072

Note: This table presents the descriptive statistics for the regression variables. It includes the mean, standard deviation (S.D.), minimum (min), and maximum (max) distributions. The baseline regression sample includes 14,382 firm-year observations from 2010 to 2019. All variables are defined in detail in Appendix A.

Table 3

Cost stickiness and the impact of SOC on labor cost stickiness in private firms.

Variables	(1) (3)	
	ΔLnLaborcost	ΔLnLaborcost
ΔLnRevenue	0.453*** (30.16)	0.496*** (35.34)
$\Delta LnRevenue \times Dec$	-0.275*** (-10.85)	-0.269*** (-9.49)
$\Delta LnRevenue \times Dec \times SOMS$		-0.154*** (-2.71)
$\Delta LnRevenue \times Dec \times Sdec$		0.079** (2.40)
$\Delta LnRevenue \times Dec \times GDP$		0.4/1 (0.59)
$\Delta LnRevenue \times Dec \times Ai$		0.021*** (3.30)
$\Delta LnRevenue \times Dec \times Ei$		-11.615*** (-6.40)
$\Delta LnRevenue \times SOMS$		0.027 (0.76)
$\Delta LnRevenue \times Sdec$		-1.083^{***} (-2.71)
$\Delta LnRevenue \times GDP$		-0.026*** (-5.36)
$\Delta Ln Revenue imes Ai$		9.184*** (7.86)
$\Delta LnRevenue imes Ei$		-0.024*** (-3.32)
Dec	-0.025*** (-4.47)	
GDP		-0.038*** (-4.70)
Ai		0.700*** (5.42)
Ei		0.005*** (2.89)
SOMS		-0.700*** (-2.75)
Constant	0.109*** (6.57)	0.059*** (4.10)
Year	YES	YES
Ind p ²	YES	YES
K N	0.340	0.369
74	11002	1 1302

Note: This table presents the regression results for Models (1) and (2). The dependent variable was the change in labor costs. The independent variables included change in revenue and the two-way interaction between revenue change and *Dec*, as well as the three-way interaction between revenue change, *Dec*, and SOMS. The control variables include four economic variables (*Sdec/GDP/Ai/Ei*) and their interaction terms. All variables are detailed in Appendix A. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

corresponding *t*-statistics are reported in parentheses in Table 3.

Column (1) of Table 3 presents the results after excluding the threedimensional interaction terms. The regression coefficient (0.466) of Δ *LnRevenue* was significantly positive at 1%. This indicates a positive relationship between labor costs and revenue changes in general. The regression coefficient of Δ *LnRevenue* × *Dec* was significantly negative at 1%, confirming labor cost stickiness. In particular, with other factors remaining constant, a 1% increase in a firm's revenue led to a 0.453% increase in labor costs. Comparatively, a 1% decrease in business volume decreased labor costs by 0.178% (0.453%–0.275%).

Column (2) of Table 3 presents the results with the three-dimensional interaction term $\Delta LnRevenue \times Dec \times SOMS$. The regression coefficient was significantly negative at 5%. The estimated coefficient indicates that the labor cost stickiness of enterprises with SOMS was 0.154 higher than that of enterprises without SOMS. The results suggest that private firms with SOMS exhibited a smaller downward adjustment in labor costs when revenue decreased (Fig. 4). This finding indicates that SOC exacerbates labor cost stickiness in private firms, confirming the inference of H1. Furthermore, China's private firms exhibited decreased labor cost



Fig. 4. Regression results.

Note: Fig. 4 illustrates the benchmark regression results. The slope of the black line represents the ratio between the change in labor costs and the change in revenue when revenue increased. The slopes of the red and blue lines represent the ratio between the changes in labor costs and revenue, respectively, when the revenue decreased. The slope of the black line is greater than that of the red and blue lines, indicating the presence of cost stickiness. Furthermore, the slope of the red line is smaller than that of the blue line, suggesting an increase in stickiness for private firms after acquiring SOC.

stickiness after our study controlled for SOC effects, contradicting the findings of Dalla Via and Perego (2014). Dalla Via and Perego (2014) found that cost stickiness existed only in the total labor costs of SMEs in Italy, providing profound suggestions for ways to implement the SOC policy.

4.3. Endogeneity discussion

Overcoming potential endogeneity issues of empirical models is a precondition for ensuring the reliability of research findings. This study addressed four aspects of endogeneity concerns. First, despite controlling for specific firm characteristics, time, and industry factors, omitted variables may affect labor cost stickiness. Second, a reciprocal relationship could exist between firms' labor cost adjustment behavior and SOC participation. SOC may intensify labor cost stickiness in private firms, whereas private firms with labor redundancy may actively seek or passively accept SOC. Third, the findings of this study may be attributed to inherent differences among firms, such as private firms with SOC exhibiting better operational performance. Fourth, the participation choices of state-owned shareholders are not subject to random natural experiments, leading to the issue of sample selection bias. We mitigated potential endogeneity issues using a firm fixed-effects model to address the above problems. We lagged the core explanatory variable by one period, performed propensity score matching (PSM), and conducted a Heckman two-stage test. The results of these tests are presented in Table 4 and outlined further below.

