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COST STICKINESS AND TOTAL FACTOR PRODUCTIVITY: ROLE OF ESG PERFORMANCE

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Abstract. Using a sample of Chinese A-share firms from 2013 to 2023, this study examines the association between cost stickiness and total factor productivity (TFP), with particular emphasis on the moderating role of ESG performance. Greater cost stickiness is significantly associated with lower TFP, and the result is robust to alternative specifications, endogeneity tests, and robustness checks. Stronger ESG performance attenuates this negative association, primarily through its social and governance dimensions. Further analysis shows that the adverse productivity effect of cost stickiness is more pronounced in state-owned enterprises and highly competitive industries. These findings extend research on asymmetric cost behavior, firm productivity, and ESG governance.

Keywords: cost stickiness, total factor productivity, ESG performance, moderating effect, cost management, sustainable development.

JEL Classification: D24, M41, M14, Q56.

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1. Introduction

Firms are facing more frequent operating shocks and mounting pressure to improve efficiency amid heightened global economic uncertainty and rapid industrial restructuring. After the COVID-19 pandemic, many firms experienced sharp declines in revenue, yet their costs fell more slowly, weakening profitability and operational stability. Such inertia in cost adjustment can constrain a firm's response to fluctuations in demand. At the same time, firms operating under similar conditions differ markedly in input-output efficiency. This variation raises two questions: How does cost stickiness affect firm productivity, and under what conditions is that effect strengthened or attenuated? Answering these questions can advance understanding of cost adjustment and high-quality development in China.

Cost stickiness describes an asymmetry in cost behavior: costs decline less when business activity falls than they rise when activity increases (Anderson et al., 2003). The literature attributes this pattern primarily to adjustment costs, managerial optimism, and agency problems (Chen et al., 2012; Banker et al., 2018; Ibrahim et al., 2022; Hartlieb, 2023; Agarwal & Agarwal, 2024). Documented consequences include lower analyst forecast accuracy (Weiss, 2010), as well as effects on firm performance (Kontesa & Brahmana, 2018), firm value (Costa & Habib, 2023), enterprise risk (Binhua & Boyuan, 2024), resilience (Bai et al., 2025), credit

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risk (Homburg et al., 2019), stock price crash risk (Habib & Costa, 2022), and market reactions (Sabzalipour et al., 2024).

The performance implications of cost stickiness nevertheless remain unresolved. Conventional financial indicators are often sensitive to business cycles and accounting treatments, which limits their ability to reflect long-term competitiveness. Total factor productivity (TFP), by contrast, offers a broader measure of input-output efficiency and sustainable competitiveness (Boubaker et al., 2021; Su et al., 2023). Studies have identified several internal and external determinants of TFP, including financing constraints (Hall et al., 2016), R&D (Herzer, 2022), policy interventions (Lee et al., 2023), taxation (Wu et al., 2023), and finance (Rehman & Islam, 2023). Asymmetric cost behavior, however, has received little attention. By leaving resources idle when demand falls, cost stickiness may depress TFP through less efficient resource allocation and a weaker capacity for technological innovation. This omission constitutes an important gap in the literature.

The consequences of cost stickiness may also vary with a firm's ESG performance. ESG has become an important indicator of sustainable competitiveness (Şerban et al., 2023). Strong ESG performance is associated with higher returns and profitability (Aydoğmuş et al., 2022; Morea et al., 2025) and has implications for default risk, financing constraints, investment efficiency, the cost of capital, corporate innovation, and cost stickiness (Li et al., 2022; Bilyay-Erdogan et al., 2024; Jiang & Yang, 2024; Postiglione et al., 2024; Chen et al., 2025; Li et al., 2025). ESG integration can also improve TFP (Ding et al., 2024). Although previous research has examined the separate effects of ESG on cost stickiness and TFP, it remains unclear whether ESG conditions the relationship between them.

Accordingly, this study asks whether cost stickiness affects firm-level TFP and whether ESG performance moderates that relationship. It has three specific objectives: (1) to estimate the effect of cost stickiness on TFP, (2) to validate the firm-level measure of cost stickiness, and (3) to determine whether ESG performance conditions the association between cost stickiness and TFP.

The analysis draws on Chinese A-share firms observed from 2013 to 2023. The results indicate that greater cost stickiness is significantly associated with lower TFP, and the relationship persists across endogeneity tests and multiple robustness checks. Strong ESG performance attenuates this negative association. The adverse effect of sticky costs on TFP is also more pronounced among state-owned enterprises and firms in highly competitive industries. These findings offer guidance for strengthening the sustainable development capacity of Chinese firms and supporting their high-quality growth.

This study makes three potential contributions. First, it extends research on the determinants of TFP. Previous work has emphasized factors such as R&D, financing constraints, and policy, but has devoted limited attention to the productivity consequences of asymmetric cost behavior. Incorporating cost stickiness into the TFP framework shows how such behavior relates to firm-level productivity and broadens the set of recognized determinants. Second, the study develops research on the economic consequences of cost stickiness. Existing studies have concentrated mainly on earnings forecasts, corporate risk, and short-term performance, with less attention to long-term competitiveness and sustainable development. The empirical analysis extends this literature to productivity outcomes. Third, the study offers a different perspective on corporate ESG governance. Rather than treating ESG only as a direct determinant of firm performance or value, it examines how ESG moderates the association between cost stickiness and TFP. Identifying this interaction provides theoretical insight and practical guidance for firms pursuing sustainable development.

The paper proceeds as follows. Section 2 develops the theoretical arguments and hypotheses. Section 3 describes the sample, variables, and empirical models. Section 4 reports the main results and robustness tests. Section 5 presents further analyses of ESG moderation and heterogeneity. Section 6 summarizes the findings and discusses their managerial and policy implications, the study's limitations, and directions for future research.

2. Hypothesis development

Cost stickiness arises when costs adjust asymmetrically because of adjustment costs, managerial expectations, and incentive constraints (Anderson et al., 2003; Banker & Byzalov, 2014). Prior evidence suggests that persistent cost stickiness may impair firm performance and long-term competitiveness (Kontesa & Brahmana, 2018; Gnoth et al., 2025). This study therefore proposes that cost stickiness reduces TFP through two principal channels: internal resource allocation and technological innovation.

The first channel concerns internal resource allocation. When sales fall, firms with greater cost stickiness tend to retain labor, equipment, production capacity, and managerial resources rather than immediately incur the costs of layoffs, asset disposal, or restructuring. These resources may remain idle or underused while continuing to generate wages, depreciation, maintenance costs, and administrative expenses. Factor utilization consequently deteriorates when output contracts faster than inputs. Resources may also remain committed to declining departments, mature products, or low-return projects because reallocation entails severance payments, retraining expenses, losses on asset disposal, and organizational coordination costs (Anderson et al., 2003; Banker & Byzalov, 2014). A firm's cost structure and resource commitments therefore determine how readily it can adjust inputs as operating activity changes (Balakrishnan et al., 2014).

Agency problems can reinforce this tendency to retain resources. Managers may preserve larger departments, workforces, and asset bases to protect the private benefits associated with them (Chen et al., 2012). Overconfident managers may likewise postpone cost reductions because they expect demand to recover (Chen et al., 2022). Cost stickiness can thus reflect managerial incentives and biased expectations as well as unavoidable adjustment costs. Persistent retention distorts both the scale and the composition of inputs by tying excess labor and capital to established activities instead of higher-return uses. The result is weaker allocative and technical efficiency and less organizational flexibility. Retained resources can provide a useful buffer when demand rebounds quickly. Under prolonged weak demand, however, precautionary retention may develop into organizational inertia and resource misallocation, ultimately reducing TFP.