(1) The firm fixed-effects model: Controlling for firm fixed-effects can alleviate the issue of omitted variables that do not vary over time. Column (1) of Table 4 illustrates that the coefficient of the three-dimensional interaction term ($\Delta LnRevenue \times Dec \times$

Table 4

Endogeneity tests.

Variables	(1)	(2)	(3)	(4)
	∆LnLaborcost	ΔLnLaborcost	∆LnLaborcost	ΔLnLaborcost
ΔLnRevenue	0.497*** (33.76)	0.491*** (34.75)	0.455*** (17.20)	0.494*** (29.70)
$\Delta Ln Revenue imes Dec \Delta Ln Revenue imes Dec imes SOMS$	-0.334^{***} (-10.70) -0.120^{*} (-1.95)	-0.262*** (-9.14)	-0.307^{***} (-6.19) -0.158^{**} (-2.51)	-0.276^{***} (-8.45) -0.157^{**} (-2.56)
$\Delta Ln Revenue \\ \times Dec \times L. \\ SOMS \\ IMR$		-0.198*** (-3.47)		0.037***
Constant	0.091*** (25.90)	0.097*** (30.81)	0.092*** (15.80)	(3.08) 0.096*** (22.61)
CV	YES	YES	YES	YES
Year	YES	YES	YES	YES
Ind	NO	YES	YES	YES
FITM P ²	1E5 0.481	NU 0.360	NU 0.330	NU 0.366
N	14049	14382	5151	10995

Note: This table illustrates the four methods for addressing endogeneity: stronger fixed-effects control, one-period lag in SOMS, PSM, and Heckman's selection model. All regressions include control variables. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

SOMS) remained significantly positive, aligning with the baseline regression.

- (2) One-period lag of *SOMS*: As the labor cost adjustment decision of firms in the current period does not affect the equity participation decision of state-owned shareholders in the previous period, the problem of reverse causality can be overcome. Column (2) illustrates that the coefficient of the three-dimensional interaction term remained significantly positive even after lagging the *SOMS*. This indicates the robustness of our main findings.
- (3) PSM: This approach can be employed by considering the sample firms receiving SOC participation as the treatment group. We matched suitable control groups from the sample firms without SOC participation to reduce the estimation bias resulting from inherent firm differences. Variables such as leverage ratio and firm size were selected as covariates. The 1:1 nearest neighbor method with a radius of 0.05 was used for repeatable matching. Comparing the density function graphs before and after matching shows that differences between the treatment and control groups were reduced. The *t*-tests indicate no significant differences in covariates between groups. We conducted regression tests on the successfully matched samples. Column (3) shows that the coefficient was positive and exhibited improved significance compared with the baseline regression, further validating H1.
- (4) Heckman two-stage test: To address the sample selection bias resulting from the self-selection behavior of state-owned shareholders, we employed the Heckman two-stage method. In the first stage, the dependent variable was the ownership of the state's major shareholder; the exclusion restriction variable was the average ownership of other private firms within the same industry in the previous period (Fisman and Svensson, 2007). The inverse Mills ratio (IMR) can be calculated based on the regression results of the Probit probability model. In the second stage, the IMR variable was included as a control variable in (2) to ensure the representativeness of sample selection. Column (4) demonstrates that the three-dimensional interaction term coefficient remained significantly positive, indicating that H1 still holds. The significance of the IMR variable at 1% implies the presence of sample selection bias in the model; however, this did not significantly alter the research conclusions.

Table 5	
Robustness	tests.

Variables	(1)	(2)	(3)	(4)
	ΔLnLaborcost	ΔLnLaborcost	ΔLnLaborcost	Sticky
$\Delta Ln Revenue$	0.542***	0.541***	0.498***	
	(31.36)	(42.48)	(37.30)	
$\Delta LnRevenue imes Dec$	-0.303***	0.029	-0.284***	
	(-7.88)	(1.00)	(-10.26)	
$\Delta Ln Revenue imes Dec$	-0.147*	-0.117**		
\times SOMS	(-1.68)	(-2.06)		
$\Delta Ln Revenue imes Dec$			-0.007***	
\times SOER			(-4.19)	
SOMS	-0.023***	-0.019**		0.043**
	(-2.59)	(-2.38)		(2.02)
Constant	0.087***	0.107***	0.093***	
	(23.40)	(33.49)	(31.82)	
CV	YES	YES	YES	YES
Year	YES	YES	YES	YES
Ind	YES	YES	YES	YES
R^2	0.422	0.560	0.369	0.190
Ν	9880	11016	14377	13956

Note: This table presents the results of the robustness tests. We ensured the reliability of the benchmark results from two dimensions: replacing the sample and replacing the variables. In Column (1), we only included samples from manufacturing firms. In Column (2), we excluded samples with inconsistent changes in costs and revenue. In Column (3), we substituted the state-owned equity ratio (SOER) for SOMS in the benchmark regression. In Column (4), we directly measured the numerical value of cost stickiness instead of using an interaction term. All regressions included control variables and fixed-effects. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

4.4. Robustness testing

We conducted a series of additional robustness tests to further validate the research findings. Detailed results are presented in Table 5.

- (1) Sample replacement: First, cost stickiness was more prevalent in manufacturing firms. Following Xu and Sim (2017), we excluded non-manufacturing firms from the sample for retesting. Second, examining cost stickiness is contingent upon concurrent firm costs and revenue changes. Following Anderson and Lanen (2007), we excluded samples in which labor costs and company business volume did not increase or decrease simultaneously from further testing. The results in Columns (1) and (2) of Table 5 indicate that the three-dimensional interaction term coefficient remained significantly positive, confirming the reliability of the research findings.
- (2) Variable replacement: First, we replaced the core explanatory variable SOMS from the baseline regression with the continuous variable state-owned equity ratio (SOER). The results in Column (3) of Table 5 support the conclusions of the baseline study. Second, instead of using interaction terms to analyze cost stickiness as in the ABJ model, we directly calculated the numerical value of cost stickiness based on quarterly data following Weiss (2010). The larger the value of the variable Sticky, the higher was the cost stickiness. The regression results in Column (4) of Table 5 indicate that the SOMS coefficient was significantly positive at 5%. This suggests that SOC participation exacerbated labor cost stickiness in the private firms in the study sample. Thus, the research findings remain robust.

5. Further analysis

5.1. Mechanism analysis

Based on benchmark research results, we further investigated the mechanisms through which SOC exacerbated labor cost stickiness in

private firms. Based on theoretical deductions in prior studies, SOC participation in private firms has two effects. First, policy burdens result in employee redundancy and labor protection, thereby directly increasing labor adjustment costs. This serves as a driving factor for labor cost stickiness. Second, government resource allocation can alleviate firms' financing constraints and increase the opportunity cost of labor, thus indirectly increasing labor adjustment costs. This serves as a safeguarding factor for labor cost stickiness. Therefore, we verified these two channels of influence separately.

5.1.1. Cost effects

SOC shareholders at various levels of the government represent the interests and demands of the state. SOC participation in private firms allows the government to impose policy burdens while forcing private firms to absorb excessive social employment. For increased revenue, employees may be used to meet business expansion demands. However, if revenue decreases, employees impede the firm's development. Representing national interest, SOC participation can also lead to improved labor protection and increased salary benefits. Consequently, it can result in an excessive number of employees in a firm in which measures such as layoffs and salary reductions to reduce costs will be restricted.

We used the mechanism variables of excessive employees (*ExEmp*) and relative compensation (RelComp) to examine the cost channel through which SOC influences labor cost stickiness in private firms. First, we employed the residual method (Zeng and Chen, 2006) to measure excess employees. Positive values indicate employee redundancy, and negative values indicate employee shortage. We characterized the relative compensation of firms by the ratio of average employee wages to industry average wages (Kong et al., 2020). Second, we employed a two-way fixed-effects model to examine the impact of SOC on the two mechanism variables separately. We controlled for firm size, age, leverage ratio, and other variables. Finally, based on the results in Columns (1) and (2) of Table 6, the SOC regression coefficients were 0.046 and 0.050, respectively, which were significant at 10%. This finding indicates that SOC significantly increased excessive employees and relative compensation in private firms, confirming the presence of the cost channel.

5.1.2. Resource effects

Private firms essentially pursue profit maximization, which typically leads to more efficient cost management. However, policy burdens imposed by SOC can restrict the cost adjustment behavior of private controlling shareholders, leading firms to channel additional government resources or obtain greater access to social resources. The resource

Table 6 Mechanism analysis.

	(1)	(2)	(3)	(4)	(5)
	ExEmp	RelComp	Sub	Tax	SA
SOMS	0.075**	0.078**	0.042*	-0.751***	-0.091***
	(2.39)	(2.13)	(1.67)	(-2.77)	(-7.19)
Constant	0.876**	-0.282	0.762***	5.899	-3.261***
	(2.05)	(-1.22)	(5.05)	(1.61)	(-29.79)
CV	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES
Ind	YES	YES	YES	YES	YES
R^2	0.779	0.068	0.215	0.715	0.235
Ν	11515	14371	14382	14049	14382

Note: This table presents the mechanisms through which SOC influenced labor cost stickiness in the private firms in the study sample. Columns (1) and (2) indicate the cost effects using the indicators of excess employees and relative wages, respectively. Columns (3) to (5) illustrate the resource effects, including government subsidies, tax burdens, and financing constraints. Furthermore, we use control variables such as firm size, firm age, and leverage ratio in the regression analysis, as well as year and firm fixed-effects. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

effects generated by SOC mainly include more government subsidies and greater tax incentives. This study measures the resource channels accordingly. Government subsidies (*Sub*) are the ratio of government subsidies to total assets. Tax burden (*Tax*) is defined as the ratio of the difference between taxes paid and tax refunds received to operating revenue.