The second channel operates through technological innovation. Sticky operating expenditures may limit a firm's capacity to sustain innovation investment. Innovation is risky, long-term, and resource-intensive. R&D-intensive firms face particularly severe financing frictions because technological knowledge and early-stage research offer little collateral value and are difficult for outsiders to assess (Brown et al., 2009; Hsu et al., 2014). If revenue declines while operating costs adjust slowly, committed expenditures consume a larger share of cash flow and leave fewer resources available for R&D, technological upgrading, employee training, and process innovation.

Corporate innovation is highly sensitive to financing conditions. Internal cash flow and external equity financing support R&D growth (Brown et al., 2009), whereas financing constraints suppress R&D investment, particularly when innovation expenditure is itself subject to

adjustment costs (Brown et al., 2012). Evidence from Chinese firms likewise shows that R&D participation and expenditure depend on cash-flow availability (Weng & Söderbom, 2018). Cost stickiness has also been found to reduce R&D expenditure among Chinese manufacturing firms, especially when macroeconomic, industry, and firm-level risks are greater (Sun et al., 2019). Sticky operating expenditures may therefore weaken a firm's ability to maintain innovation investment.

Because technological development depends on continuity and cumulative learning, the effect can extend beyond current R&D spending. Funding cuts may interrupt research projects, erode knowledge accumulation, and lead to the loss of skilled employees. Cost stickiness can also heighten the sensitivity of earnings to declining sales and reduce analysts' forecast accuracy (Weiss, 2010), making future cash flows and operating risks harder for external capital providers to evaluate. Financing for long-term innovation may become still more constrained. In addition, sticky resource structures can entrench established routines and resistance to technological change, limiting a firm's ability to absorb new knowledge and reorganize production. These effects collectively slow technological progress and weaken productivity growth.

The two channels are closely connected. Inefficient resource retention lowers current factor utilization and absorbs cash flow, while weaker innovation limits the firm's capacity to upgrade production processes and raise the productivity of retained resources. Cost stickiness may therefore impose both immediate efficiency losses and longer-term constraints on organizational capabilities, ultimately lowering TFP.

These arguments lead to the following hypothesis:

Hypothesis 1: Cost stickiness has a significant negative effect on TFP.

Hypothesis 1 provides the basis for considering ESG performance as a moderator of the negative association between cost stickiness and TFP. Firms with strong ESG performance generally attach greater importance to the sustainable and efficient use of resources. Stronger internal controls, process management, and accountability mechanisms may also give them greater capacity to reallocate those resources. When demand falls, such firms can restructure or redeploy redundant assets, or improve their utilization, instead of merely retaining low-efficiency inputs. ESG performance may therefore reduce the resource-misallocation consequences of cost stickiness.

Strong ESG performance can also improve relationships with external stakeholders. High-ESG firms tend to disclose higher-quality information (Ferdous et al., 2025) and accumulate more reputational capital, creating a more transparent and credible presence in capital markets (Huang, 2022). ESG performance also signals stronger governance, risk management, and a longer-term orientation (Zhao et al., 2023). When these firms retain critical employees, processes, or strategic investments during a downturn in demand, external stakeholders may therefore be more likely to view the decision as a strategic buffer for long-term capability development rather than as inefficient resource accumulation.

Stronger ESG performance also improves disclosure quality and reduces information asymmetry (Kim & Park, 2023), which can ease external financing constraints. Better access to finance enables firms to sustain innovation investment and technological development (Lei et al., 2022), offsetting the crowding-out effect of sticky operating expenditures. By improving resource-allocation efficiency and technological innovation capacity, ESG performance can thus attenuate the adverse productivity consequences of cost stickiness. This reasoning yields the following hypothesis:

Hypothesis 2: Stronger ESG performance attenuates the negative association between cost stickiness and TFP.

3. Research design

3.1. Sample selection

The sample comprises firms listed on China's Shanghai and Shenzhen A-share markets between 2013 and 2023. This period was chosen for three reasons. First, improvements in financial reporting and disclosure since 2013 have increased the reliability and comparability of firm-level data. Second, the period encompasses China's shift from high-speed growth toward high-quality development, during which firms faced growing pressure to improve cost and resource efficiency. Third, the gradual institutionalization of ESG practices and disclosure creates an appropriate setting in which to examine the moderating role of ESG performance.

The sample was screened in five steps. Financial and insurance firms were excluded because they follow distinct reporting standards. ST, ST*, and PT firms were removed because of their abnormal operating characteristics, as were observations with substantial missing data. The sample was then limited to firm-year observations in which costs and sales moved in the same direction. Finally, all continuous variables were winsorized at the 1st and 99th percentiles. These procedures yielded a final sample of 18,082 firm-year observations.

3.2. Variable definitions

3.2.1. Dependent variable

Following Lu and Lian (2012) and Su et al. (2023), firm-level TFP is estimated with the Levinsohn-Petrin (LP) method; the Olley-Pakes (OP) method is used in the robustness tests. Relative to conventional OLS, these semiparametric methods better address the endogeneity between input choices and productivity shocks while reducing sample attrition.

$$\ln Y_{i,t} = \alpha_0 + \alpha_1 \ln K_{i,t} + \alpha_2 \ln L_{i,t} + \alpha_3 \ln M_{i,t} + \varepsilon_{i,t}. \quad (1)$$

In this specification, $Y_{i,t}$ denotes a firm's total output, measured by operating income. $K_{i,t}$ denotes capital input, measured by the net value of fixed assets. $L_{i,t}$ denotes labor input, measured by the firm's total number of employees. $M_{i,t}$ denotes intermediate input, constructed as operating costs plus SG&A expenses and financial expenses, minus current-period depreciation, amortization and employee wages. α_0 is the constant term, while α_1, α_2 and α_3 are the output elasticities of capital, labor, and intermediate inputs, respectively, reflecting the relationships between K, L, M and Y.

3.2.2. Independent variable

Two approaches are commonly used to measure cost stickiness: the ABJ model (Anderson et al., 2003) and the firm-level Weiss model (Weiss, 2010). The ABJ model estimates average cost stickiness for the sample, whereas the Weiss model produces a firm-specific measure and is therefore better suited to examining its economic consequences. This study accordingly follows Weiss (2010) to measure firm-level cost stickiness (Sticky). The model is specified as follows:

$$Sticky_{(i,t)} = \ln\left(\frac{\Delta Cost_{i,t_1}}{\Delta Sale_{i,t_1}}\right) + \ln\left(\frac{\Delta Cost_{i,t_2}}{\Delta Sale_{i,t_2}}\right)\ t_1,\ t_2 \in (t, t-3), \quad (2)$$

where t_1 and t_2 identify, respectively, the most recent quarters within the preceding four quarters in which the sample firm's annual revenue decreased and increased; $\Delta Cost$ denotes the change in total operating costs between two consecutive quarters; and $\Delta Sale$ represents the change in sales over the same interval. Following Weiss (2010), negative raw values indicate cost stickiness, whereas positive values indicate anti-stickiness. Because the analysis focuses on cost stickiness, observations with positive values are excluded. The absolute values of the remaining negative observations are then used, so higher values of Sticky indicate greater cost stickiness.

The firm-level measure is validated against three established determinants of cost stickiness: adjustment costs, managerial optimism, and agency problems. Asset intensity (Ain), salary concentration (Salary), and the sales-to-assets ratio (Sta) serve as their respective proxies. Ain equals total assets divided by sales. Salary is calculated as the compensation of the three highest-paid directors, supervisors, and executives divided by total management compensation. Sta equals sales divided by total assets. Each variable is lagged by one period to reduce concerns about reverse causality.