Similarly, we employ a two-way fixed-effects model. The results are presented in Columns (3) and (4) of Table 6. Column (3) shows that the *SOMS* coefficient in the regression of government subsidies is significantly positive. In contrast, Column (4) shows that the *SOMS* coefficient in the tax burden regression is significantly negative. This finding indicates that SOC increases the amount of government subsidies received by private firms and also reduces their tax burden. We further examine whether SOC's resource effects alleviate the financing constraints of private firms using the inverse SA index (Hadlock and Pierce, 2010) as a measure of financing constraints. The regression results in Column (5) show that the *SOMS* coefficient is significantly negative, confirming the presence of resource channels.

5.2. Structural decomposition

In the basic regression, we used the sum of firm labor costs. The type of employees could generally be divided into company executives and ordinary employees. Ordinary employees accounted for a larger proportion in terms of number. However, the average salary of company executives was higher. Executive compensation is a widely discussed topic in society. Garvey and Milbourn (2006) suggest evidence regarding executive pay stickiness. Firth et al. (2006) found that executive pay stickiness in private companies is low. As ordinary employees are considered more replaceable than executives, they are likelier to lose their jobs. Therefore, the policy burden of SOC transfer may primarily involve ordinary employees.

We divide the total labor cost into two parts. The company's executive compensation cost ($\Delta lnLaborcost_M$) was measured by the "total annual salary of supervisors" based on the CSMAR database. In contrast, the ordinary employee compensation cost ($\Delta lnLaborcost_O$) was measured by "total labor cost" minus "executive compensation costs." Thus, we examined the differences in the impact of SOMS on the different types of labor cost stickiness. Columns (1) and (2) of Table 7 indicate that SOMS had no significant effect on executive compensation cost stickiness but exacerbated the cost stickiness of ordinary employees. Three reasons for this finding are evident. First, unemployed individuals

Table 7	
Labor cost structure deco	mposition.

Variable	(1)	(2)	(3)	(4)
	$\Delta lnLaborcost_E$	ΔlnLaborcost_O	∆lnLabor_H	∆lnLabor_L
$\Delta Ln Revenue$	0.167***	0.510***	0.489***	0.610***
	(11.38)	(35.39)	(12.70)	(15.49)
Δ LnRevenue $ imes$	-0.021	-0.286***	-0.140	-0.411***
Dec	(-0.56)	(-9.19)	(-1.59)	(-5.53)
$\Delta LnRevenue imes$	-0.071	-0.145**	-0.153	-0.338*
$\textit{Dec} \times \textit{SOMS}$	(-0.84)	(-2.43)	(-0.67)	(-1.85)
Constant	0.076***	0.096***	-0.030***	0.023***
	(19.53)	(30.17)	(-3.66)	(2.97)
CV	YES	YES	YES	YES
Year	YES	YES	YES	YES
Ind	YES	YES	YES	YES
R^2	0.045	0.361	0.096	0.213
Ν	14358	14363	11461	11597

Note: This table presents the impact of SOC on cost stickiness for different types of labor. Columns (1) and (2) are divided into executive labor costs and general labor costs based on employee levels. Columns (3) and (4) are divided into high-skilled and low-skilled labor based on technical levels. Similarly, we controlled for four economic variables, interaction terms, year fixed-effects, and industry fixed-effects in the regression. ***, **, * denote significance at 1%, 5%, and 10% levels, respectively.

have primarily worked as ordinary employees in enterprises. Second, executive compensation is directly linked to business performance (Firth et al., 2006). The relationship between labor costs and business volume is nearly linear. Third, company executives receive better treatment while government–enterprise relations primarily increase employee protection for ordinary employees.

Additionally, if high skilled labor has cost stickiness, this talent reserve strategy will be beneficial for enterprises to achieve long-term benefits. We further divided employees into high-skilled labor ($\Delta lnLabor_H$) and low-skilled labor ($\Delta lnLabor_L$) based on corporate employee statistics. The regression results indicate that SOMS only intensified labor stickiness for low-skilled labor and had no significant impact on high-skilled labor. Therefore, the structural decomposition illustrates that SOMS's exacerbating effect on labor cost stickiness was only evident among low-skilled ordinary employees.

5.3. Heterogeneity analysis

The influence of SOC on labor cost stickiness in private firms may be constrained by other exogenous factors. Therefore, we examined the heterogeneity effects of H1 by considering industry, regional, and temporal characteristics.