3.2.3. Moderating variable

Corporate ESG performance (ESG) is measured with the Sino-Securities ESG ratings, following Lin et al. (2021). The system combines international ESG standards with characteristics of the Chinese market and assigns firms to nine categories ranging from C to AAA. For the empirical analysis, these categories are converted to values from 1 to 9, with higher scores denoting stronger ESG performance. The highest rating observed in the final sample is A, which corresponds to 7. Thus, although the coding scheme theoretically ranges from 1 to 9, the ESG scores observed in the sample range from 1 to 7.

3.2.4. Control variables

Following Su et al. (2023) and Ma et al. (2022), the regressions include controls for firm size (Size), leverage (Lev), profitability (Roa), operating cash flow (Cashflow), sales growth (Growth), independent directors (Indep), ownership concentration (Top1), and listing age (Listage). Firm-level financial variables are expressed in RMB yuan. Table 1 provides the detailed definitions.

Table 1. Variable definitions

Variable	Definition
TFP	Firm-level total factor productivity estimated using the LP method
Sticky	Firm-level cost stickiness measured using the Weiss model
ESG	Sino-Securities ESG rating, converted from nine categories (AAA to C) into numerical values from 9 (highest) to 1 (lowest)
Size	Natural logarithm of total assets
Lev	Total liabilities divided by total assets
Roa	Net income divided by total assets
Cashflow	Net cash flow from operating activities divided by total assets
Growth	Annual sales growth rate
Indep	Number of independent directors divided by the total number of directors

End of Table 1

Variable	Definition
Top1	Shareholding percentage of the largest shareholder
Listage	Natural logarithm of the listed age of the firm
YearFE	Year fixed effects
IndustryFE	Industry fixed effects
Ain	Asset intensity calculated as total assets divided by sales.
Salary	Ratio of the total salary of the top three directors, supervisors, and senior executives to the total salary of the entire management.
Sta	Sales-to-assets ratio measured as sales divided by total assets.

3.3. Model specification

Equation (3) is estimated to test the main prediction in Hypothesis 1:

$$TFP_{i,t} = \beta_0 + \beta_1 Sticky_{i,t} + \beta_2 ESG_{i,t} + \sum Controls_{i,t} + YearFE + IndustryFE + \varepsilon_{i,t}. \quad (3)$$

In the basic model, the subscripts t and i denote fiscal year and firm, respectively. $TFP_{i,t}$ denotes firm-level total factor productivity. $Sticky_{i,t}$ measures the degree of cost stickiness at the firm level. $Controls_{i,t}$ is the set of control variables. The model includes year and industry fixed effects, with standard errors clustered at the firm level. A significantly negative coefficient on Sticky would support Hypothesis 1. Equation (4) is then estimated to validate the cost-stickiness measure:

$$Sticky_{i,t} = \beta_0 + \beta_1 Ain_{i,t-1} + \beta_2 Salary_{i,t-1} + \beta_3 Sta_{i,t-1} + YearFE + IndustryFE + \varepsilon_{i,t}. \quad (4)$$

Ain, Salary, and Sta serve as proxies for adjustment costs, managerial optimism, and agency problems, respectively. The preceding theoretical arguments predict positive coefficients on Ain and Salary and a negative coefficient on Sta.

To test the moderating effect of ESG performance, Equation (3) is augmented with ESG and the interaction term Sticky×ESG. This produces the empirical specification in Equation (5):

$$TFP_{i,t} = \beta_0 + \beta_1 Sticky_{i,t} + \beta_2 ESG_{i,t} + \beta_3 Sticky_{i,t} \times ESG_{i,t} + \sum Controls_{i,t} + YearFE + IndustryFE + \varepsilon_{i,t}. \quad (5)$$

A significantly positive coefficient on Sticky×ESG would support Hypothesis 2.

4. Empirical results

4.1. Descriptive statistics

Table 2 presents the descriptive statistics. TFP averages 8.40 and ranges from 5.80 to 11.45, revealing substantial variation across firms. The mean of Sticky is 0.78, with values between 0 and 5.10, which indicates considerable heterogeneity in cost-adjustment behavior. ESG has a mean of 4.17 and an observed range of 1 to 7, suggesting that ESG performance remains modest among the sample firms. All other variables lie within reasonable ranges.

Table 2. Descriptive statistics

Variable	N	Mean	Sd	Minimum	Median	Maximum
TFP	18,082	8.40	1.04	5.80	8.28	11.45
Sticky	18,082	0.78	0.89	0.00	0.45	5.10
ESG	18,082	4.17	1.00	1.00	4.00	7.00
Size	18,082	22.30	1.27	19.73	22.10	26.61
Lev	18,082	0.43	0.20	0.05	0.42	0.93
Roa	18,082	0.03	0.07	–0.37	0.03	0.23
Cashflow	18,082	0.05	0.07	–0.20	0.05	0.27
Growth	18,082	0.12	0.34	–0.63	0.08	3.59
Indep	18,082	37.86	5.40	33.33	36.36	60.00
Top1	18,082	0.33	0.15	0.07	0.31	0.76
ListAge	18,082	2.19	0.78	0.69	2.30	3.43
L.Ain	15,282	2.31	1.59	0.37	1.89	10.85
L.Salary	15,655	0.73	0.13	0.42	0.73	1.00
L.Sta	15,282	0.62	0.39	0.09	0.53	2.68

4.2. Correlation analysis

The correlation matrix is reported in Table 3. Sticky is negatively correlated with TFP at the 1% level, while ESG is positively correlated with TFP and negatively correlated with Sticky. Most control variables are also significantly correlated with TFP. These bivariate results provide preliminary support for the hypotheses.

Table 3. Correlation matrix

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
TFP	1										
Sticky	–0.171***	1									
ESG	0.192***	–0.041***	1								
Size	0.807***	–0.066***	0.203***	1							
Lev	0.464***	–0.074***	–0.100***	0.496***	1						
Roa	0.149***	–0.185***	0.231***	0.051***	–0.348***	1					
Cash-flow	0.107***	–0.001	0.108***	0.076***	–0.176***	0.424***	1				
Growth	0.136***	–0.101***	0.020***	0.044***	0.020***	0.290***	0.039***	1			
Indep	–0.007	0.014*	0.073***	–0.009	–0.020***	–0.016**	–0.002	–0.015**	1		
Top1	0.158***	–0.062***	0.084***	0.169***	0.023***	0.173***	0.108***	0.018**	0.041***	1	
ListAge	0.372***	0.000	–0.067***	0.472***	0.367***	–0.182***	–0.010	–0.081***	–0.030***	–0.073***	1

*Note:****, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Variance inflation factors (VIFs) are also calculated to assess potential multicollinearity among the principal variables. As Table 4 shows, every VIF is below the conventional threshold of 10, and the mean VIF is 1.35. Multicollinearity is therefore unlikely to materially affect the regression estimates that follow.

Table 4. Multicollinearity diagnostics

Variable	VIF	1/VIF
Sticky	1.07	0.936123
Size	1.76	0.568551
Lev	1.71	0.583186
Roa	1.73	0.578669
Cashflow	1.25	0.796972
Growth	1.13	0.883780
Indep	1.00	0.996008
Top1	1.09	0.919126
ListAge	1.41	0.708053
Mean VIF	1.35	

4.3. Baseline regression results

Table 5 presents the baseline tests of Hypothesis 1. The coefficient on Sticky is negative and significant at the 1% level in every specification. In the fully specified model, which includes the control variables and year and industry fixed effects, the coefficient is –0.087. Greater cost stickiness is therefore associated with lower TFP, supporting Hypothesis 1.

Table 5. Effect of Cost Stickiness on TFP

Variable	TFP		
	(1)	(2)	(3)
Sticky	–0.199***	–0.098***	–0.087***
	(–18.528)	(–15.862)	(–15.567)
Size		0.580***	0.587***
		(71.498)	(75.315)
Lev		0.758***	0.742***
		(14.518)	(15.138)
Roa		1.866***	1.878***
		(13.869)	(15.058)
Cashflow		0.393***	0.548***
		(3.880)	(5.800)
Growth		0.177***	0.198***
		(10.248)	(11.912)
Indep		0.001	–0.000
		(0.910)	(–0.227)
Top1		0.031	0.143***
		(0.519)	(2.597)
ListAge		0.012	0.017
		(1.008)	(1.589)
cons	8.551***	–4.968***	–5.128***
	(427.964)	(–29.964)	(–31.674)

End of Table 5

Variable	TFP		
	(1)	(2)	(3)
Year FE	No	No	Yes
Industry FE	No	No	Yes
N	18,082	18,082	18,082
Adj.R^2	0.029	0.691	0.738

Note: Robust t-statistics, based on standard errors clustered at the firm level, are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 6 provides further validation of the cost-stickiness measure. Columns (1)–(4) examine the associations of Sticky with Ain, Salary, Sta, and the three proxies jointly. The coefficients on Ain and Salary are significantly positive, whereas the coefficient on Sta is significantly negative at the 1% level. These results support the validity of the measure and confirm managerial optimism, adjustment costs, and agency considerations as important determinants of cost stickiness.

Table 6. Validation of the Cost-Stickiness Measure

Variable	Sticky			
	(1)	(2)	(3)	(4)
L.Ain	0.104***			0.064***
	(16.279)			(7.731)
L.Salary		0.228***		0.209***
		(3.893)		(3.618)
L.Sta			–0.402***	–0.229***
			(–20.219)	(–9.042)
cons	0.519***	0.592***	1.007***	0.599***
	(33.387)	(13.588)	(62.852)	(11.094)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
N	15,282	15,655	15,282	15,247
Adj.R^2	0.044	0.018	0.042	0.049

Note: Robust t-statistics, based on standard errors clustered at the firm level, are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

4.4. Endogeneity tests

Potential endogeneity may arise from omitted variables, reverse causality, and sample-selection bias. Table 7 reports four complementary tests designed to address these concerns.

The first test re-estimates Equation (3) with firm fixed effects in place of industry fixed effects to control for unobserved, time-invariant firm characteristics. As Column (1) of Panel A shows, the coefficient on Sticky remains negative and significant at the 1% level. The baseline result is therefore not attributable to persistent firm-specific characteristics.

The second test replaces the dependent variable with one-period-ahead TFP to reduce concerns about reverse causality. The coefficient on Sticky remains negative and significant at

the 1% level in Column (2). This result is consistent with the baseline estimate and indicates that contemporaneous reverse causality alone does not explain the negative association.

The third test follows Li and Sun (2023) and applies one-to-one propensity-score matching to reduce observable differences between firms with relatively high and low cost stickiness. The mean value of Sticky defines the treatment and control groups, which are matched on all control variables and on year and industry fixed effects. In Column (3), Sticky remains negative and significant at the 1% level after matching. The result is thus robust to observable differences in sample selection.

The final test uses an instrumental-variable approach. Following Binhua and Boyuan (2024), the median cost stickiness of firms in the same province and year serves as the instrument. Firms within a given province-year face similar labor-market, resource-adjustment, and institutional conditions, supporting the relevance of the instrument. Because regional economic conditions may influence both cost stickiness and TFP, both stages of the 2SLS estimation additionally control for provincial GDP growth and the annual provincial average monetary wage index for employees in urban units. Panel B reports the results. In the first stage, the coefficient on IV is positive and significant at the 1% level. The Kleibergen-Paap rk LM statistic is 198.318 (p = 0.000), rejecting underidentification, and the Kleibergen-Paap rk Wald F statistic is 264.553, well above the commonly used empirical threshold. In the second stage, the coefficient on instrumented Sticky is negative and remains significant at the 1% level. All four tests are therefore consistent with the baseline finding.

Table 7. Endogeneity tests

Panel A: Firm fixed effects, one-period-ahead TFP, and PSM			
Variable	TFP	L.TFP	TFP
	(1)	(2)	(3)
Sticky	–0.017***	–0.084***	–0.084***
	(–4.712)	(–14.090)	(–12.509)
Size	0.527***	0.599***	0.589***
	(32.220)	(72.527)	(64.733)
Lev	0.325***	0.719***	0.746***
	(6.025)	(13.735)	(12.886)
ROA	1.345***	1.671***	1.835***
	(13.939)	(12.925)	(11.776)
Cashflow	0.479***	0.473***	0.686***
	(7.589)	(4.638)	(5.185)
Growth	0.217***	–0.525***	0.177***
	(16.845)	(–28.827)	(6.873)
Indep	0.001	–0.000	–0.000
	(1.181)	(–0.086)	(–0.045)
Top1	–0.080	0.152***	0.137**
	(–0.906)	(2.611)	(2.228)
ListAge	–0.000	–0.001	0.013
	(–0.006)	(–0.044)	(1.015)

End of Table 7

Panel A: Firm fixed effects, one-period-ahead TFP, and PSM			
Variable	TFP	L.TFP	TFP
	(1)	(2)	(3)
cons	–3.577***	–5.299***	–5.192***
	(–10.064)	(–31.091)	(–27.608)
Year FE	Yes	Yes	Yes
Firm/IndustryFE	Yes	Yes	Yes
N	17,371	16,697	8,295
Adj.R^2	0.927	0.732	0.733

Panel B: Instrumental variables approach (2SLS)		
Variable	Sticky	TFP
	(1)	(2)
Sticky		–0.112***
		(–3.039)
IV	0.931***	
	(16.265)	
Controls	Yes	Yes
Year FE	Yes	Yes
Industry FE	Yes	Yes
Underidentification test		
Kleibergen-Paap rk LM statistic		198.318
p		0.000
Weak identification test		
Kleibergen-Paap rk Wald F statistic		264.553
Stock-Yogo 10% maximal IV size (critical value)		16.38
N		18,082

Note: Robust t-statistics, based on standard errors clustered at the firm level, are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

4.5. Robustness tests

Table 8 reports further robustness tests based on alternative measures and sample adjustments. First, following Lu and Lian (2012), TFP is re-estimated with the OP method. The resulting coefficient on Sticky is –0.077 and significant at the 1% level. Second, following He et al. (2020), cost stickiness is recalculated from each firm's cost and sales data for the preceding 16 quarters. Under this alternative measure, the coefficient on Sticky is –0.087 and significant at the 1% level.

Two additional tests restrict the sample. Following Weiss (2010), Column (3) retains only manufacturing firms, while Column (4) retains firms that exhibit cost stickiness in two consecutive years. The corresponding coefficients on Sticky are –0.062 and –0.081; both are significant at the 1% level.

The final test excludes observations from 2020 through 2022 because the COVID-19 pandemic may have influenced cost behavior and productivity through revenue volatility,

supply-chain disruption, and involuntary cost rigidities (Bloom et al., 2020; Lee et al., 2026). Sticky remains negative and significant, with a coefficient of –0.093. Taken together, the tests show that the baseline finding is robust to alternative measures and sample specifications.