5.3.1. Industry competition

Industry competition can change the cost management methods of enterprises, engendering differences in the matching and adaptability of private enterprises to SOC participation. Business managers in competitive industries care more about efficiency and exhibit less cost stickiness. In monopolistic industries, business managers must proactively maintain good government–enterprise relations to obtain better government resources and protection, with the cost of bearing additional policy burdens. Therefore, we speculate that the exacerbating effect of SOMS on labor cost stickiness in private enterprises is more evident in competitive industries.

We measured the degree of competition in an industry based on the square sum of the operating income proportions of each enterprise in that industry. We divided the sum into two equal parts to obtain the dummy variable (*HHI*). We assigned a value of 1 for monopolistic

Table 8

Heterogeneity tests 1 and 2.

Variable	(1)	(2)	(3)	(4)
	HHI = 0	HHI = 1	East = 0	East = 1
$\Delta Ln Revenue$	0.463***	0.568***	0.492***	0.500***
	(27.15)	(24.67)	(19.31)	(30.28)
$\Delta Ln Revenue imes Dec$	-0.222^{***}	-0.377***	-0.288^{***}	-0.256^{***}
	(-6.33)	(-8.36)	(-5.88)	(-7.41)
Δ LnRevenue $ imes$ Dec $ imes$	-0.161**	-0.173	-0.175^{**}	-0.132
SOMS	(-2.47)	(-1.42)	(-2.38)	(-1.59)
Constant	0.109***	0.075***	0.096***	0.096***
	(25.36)	(16.46)	(16.47)	(26.42)
CV	YES	YES	YES	YES
Year	YES	YES	YES	YES
Ind	YES	YES	YES	YES
R^2	0.348	0.421	0.376	0.372
Ν	8614	5768	4253	10129

Note: This table presents the heterogeneous effect of SOC in exacerbating labor cost stickiness. We conducted empirical testing using group-by-group regression. The results show the heterogeneous effect of SOC in exacerbating labor cost stickiness. We conducted empirical tests using grouped regression. The group variables in (1) and (2) represent the degree of industry competition. The group variables in (3) and (4) depict regional development levels. By comparing the estimated coefficients of the three-dimensional interaction terms of each regression within the group, we can infer the differentiated results of SOMS's adjustment of private enterprise labor costs. All regressions controlled for four economic variables, interaction terms, year fixed-effects, and firm fixed-effects. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

industries and 0 for competitive industries. The results of the group regression are presented in Columns (1) and (2) of Table 8. The empirical results indicate that the exacerbating effect of SOMS on labor cost stickiness in competitive industries is no longer valid but is still significantly negative in monopolistic industries. This confirms that the negative impact of SOE on the labor cost stickiness of private enterprises primarily exists in monopolistic industries.

5.3.2. Regional development

China's economic development has exhibited a pattern of "strong in the east, weak in the west" since 1978. Marketization processes are faster and the business environment is better in China's eastern regions. Furthermore, the government has a weaker influence on the operational management of listed firms within this jurisdiction. Firms have relatively more freedom in making cost adjustment decisions while facing fewer financing constraints. In contrast, the institutional environment is poorer in the central and western regions, with greater rent-seeking opportunities for the government. Firm development in these regions relies more on government resource support; thus, private firms seek to establish relationships with the government more actively. Simultaneously, listed firms guarantee tax revenue and employment in these underdeveloped areas, and local officials under political pressure may face budget constraints. Thus, the cost and resource effects are more prominent in firms in China's central and western regions.

We divided the sample enterprises into two groups: central and western (*East* = 0) and eastern (*East* = 1) based on the province to which they belong. Columns (3) and (4) of Table 8 present the group regression results. The three-dimensional interaction term's regression coefficient was significantly negative only in the central and western groups. This result indicates that the negative impact of SOE on the labor cost stickiness of private enterprises primarily occurs in the central and western regions.

5.3.3. Supply-side reform

While SOC participation has increased labor cost stickiness in private enterprises, some of China's policies seek to address the negative impacts of MOR. In November 2015, General Secretary Xi Jinping proposed the implementation of supply-side reform policies for the first time.⁷ The goal was to unleash market vitality to help private enterprises reduce resource dependence on government relations. China's supply-side reform is aimed at adjusting the economic structure to achieve optimal factor allocation, aligning with the policy objectives of MOR. Policy implementation focused on enterprises with lower capacity utilization rates. Therefore, we speculate that supply-side reform policies act as exogenous shocks and weaken the impact of SOC on labor cost stickiness.