Table 8. Robustness tests

Variable	TFP				
	TFP_OP	Sticky1	Mfg. firms	2-year cost stickiness	Excluding 2020-2022
	(1)	(2)	(3)	(4)	(5)
Sticky	–0.077***	–0.087***	–0.062***	–0.081***	–0.093***
	(–14.419)	(–15.603)	(–10.903)	(–10.615)	(–13.644)
Size	0.414***	0.587***	0.594***	0.591***	0.588***
	(54.417)	(75.318)	(64.901)	(61.867)	(69.306)
Lev	0.561***	0.742***	0.705***	0.698***	0.697***
	(11.758)	(15.134)	(13.378)	(11.679)	(13.533)
ROA	1.586***	1.877***	2.132***	1.861***	1.919***
	(13.228)	(15.056)	(15.267)	(11.465)	(13.105)
Cashflow	0.151	0.548***	0.654***	0.671***	0.638***
	(1.600)	(5.799)	(6.331)	(5.485)	(5.508)
Growth	0.210***	0.198***	0.136***	0.178***	0.164***
	(12.761)	(11.912)	(7.102)	(7.922)	(8.407)
Indep	0.001	–0.000	–0.001	0.001	–0.001
	(0.720)	(–0.226)	(–0.955)	(0.623)	(–0.624)
Top1	0.059	0.143***	0.293***	0.122*	0.169***
	(1.089)	(2.598)	(4.895)	(1.810)	(2.904)
ListAge	0.022**	0.017	0.060***	0.030**	0.018
	(2.013)	(1.588)	(4.955)	(2.058)	(1.518)
cons	–2.841***	–5.128***	–5.422***	–5.257***	–5.138***
	(–17.782)	(–31.674)	(–28.697)	(–26.682)	(–28.707)
YearFE	Yes	Yes	Yes	Yes	Yes
IndustryFE	Yes	Yes	Yes	Yes	Yes
N	18,082	18,082	12,578	10,025	11,862
Adj.R^2	0.636	0.738	0.758	0.749	0.737

Note: Robust t-statistics, based on standard errors clustered at the firm level, are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

4.6. Moderating effect of ESG performance

Table 9 reports the test of ESG's moderating effect. In Column (1), the coefficient on Sticky × ESG is 0.011 and significant at the 5% level. Stronger ESG performance therefore attenuates the negative association between cost stickiness and TFP, supporting Hypothesis 2.

Columns (2)–(4) examine the environmental (E), social (S), and governance (G) pillars separately to identify the dimensions underlying this moderating effect. The interaction involving E is not statistically significant. By contrast, the interaction coefficients for S and G are 0.007 and

0.009, respectively, and both are significant at the 5% level. The moderating effect of ESG is therefore attributable mainly to its social and governance dimensions.

Table 9. Moderating effect of ESG performance

Variable	TFP			
	(1)	(2)	(3)	(4)
Sticky	–0.129***	–0.079***	–0.120***	–0.132***
	(–6.121)	(–7.329)	(–7.394)	(–6.350)
ESG	0.008			
	(1.026)			
Sticky × ESG	0.011**			
	(2.128)			
E		0.018***		
		(3.051)		
Sticky × E		–0.004		
		(–0.835)		
S			0.002	
			(0.481)	
Sticky × S			0.007**	
			(2.238)	
G				0.004
				(0.720)
Sticky × G				0.009**
				(2.315)
Size	0.583***	0.583***	0.585***	0.585***
	(72.982)	(72.557)	(74.203)	(74.484)
Lev	0.756***	0.742***	0.741***	0.766***
	(15.418)	(15.155)	(15.102)	(15.334)
ROA	1.835***	1.875***	1.854***	1.831***
	(14.689)	(15.050)	(14.860)	(14.720)
Cashflow	0.549***	0.539***	0.549***	0.553***
	(5.813)	(5.715)	(5.810)	(5.853)
Growth	0.200***	0.200***	0.198***	0.200***
	(12.034)	(12.023)	(11.919)	(12.050)
Indep	–0.000	–0.000	–0.000	–0.001
	(–0.367)	(–0.243)	(–0.218)	(–0.447)
Top1	0.143***	0.145***	0.148***	0.137**
	(2.595)	(2.629)	(2.689)	(2.476)
ListAge	0.020*	0.018	0.020*	0.019*
	(1.832)	(1.634)	(1.819)	(1.735)
cons	–5.071***	–5.061***	–5.094***	–5.097***
	(–31.041)	(–30.711)	(–31.291)	(–31.099)

End of Table 9

Variable	TFP			
	(1)	(2)	(3)	(4)
YearFE	Yes	Yes	Yes	Yes
IndustryFE	Yes	Yes	Yes	Yes
N	18,082	18,082	18,082	18,082
Adj.R^2	0.739	0.739	0.739	0.739

Note: Robust t-statistics, based on standard errors clustered at the firm level, are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

The significant result for the social pillar suggests that stakeholder-oriented practices enable firms to use retained resources more effectively when demand declines. Strong social performance can motivate employees, preserve customer loyalty, and stabilize supplier relationships, thereby limiting operational disruption and sustaining the use of labor, production capacity, and supply-chain resources during external shocks (Hsu et al., 2024). Retained resources are consequently less likely to become idle, attenuating the negative effect of cost stickiness on TFP.

The significant governance effect indicates that sound governance constrains efficiency losses arising from managerial decisions to retain resources. Because sticky costs may reflect agency motives and managers' reluctance to reduce resources, stronger board oversight, internal controls, and information transparency can curb opportunistic retention and improve cost-adjustment decisions (Chen et al., 2012; Xue & Hong, 2016; Zhang et al., 2023). Retained resources are then more likely to support operational continuity and future value creation than managerial slack, reducing the adverse effect of cost stickiness on TFP.

The insignificant environmental effect may, by contrast, reflect the increasingly binding nature of environmental regulation in China. The revised Environmental Protection Law, implemented in 2015, strengthened firms' environmental compliance obligations. Environmental activities often require pollution-control equipment, monitoring systems, and emission-reduction projects. The fixed and irreversible nature of these investments makes the associated expenditure difficult to reduce when revenue falls (Xu et al., 2024). Although the investments may yield long-term technological and productivity benefits, they offer limited support for short-term resource reallocation during a downturn in demand. This may explain why the environmental pillar does not significantly attenuate the TFP losses associated with cost stickiness.

5. Heterogeneity analysis

5.1. State-owned and non-state-owned enterprises

Cost management differs between state-owned enterprises (SOEs) and non-SOEs, suggesting that the effect of cost stickiness on TFP may vary by ownership. The sample is divided according to the ultimate controller, and Equation (3) is estimated separately for SOEs and non-SOEs. Columns (1) and (2) of Table 10 report Sticky coefficients of –0.113 for SOEs and –0.073 for non-SOEs, both significant at the 1% level. The negative effect of cost stickiness on TFP is thus stronger among SOEs. Several factors may account for this difference. SOEs often assume policy responsibilities, including maintaining employment and avoiding layoffs during

downturns in demand to support social stability (Lin et al., 2020), which reduces their flexibility in adjusting internal resources. Close government ties and relatively stable operating environments may also encourage managerial optimism and greater resource retention. In addition, because profit maximization is not the sole objective of SOEs, performance evaluation and managerial oversight may be more complex, potentially increasing agency problems and incentives for empire building. These features can weaken the efficiency of resource adjustment and lower productivity (Bu et al., 2015).

Table 10. Heterogeneity analysis

Variable	TFP			
	SOEs	Non-SOEs	High-HHI	Low-HHI
	(1)	(2)	(3)	(4)
Sticky	–0.113***	–0.073***	–0.120***	–0.061***
	(–10.135)	(–11.494)	(–12.085)	(–10.272)
Size	0.585***	0.591***	0.578***	0.591***
	(45.718)	(57.990)	(44.507)	(63.106)
Lev	0.697***	0.755***	0.833***	0.680***
	(7.238)	(13.622)	(9.642)	(12.266)
ROA	2.401***	1.694***	1.471***	2.219***
	(8.899)	(12.058)	(7.148)	(15.054)
Cashflow	0.189	0.715***	0.349**	0.613***
	(1.071)	(6.484)	(2.217)	(5.485)
Growth	0.200***	0.194***	0.268***	0.138***
	(7.725)	(9.057)	(9.928)	(7.232)
Indep	–0.000	–0.001	0.004*	–0.002*
	(–0.141)	(–0.592)	(1.660)	(–1.680)
Top1	0.163	0.149**	–0.061	0.309***
	(1.632)	(2.136)	(–0.654)	(4.855)
ListAge	0.063***	0.004	–0.077***	0.073***
	(2.631)	(0.322)	(–3.897)	(5.831)
cons	–5.199***	–5.148***	–4.751***	–5.346***
	(–20.139)	(–23.582)	(–17.584)	(–27.439)
YearFE	Yes	Yes	Yes	Yes
IndustryFE	Yes	Yes	Yes	Yes
N	6,074	12,008	7,149	10,933
Adj.R^2	0.746	0.712	0.709	0.765
Empirical p-value	0.000		0.000	

Note: Robust t-statistics, based on standard errors clustered at the firm level, are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. The empirical p-value for the difference between group coefficients was obtained using Fisher's permutation test with 1,000 bootstrap replications.