We used the stochastic frontier production function method (Pascoe, 2007) to measure enterprise capacity utilization (CU) and divided the sample into a control group (high CU) and a treatment group (low CU). Each group was divided again into pre-policy and post-policy using 2015 as the time node to obtain a total of four groups (2×2). The group regression results are presented in Table 9. Before policy implementation, SOMS had a significant exacerbating effect in the control and treatment groups, with a greater impact on companies in the treatment group. After policy implementation, the aggravating effect of SOMS in the control group was no longer significant and the effect in the treatment group weakened substantially. Thus, supply-side reform

⁷ Supply-side structural reform is an economic policy of the People's Republic of China proposed by General Secretary Xi Jinping at the 11th meeting of the Central Financial and Economic Affairs Leading Group in November 2015. The core objective of this reform is to eliminate outdated production capacity while improving supply quality. The policy framework includes initiatives such as reducing excess capacity, destocking, deleveraging, reducing costs, and addressing weaknesses.

Table 9

Heterogeneity test 3.

Variable	(1)	(2)	(3)	(4)
	High-capacity utilization		Low-capac	ity utilization
	Before	After	Before	After
$\Delta Ln Revenue$	0.455***	0.499***	0.488***	0.882***
	(20.08)	(18.72)	(10.52)	(10.71)
$\Delta LnRevenue imes Dec$	-0.247***	-0.300***	-0.062	-0.770***
	(-4.69)	(-6.56)	(-0.68)	(-7.03)
$\Delta LnRevenue imes Dec imes SOMS$	-0.174*	-0.108	-0.291*	0.302*
	(-1.95)	(-0.97)	(-1.83)	(1.73)
Constant	0.122***	0.070***	0.161***	0.052**
	(20.29)	(12.61)	(13.92)	(2.41)
CV	YES	YES	YES	YES
Year	YES	YES	YES	YES
Ind	YES	YES	YES	YES
R^2	0.360	0.374	0.333	0.433
Ν	4690	4034	2093	1662

Note: This table shows the heterogeneous effect of SOC in exacerbating labor cost stickiness. We considered the impact of MOR policies on the baseline results. We first divided them into high-capacity and low-capacity utilization groups to examine each group's regression results before and after policy implementation. Comparing the estimated coefficients of the three-dimensional interaction terms of the four regressions shows the policy effects of MOR. All regressions controlled for economic variables, interaction terms, year fixed-effects, and firm fixed-effects. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

effectively solved the stickiness problem of labor costs caused by SOC participation in low-CU enterprises. The positive effect of supply-side reform on reducing labor cost stickiness was consistent with the effects of labor reforms (Josep et al., 2023) and private enterprise groups (Xu et al., 2023). A possible economic explanation for this positive

Table 10

Economic	consec	uences	of	cost	stickiness.
			_		

impact is that the development of low-CU enterprises before the reform was limited by the "gift exchange" type of government–enterprise relationship; firms needed to bear the policy burden of transferring state-owned shareholders. After the reform, reducing redundant employees and increasing disposable resources would have enabled the pure resource effect to promote enterprise development, especially the efficiency of labor resource allocation.

5.4. Economic consequences

Existing literature indicates the ambivalence of SOC. Kong et al. (2023) demonstrated that SOC weakens private firm profitability. Huang et al. (2021) found that SOC leads to lower profitability and lower labor productivity. The present study has confirmed that introducing SOC in private enterprises will increase labor cost stickiness. Next, we consider whether slowing down the pace of labor cost adjustment will generate positive or negative economic value.

This study examined the economic consequences of labor cost stickiness from three perspectives: single-factor production efficiency, multi-factor production efficiency, and innovation investment level. We selected labor productivity (*LP*), total factor productivity (*TFP*) (Olley and Pakes, 1996), and the proportion of R&D investment in operating income (*R&D*), respectively. Unlike the previous interaction model used to test the existence of cost stickiness, here, we followed Weiss (2010) and used quarterly financial data of listed companies to calculate the specific value of labor cost stickiness (*Sticky*). The larger the value, the stronger was the stickiness. To determine the short- and long-term economic effects of labor cost stickiness, we used the values of the economic variables in the current period and the following five periods for regression testing. The results are presented in Table 10.

The results indicate that cost stickiness significantly negatively impacted labor productivity in the current period. We also found a

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	LP_t	LP_{t+1}	LP_{t+2}	LP_{t+3}	LP_{t+4}	LP_{t+5}
Sticky	-0.536***	-0.528***	-0.455***	-0.241***	-0.102	-0.158
U U	(-10.66)	(-9.44)	(-7.89)	(-3.39)	(-1.32)	(-1.53)
CV	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES
Firm	YES	YES	YES	YES	YES	YES
R^2	0.744	0.750	0.745	0.747	0.767	0.799
Ν	13956	13921	13888	11721	9826	8146
Variable	(1)	(2)	(3)	(4)	(5)	(6)
	TFP _t	TFP_{t+1}	TFP_{t+2}	TFP_{t+3}	TFP_{t+4}	TFP_{t+5}
Sticky	-0.284***	-0.252***	-0.192***	-0.082^{***}	-0.025	-0.008
	(-18.96)	(-13.45)	(-9.42)	(-3.62)	(-1.01)	(-0.29)
CV	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES
Firm	YES	YES	YES	YES	YES	YES
R^2	0.930	0.901	0.872	0.865	0.877	0.894
Ν	13956	13907	13853	11672	9771	8088
Variable	(1)	(2)	(3)	(4)	(5)	(6)
	$R\&D_t$	$R\&D_{t+1}$	$R\&D_{t+2}$	$R\&D_{t+3}$	$R\&D_{t+4}$	$R\&D_{t+5}$
Sticky	1.621***	0.957***	0.496***	0.133	0.109	0.110
	(11.69)	(7.90)	(3.96)	(1.08)	(0.84)	(0.63)
CV	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES
Firm	YES	YES	YES	YES	YES	YES
R^2	0.835	0.820	0.817	0.824	0.835	0.854
Ν	10945	11343	11720	9854	8241	6832

Note: This table illustrates the economic consequences of cost stickiness. We selected three economic variables, namely, labor productivity (*LP*), total factor productivity (*TFP*), and R&D expenditure (*R&D*), as the dependent variables. In contrast, the explanatory variable measured cost stickiness, which was obtained using the method developed by Weiss (2010). Furthermore, we controlled for firm size, firm age, leverage ratio, and other control variables, as well as firm fixed-effects and year fixed-effects. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

negative impact on labor productivity in future periods; productivity gradually decreased until the effect disappeared in the fourth period. Cost stickiness similarly affected total factor productivity in the current and future periods. The results also indicate that cost stickiness positively affected a company's R&D investment level in the current period as well as in the following two periods. This finding suggests that although stronger cost stickiness indicates inefficient labor resource allocation, it is conducive to corporate innovation because it requires long-term capital investment (Suarez, 2014).

6. Conclusion

Cost competition is crucial for modern firms because maintaining a cost advantage is essential for sustainable development. This study investigated the impact of SOC-and its underlying mechanisms-on the efficiency of labor cost management in private firms while focusing on cost stickiness. The research findings are as follows. First, SOC intensified labor cost stickiness in private firms in the study sample. Second, mechanism analysis showed how SOC increased excessive staffing and relative wages in firms and also alleviated financing constraints through government subsidies and tax incentives. The combined cost and resource effects led to increased labor cost stickiness. Third, after decomposing the labor cost structure, we found that the labor cost stickiness of private firms was predominantly evident for ordinary employees, particularly low-skilled labor. Fourth, heterogeneity analysis showed that SOC's intensifying effect on labor cost stickiness was more pronounced in competitive industries and China's central and western regions. However, this effect became insignificant after the implementation of the supply-side reform policy. Finally, examining the value effects demonstrated that labor cost stickiness decreased labor and total factor productivity but still benefited enterprises' innovation in the long term.

Based on the above findings, we propose several policy implications. First, the benchmark regression results confirmed the positive impact of "reverse mixed-ownership reform" on labor cost stickiness in private firms. However, the initial intention behind introducing SOC participation in private firms was to achieve a fair, competitive environment while strengthening and expanding the private economy. Therefore, China's MOR should fully leverage the respective advantages of SOC and POC as well as their synergistic effects. Government departments should strengthen pre-matching and post-supervision to prevent SOC from becoming a tool for local governments to impose policy burdens, thereby reducing the cost management efficiency of private firms. The dual challenges of labor shortage and job scarcity coexist in the labor market. Thus, the government-firm relationship facilitated by SOC should actively reduce information asymmetry in employment and enhance labor market supply-demand matching. After SOC participation is implemented, an assessment mechanism should be established to ensure a rationalized ownership structure while minimizing government intervention.

Second, the study results suggest mixed effects in a two-way mixed reform approach. We found that labor cost stickiness was exacerbated in private SMEs (private listed enterprises) with SOC participation. This finding implies that larger enterprises (SOEs) with stronger labor cost stickiness will spill over into private enterprises. While previous studies suggest that developed economies exhibit lower labor cost stickiness in larger enterprises, China should endeavor to minimize the social responsibilities imposed by government intervention via SOC. This approach can mitigate the negative effects of SOE labor cost stickiness on private enterprises while improving market resource allocation efficiency. Furthermore, it is imperative to pay equal attention to stickiness costs incurred by private enterprises. This balanced approach could ensure that the stickiness costs of both types of enterprises are not mutually amplified, thereby averting potential negative repercussions of MOR policies.

The heterogeneity analysis indicated that after implementing the supply-side reform, SOC no longer significantly exacerbated labor cost stickiness in private firms. However, the analysis did not demonstrate a superior effect of SOC in restraining cost stickiness. This finding suggests that the supply-side reform only assisted firms in reducing costs concerning external aspects such as taxes, financing, and energy; it has not rectified the misconceptions in firm cost management internally. External cost reduction measures demonstrate support for firms while mitigating difficulties. However, potential risks in promoting firms to commit to downward resource adjustments cannot be ruled out. Therefore, cost reduction should still originate from the internal structure of firms, aimed at minimizing labor adjustment costs while dampening the effects of cost stickiness.