5.2. Industry competition

Industry competition may also influence firms' cost-adjustment behavior and its productivity consequences. Following Askarany et al. (2024), competition is measured with the Herfindahl-Hirschman Index (HHI). Industries are divided into high- and low-competition groups at the annual median HHI, and Equation (3) is estimated separately for the two subsamples. Columns (3) and (4) of Table 10 report Sticky coefficients of –0.120 for the high-competition group and –0.061 for the low-competition group, both significant at the 1% level. The negative association between cost stickiness and TFP is therefore stronger in highly competitive industries. When competition is intense, firms may hesitate to reduce production capacity, employment, or marketing expenditure after sales decline because they seek to protect market share and their strategic position (Li & Zheng, 2017). Such retention may increase idle resources and intensify cost stickiness, magnifying its adverse effect on TFP (Costa et al., 2021).

6. Conclusions and implications

6.1. Conclusions

Using data for Chinese A-share firms from 2013 to 2023, this study examines the relationships among cost stickiness, TFP, and ESG performance and establishes three main findings. First, cost stickiness is significantly associated with lower TFP. This result is robust across alternative specifications, endogeneity tests, and robustness checks. The theoretical analysis suggests that sticky resource commitments may impair productivity by misallocating internal resources and constraining technological innovation. Second, stronger ESG performance attenuates the negative association between cost stickiness and TFP. This moderating effect is driven primarily by the social and governance dimensions; the environmental dimension is not statistically significant. Third, the negative association is stronger among SOEs and firms in highly competitive industries. Ownership characteristics and competitive conditions therefore shape the productivity consequences of asymmetric cost adjustment.

6.2. Theoretical contributions

This study contributes to the literature by bringing asymmetric cost behavior, ESG performance, and firm productivity into a single empirical framework.

The first contribution concerns the determinants of TFP. Previous studies have emphasized financing constraints, R&D, policy interventions, taxation, and financial development as important drivers of firm productivity (Hall et al., 2016; Herzer, 2022; Lee et al., 2023; Wu et al., 2023; Rehman & Islam, 2023). This study instead focuses on internal cost-adjustment behavior. Introducing cost stickiness into the TFP framework identifies asymmetric cost adjustment as another firm-level factor associated with productivity and demonstrates the importance of internal resource-allocation decisions. The theoretical analysis further indicates that sticky resource commitments may impair productivity through resource misallocation and constraints on technological innovation.

The second contribution is to research on the economic consequences of cost stickiness. Previous studies have examined analyst forecast accuracy, firm performance, firm value, enterprise risk, resilience, credit risk, stock price crash risk, and market reactions (Weiss, 2010; Kontesa & Brahmana, 2018; Homburg et al., 2019; Habib & Costa, 2022; Costa & Habib, 2023; Binhua & Boyuan, 2024; Sabzalipour et al., 2024; Bai et al., 2025). Although this evidence is

important, these outcomes do not fully capture firms' structural input-output efficiency or long-term productive capacity. By adopting TFP as the outcome, the present study extends the consequences of cost stickiness beyond short-term financial and market outcomes to productivity, long-term competitiveness, and sustainable growth potential.

Third, the study offers an additional perspective on the economic role of ESG. Prior research has generally treated ESG as a direct determinant of firm performance and value (Aydoğmuş et al., 2022; Morea et al., 2025), financing constraints, investment efficiency, innovation, or TFP. Here, ESG instead operates as a conditioning mechanism that shapes the productivity consequences of asymmetric cost behavior. The results show that stronger ESG performance, particularly in its social and governance dimensions, attenuates the negative association between cost stickiness and TFP. This approach connects ESG-related governance, stakeholder management, and resource discipline with firms' cost-adjustment decisions, linking sustainability research to management-accounting research on asymmetric cost behavior.

6.3. Practical and policy implications

The findings have implications for firms, regulators, and policymakers.

At the firm level, cost stickiness should form part of long-term cost management and resource-allocation decisions. It reflects more than a high level of costs; it also captures delayed resource adjustment when demand falls. Firms should therefore avoid indiscriminate cost cutting and establish flexible mechanisms for adjusting labor, production capacity, and operating assets. Digital budgeting, rolling forecasts, and resource-utilization monitoring can help managers distinguish strategically necessary retention from persistent redundancy, improving productivity without eroding long-term capabilities. ESG practices should also be integrated with cost adjustment and productivity management. The significant moderating effects of the social and governance dimensions indicate that employee stability, supplier and customer relationships, board oversight, internal controls, and information transparency can reduce the risk that retained resources remain inefficient. ESG objectives should accordingly be incorporated into budgeting, human-resource allocation, supply-chain management, and investment appraisal rather than treated merely as disclosure requirements. Because environmental investments are often fixed, compliance-oriented, and slow to generate returns, they should be evaluated over a longer horizon rather than solely against short-term financial outcomes.

At the governmental and regulatory level, the stronger negative effect of cost stickiness among SOEs suggests that SASAC and local state-owned asset regulators should give greater weight to cost-adjustment efficiency, resource utilization, and productivity in performance evaluations. Regulators should monitor persistently idle labor and assets more closely while improving market-oriented employment arrangements, incentive mechanisms, and internal resource reallocation. Such measures can limit inefficient retention without compromising legitimate public and strategic objectives. The CSRC and stock exchanges should also improve the consistency and comparability of sustainability disclosures. Alongside environmental information, firms should disclose more measurable information on employee stability, supplier and customer relationships, internal controls, board oversight, and resource utilization. Greater comparability would help investors and creditors distinguish strategic retention from managerial inefficiency and strengthen external governance of cost-adjustment decisions. Because the productivity loss associated with cost stickiness is greater in highly competitive industries, local governments and industry regulators should avoid indiscriminate support

that prolongs inefficient retention. Policy support should instead prioritize technological upgrading, resource-adjustment capacity, and productivity performance, while improving labor mobility, asset-transfer mechanisms, and market-based exit channels to facilitate more efficient reallocation.

6.4. Limitations and future research

This study has several limitations, each of which suggests a direction for future research. First, the sample is confined to Chinese A-share firms, and institutional and governance differences may limit the generalizability of the results. Future research could extend the analysis to other countries or conduct cross-country comparisons. Second, ESG performance is measured with the Sino-Securities ESG rating. Because rating methodologies and information coverage vary across agencies, subsequent studies could use alternative ratings or combine multiple data sources. Third, the theoretical analysis identifies internal resource misallocation and constrained technological innovation as potential channels connecting cost stickiness to TFP. Consistent firm-level measures are unavailable for the full sample period, however, precluding reliable direct tests. Future research could examine these mechanisms through measures of idle resources, investment inefficiency, R&D intensity, technological upgrading, and innovation output. Finally, although the IV analysis controls for provincial economic and wage conditions, it cannot fully eliminate endogeneity arising from unobserved regional shocks. Exogenous policy shocks, quasi-natural experiments, or stronger external instruments may permit more credible causal identification.