Finally, economic consequences suggest that labor cost stickiness in private firms can have a series of negative impacts but can still have certain positive effects. We found that certain types of SOC increased the creation of private enterprises. However, for many firms, the efficiency of human resource management represents a core competitiveness for business development. Private SMEs can consider appropriate layoffs or salary reductions to respond to revenue adjustments, alleviate operational difficulties, and optimize employee structures. However, the management of labor costs within firms must adhere to market economy principles, neither acting impulsively nor hesitating to increase or reduce labor costs. Deliberately delaying cost adjustments for the sake of short-term benefits should be avoided as this may lead to the loss of competitive advantage due to long-term cost stickiness.

This study investigated the impact of SOC on labor cost stickiness in private firms. By demonstrating that SOC exacerbates labor cost stickiness in private firms, this study emphasizes the cost management inefficiency of private firms and highlights the negative consequences of reverse MOR.

Statement of generative Al and Al-assisted technologies

I declare that I do not use generative Al and AI-assisted technologies in the writing process.

CRediT authorship contribution statement

Zheng Xiao: Conceptualization, Methodology, Software, Formal analysis, Writing – original draft, Writing – review & editing, Supervision. **Qingqing Niu:** Formal analysis, Methodology, Validation, Writing – review & editing. **Feng Yun:** Visualization, Writing – review & editing, Project administration. **Yongwei Ye:** Writing – review & editing, Supervision, Funding acquisition.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix

Table A

Definitions of main variables

Variable type	Variable	Specific definition
variable type	symbol	openie deminion
Dependent variable	$\Delta LnLaborcost$	The natural logarithm is taken from the ratio between the labor cost in the current year and the labor cost in the previous year.
Independent	$\Delta Ln Revenue$	The natural logarithm is taken from the ratio between the revenue in the current year and the revenue in the previous year.
variable	Dec	Dummy variable: takes a value of 1 if the firm's current revenue is less than the previous period, and 0 otherwise.
	SOMS	Dummy variable: takes the value 1 if the ownership percentage of a state-owned shareholder group among the top ten shareholders of a firm exceeds 10%; otherwise, it takes a value 0.
Control variable	Sdec	Dummy variable: takes a value of 1 if the firm's current revenue is successive decrease, and 0 otherwise.
	GDP	The growth rate of GDP
	Ai	Total assets/operating revenue
	Ei	Number of employees \times 10,000/operating revenue
	Size	Natural logarithm of the total assets of the firm
	Age	Current year – listing year
	Lev	Total liabilities/total assets
	Dual	Dummy variable: takes a value of 1 if the chairperson and CEO roles are combined, otherwise 0.
	PClevel	Dummy variable: takes a value of 1 if the chairperson or CEO has political experience, and a value of 0 otherwise.
	Ind	Industry dummy variable
	Year	Year dummy variable
Mediating variable	ExEmp	The residual measure: positive values indicate employee redundancy, while negative values indicate employee shortage.
0	RelComp	Average employee compensation/industry average compensation
	SA	SA index, with larger numerical values indicating greater financing constraints after take the opposite sign.
	Sub	Government subsidies/total assets * 100
	Tax	(Paid taxes and fees - tax refunds received)/operating income * 100
Other variables	$\Delta lnLaborcost_E$	The natural logarithm from the ratio between the total annual remuneration of executives in the current year and the previous year.
	$\Delta lnLaborcost_O$	The natural logarithm from the ratio between the annual compensation of regular employees in the current year and the previous year.
	$\Delta lnLabor_H$	The natural logarithm from the ratio of the number of highly-skilled employees between the current year and the previous year
	$\Delta lnLabor_L$	The natural logarithm from the ratio of the number of low-skilled employees between the current year and the previous year
	HHI	A dummy variable calculated as the median of the Herfindahl index based on the revenue of firms within the industry. A higher value
		indicates stronger monopoly power.
	East	A dummy variable representing the eastern region based on the National Bureau of Statistics classification criteria, including ten provinces
		such as Hebei, Beijing, and Tianjin.
	Reform	A dummy variable that takes a value of 1 for years starting from 2016 to 0 otherwise.
	Sticky	The measure method proposed by Weiss (2010), where a larger value indicates greater stickiness after taking the opposite.
	LP	Revenue/1,000,000/number of employees
	TFP	Measured according to the OP method
	R&D	R&D investment/operating income

Table B Abbreviation correspondence

Abbreviation	Full Form
CSMAR	China Stock Market & Accounting Research
IMR	Inverse Mills ratio
MOR	Mixed-Ownership Reform
POC	Private-owned capital
PSM	Propensity score matching
S.D.	Standard deviation
SME	Small- and medium-sized enterprises
SOC	State-owned capital
SOE	State-owned enterprises
SOER	State-owned equity ratio
SOMS	State-owned majority shareholders

Data availability

Data will be made available on request.

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