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Author contributions

Yuzhe Tang: Writing – Original Draft, Writing – Review & Editing, Conceptualization, Data Curation, Methodology, Supervision, Validation. Ziyun Zhou: Writing – Original, DraftFormal Analysis, Software, Validation

Disclosure statement

The authors declare that it does not have any known interests or personal relationships that could potentially influence the reported work in this paper.

Data availability statement

The authors will supply the relevant data in response to reasonable requests.

References

Agarwal, N., & Agarwal, S. (2024). Cost decisions of supplier firms: A study based on the customer-supplier link. *Management Accounting Research*, *62*, Article 100856. https://doi.org/10.1016/j.mar.2023.100856

Anderson, M. C., Banker, R. D., & Janakiraman, S. N. (2003). Are selling, general, and administrative costs "sticky"? *Journal of Accounting Research*, *41*(1), 47–63. https://doi.org/10.1111/1475-679X.00095

Askarany, D., Parsaei, M., & Ghanbari, N. (2024). Business strategy, short-term debt, and cost stickiness. *Computational Economics*, *64*(3), 1913–1936. https://doi.org/10.1007/s10614-024-10649-7

Aydoğmuş, M., Gülay, G., & Ergun, K. (2022). Impact of ESG performance on firm value and profitability. *Borsa Istanbul Review*, *22*, S119–S127. https://doi.org/10.1016/j.bir.2022.11.006

Bai, M., Zhang, D., Dong, F., & Qin, Y. (2025). Cost stickiness and managerial resilience within organizations: Evidence from China. *International Journal of Managerial Finance*, *21*(3), 732–757. https://doi.org/10.1108/ijmf-04-2024-0242

Balakrishnan, R., Labro, E., & Soderstrom, N. S. (2014). Cost structure and sticky costs. *Journal of Management Accounting Research*, *26*(2), 91–116. https://doi.org/10.2308/jmar-50831

Banker, R. D., & Byzalov, D. (2014). Asymmetric cost behavior. *Journal of Management Accounting Research*, *26*(2), 43–79. https://doi.org/10.2308/jmar-50846

Banker, R. D., Byzalov, D., Fang, S., & Liang, Y. (2018). Cost management research. *Journal of Management Accounting Research*, *30*(3), 187–209. https://doi.org/10.2308/jmar-51965

Bilyay-Erdogan, S., Danisman, G. O., & Demir, E. (2024). ESG performance and investment efficiency: The impact of information asymmetry. *Journal of International Financial Markets, Institutions and Money*, *91*, Article 101919. https://doi.org/10.1016/j.intfin.2023.101919

Binhua, Q., & Boyuan, Y. (2024). Cost stickiness, absorbed slack and enterprise risks: Evidence from China. *PLoS ONE*, *19*(12), Article e0315675. https://doi.org/10.1371/journal.pone.0315675

Bloom, N., Bunn, P., Mizen, P., Smietanka, P., & Thwaites, G. (2025). The impact of COVID-19 on productivity. *The Review of Economics and Statistics*, *107*(1), 28–41. https://doi.org/10.1162/rest_a_01298

Boubaker, S., Manita, R., & Rouatbi, W. (2021). Large shareholders, control contestability and firm productive efficiency. *Annals of Operations Research*, *296*(1), 591–614. https://doi.org/10.1007/s10479-019-03402-z

Brown, J. R., Fazzari, S. M., & Petersen, B. C. (2009). Financing innovation and growth: Cash flow, external equity, and the 1990s R&D boom. *The Journal of Finance*, *64*(1), 151–185. https://doi.org/10.1111/j.1540-6261.2008.01431.x

Brown, J. R., Martinsson, G., & Petersen, B. C. (2012). Do financing constraints matter for R&D? *European Economic Review*, *56*(8), 1512–1529. https://doi.org/10.1016/j.euroecorev.2012.07.007

Bu, D., Wen, C., & Banker, R. D. (2015). Implications of asymmetric cost behaviour for analysing financial reports of companies in China. *China Journal of Accounting Studies*, *3*(3), 181–208. https://doi.org/10.1080/21697213.2015.1062343

Chen, C. X., Lu, H., & Sougiannis, T. (2012). The agency problem, corporate governance, and the asymmetrical behavior of selling, general, and administrative costs. *Contemporary Accounting Research*, *29*(1), 252–282. https://doi.org/10.1111/j.1911-3846.2011.01094.x

Chen, C. X., Nasev, J., & Wu, S. Y. C. (2022). CFO overconfidence and cost behavior. *Journal of Management Accounting Research*, *34*(2), 117–135. https://doi.org/10.2308/JMAR-18-055

Chen, H., Hao, Y., Li, Y., & Alodat, A. Y. (2025). How does digital transformation moderate the link between ESG ratings and financial constraints? *Journal of Business Economics and Management*, *26*(4), 982–1006. https://doi.org/10.3846/jbem.2025.24810

Costa, M. D., & Habib, A. (2023). Cost stickiness and firm value. *Journal of Management Control*, *34*(2), 235–273. https://doi.org/10.1007/s00187-023-00356-z

Costa, M. D., Habib, A., & Bhuiyan, M. B. U. (2021). Financial constraints and asymmetric cost behavior. *Journal of Management Control*, *32*(1), 33–83. https://doi.org/10.1007/s00187-021-00314-7

Ding, X., Sheng, Z., Appolloni, A., Shahzad, M., & Han, S. (2024). Digital transformation, ESG practice, and total factor productivity. *Business Strategy and the Environment*, *33*(5), 4547–4561. https://doi.org/10.1002/bse.3718

Ferdous, L. T., Rana, T., & Yeboah, R. (2025). Decoding the impact of firm-level ESG performance on financial disclosure quality. *Business Strategy and the Environment*, *34*(1), 162–186. https://doi.org/10.1002/bse.3982

Gnoth, C., Rapp, M. S., & Udoieva, J. (2025). Listed founding family firms and labor cost stickiness. *Industrial Relations*: *A Journal of Economy and Society*, *64*(2), 268–295. https://doi.org/10.1111/irel.12373

Habib, A., & Costa, M. D. (2022). Cost stickiness and stock price crash risk. *Accounting* & *Finance*, *62*(4), 4247–4278. https://doi.org/10.1111/acfi.12935

Hall, B. H., Moncada-Paternò-Castello, P., Montresor, S., & Vezzani, A. (2016). Financing constraints, R&D investments and innovative performances: New empirical evidence at the firm level for Europe. *Economics of Innovation and New Technology*, *25*(3), 183–196. https://doi.org/10.1080/10438599.2015.1076194

Hartlieb, S. (2023). Consumer sentiment, managerial expectations and resource adjustment decisions. *European Accounting Review*, *32*(2), 481–511. https://doi.org/10.1080/09638180.2021.1986091

He, J., Tian, X., Yang, H., & Zuo, L. (2020). Asymmetric cost behavior and dividend policy. *Journal of Accounting Research*, *58*(4), 989–1021. https://doi.org/10.1111/1475-679X.12328

Herzer, D. (2022). The impact of domestic and foreign R&D on TFP in developing countries. *World Development*, *151*, Article 105754. https://doi.org/10.1016/j.worlddev.2021.105754

Homburg, C., Hoppe, A., Nasev, J., Reimer, K., & Uhrig-Homburg, M. (2019, August). *How cost stickiness affects credit risk*. SSRN. https://ssrn.com/abstract=3232822

Hsu, P. H., Tian, X., & Xu, Y. (2014). Financial development and innovation: Cross-country evidence. *Journal of Financial Economics*, *112*(1), 116–135. https://doi.org/10.1016/j.jfineco.2013.12.002

Hsu, P.-H., Lee, H.-H., & Yi, L. (2024). Corporate social responsibility and external disruptions. *Journal of Corporate Finance*, *89*, Article 102675. https://doi.org/10.1016/j.jcorpfin.2024.102675

Huang, D. Z. X. (2022). Environmental, social and governance factors and assessing firm value: Valuation, signalling and stakeholder perspectives. *Accounting* & *Finance*, *62*, 1983–2010. https://doi.org/10.1111/acfi.12849

Ibrahim, A. E. A., Ali, H., & Aboelkheir, H. (2022). Cost stickiness: A systematic literature review of 27 years of research and a future research agenda. *Journal of International Accounting*, *Auditing and Taxation*, *46*, Article 100439. https://doi.org/10.1016/j.intaccaudtax.2021.100439

Jiang, W., & Yang, W. (2024). ESG disclosure and corporate cost stickiness: Evidence from supply-chain relationships. *Economics Letters*, *238*, Article 111697. https://doi.org/10.1016/j.econlet.2024.111697

Kim, J. W., & Park, C. K. (2023). Can ESG performance mitigate information asymmetry? Moderating effect of assurance services. *Applied Economics*, *55*(26), 2993–3007. https://doi.org/10.1080/00036846.2022.2107991

Kontesa, M., & Brahmana, R. K. (2018). Cost stickiness effect on firm's performance: Insights from Malaysia. *Asia-Pacific Management Accounting Journal*, *13*(1), 1–19. https://ir.uitm.edu.my/id/eprint/29646

Lee, C. C., Zhong, Q., Wen, H., & Song, Q. (2023). Blessing or curse: How does sustainable development policy affect total factor productivity of energy-intensive enterprises? *Socio-Economic Planning Sciences*, *89*, Article 101709. https://doi.org/10.1016/j.seps.2023.101709

Lee, S. J., Kim, H., & Lee, J. H. (2026). COVID-19 and cost stickiness: The impact of the pandemic on resource management decisions. *Applied Economics*, *58*(43), 9347–9360. https://doi.org/10.1080/00036846.2025.2546117

Lei, Z., Gong, G., Wang, T., & Li, W. (2022). Accounting information quality, financing constraints, and company innovation investment efficiency by big data analysis. *Journal of Organizational and End User Computing*, *34*(3), 1–21. https://doi.org/10.4018/JOEUC.292525

Li, H., Zhang, X., & Zhao, Y. (2022). ESG and firm's default risk. *Finance Research Letters*, *47*, Article 102713. https://doi.org/10.1016/j.frl.2022.102713

Li, J., & Sun, Z. (2023). Cost stickiness, earnings forecast accuracy, and the informativeness of stock prices about future earnings: Evidence from China. *Humanities and Social Sciences Communications*, *10*(1), 1–16. https://doi.org/10.1057/s41599-023-01592-3

Li, L., Wang, S., & Chen, Y. (2025). The impact of ESG performance on corporate innovation—Empirical evidence from Chinese pharmaceutical listed companies. *PLoS ONE*, *20*(11), Article e0332906. https://doi.org/10.1371/journal.pone.0332906

Li, W. L., & Zheng, K. (2017). Product market competition and cost stickiness. *Review of Quantitative Finance and Accounting*, *49*(2), 283–313. https://doi.org/10.1007/s11156-016-0591-z

Lin, K. J., Lu, X., Zhang, J., & Zheng, Y. (2020). State-owned enterprises in China: A review of 40 years of research and practice. *China Journal of Accounting Research*, *13*(1), 31–55. https://doi.org/10.1016/j.cjar.2019.12.001

Lin, Y., Fu, X., & Fu, X. (2021). Varieties in state capitalism and corporate innovation: Evidence from an emerging economy. *Journal of Corporate Finance*, *67*, Article 101919. https://doi.org/10.1016/j.jcorpfin.2021.101919

Lu, X., & Lian, Y. (2012). Estimation of total factor productivity of industrial enterprises in China: 1999–2007. *China Economic Quarterly*, *11*(2), 541–558.

Ma, J., Gao, D., & Sun, J. (2022). Does ESG performance promote total factor productivity? Evidence from China. *Frontiers in Ecology and Evolution*, *10*, Article 1063736. https://doi.org/10.3389/fevo.2022.1063736

Morea, D., Iazzolino, G., Giglio, C., Bruni, M. E., Baldissarro, G., & Farinelli, E. (2025). The role of digitalization and ESG on financial performance: An empirical analysis on the Energy and Utilities sectors. *PLoS ONE*, *20*(2), Article e0314078. https://doi.org/10.1371/journal.pone.0314078

Postiglione, M., Carini, C., & Falini, A. (2024). ESG and firm value: A hybrid literature review on cost of capital implications from Scopus database. *Corporate Social Responsibility and Environmental Management*, *31*(6), 6457–6480. https://doi.org/10.1002/csr.2940

Rehman, F. U., & Islam, M. M. (2023). Financial infrastructure—total factor productivity (TFP) nexus within the purview of FDI outflow, trade openness, innovation, human capital and institutional quality: Evidence from BRICS economies. *Applied Economics*, *55*(7), 783–801. https://doi.org/10.1080/00036846.2022.2094333

Sabzalipour, F., Esmailikia, G., & Ahmadi, M. (2024). Market reaction to asymmetric cost behavior: The impact of long-term growth expectations. *Empirical Research in Accounting*, *14*(2), 121–154.

Şerban, R. A., Mihaiu Cindea, D. M., Țichindelean, M., Ogrean, C., & Herciu, M. (2023). Factors of sustainable competitiveness at company level: A comparison of four global economic sectors. *Journal of Business Economics and Management*, *24*(3), 449–470. https://www.econstor.eu/handle/10419/317633

Su, J., Wei, Y., Wang, S., & Liu, Q. (2023). The impact of digital transformation on the total factor productivity of heavily polluting enterprises. *Scientific Reports*, *13*(1), Article 6386. https://doi.org/10.1038/s41598-023-33553-w

Sun, R., Ho, K.-C., Gu, Y., & Chen, C.-C. (2019). Asymmetric cost behavior and investment in R&D: Evidence from China's manufacturing listed companies. *Sustainability*, *11*(6), Article 1785. https://doi.org/10.3390/su11061785

Weiss, D. (2010). Cost behavior and analysts' earnings forecasts. *The Accounting Review*, *85*(4), 1441–1471. https://doi.org/10.2308/accr.2010.85.4.1441

Weng, Q., & Söderbom, M. (2018). Is R&D cash flow sensitive? Evidence from Chinese industrial firms. *China Economic Review*, *47*, 77–95. https://doi.org/10.1016/j.chieco.2017.12.008

Wu, W., Hu, Y., & Wu, Q. (2023). Subsidies and tax incentives—Does it make a difference on TFP? Evidences from China's photovoltaic and wind listed companies. *Renewable Energy*, *208*, 645–656. https://doi.org/10.1016/j.renene.2023.03.080

Xu, F., Liu, X., Liu, Q., Zhu, X., & Zhou, D. (2024). Environmental investment growth and corporate cost stickiness in China: Substantive or symbolic management? *Sustainability Accounting, Management and Policy Journal*, *15*(1), 148–170. https://doi.org/10.1108/SAMPJ-02-2023-0050

Xue, S., & Hong, Y. (2016). Earnings management, corporate governance and expense stickiness. *China Journal of Accounting Research*, *9*(1), 41–58. https://doi.org/10.1016/j.cjar.2015.02.001

Zhang, B., Yang, L., & Zhou, R. (2023). Internal governance and cost stickiness. *Journal of Management Accounting Research*, *35*(1), 173–194. https://doi.org/10.2308/JMAR-2020-043

Zhao, Y., Elahi, E., Khalid, Z., Sun, X., & Sun, F. (2023). Environmental, social and governance performance: Analysis of CEO power and corporate risk. *Sustainability*, *15*(2), Article 1471. https://doi.org/10.3390/su15021471