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Financial constraints and asymmetric cost behavior

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Abstract
This study investigates the association between financial constraints and cost asymmetry. Using a large U.S. sample of firms from 1976 to 2016, we find that financially constrained firms exhibit less cost asymmetry. However, such low cost asymmetry is more pronounced for SG&A cost category compared to operating cost category. Our results remain generally consistent across various specifications of financial constraints measures and various asymmetric cost behavior measures. We explore three contextual settings that might affect the association differentially, namely, the future value-creating potential of SG&A expense setting, the investment opportunities setting, and the earnings management setting. In addition, we find evidence that financial constraint leads to lower cost asymmetry, even when managers have received optimistic signals about future sales. As resources drive the costs of a business, and financial constraints affect resource availability, studying the cost behavior of constrained firms makes a valuable contribution to the existing cost asymmetry literature.

Keywords Cost asymmetry · Cost stickiness · Financial constraints · Resource adjustments · Investment opportunities · Agency problems

1 Introduction

This study investigates the association between financial constraints and asymmetric cost behavior. Anderson et al. (2003) document that selling, general and administrative (SG&A) costs are sticky i.e. costs rise more when sales increase but decrease less when sales decrease. However, costs can be anti-sticky as well, implying that

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the rise in costs when sales increase is less than their fall when sales decrease. Some of the firm-level determinants of asymmetric cost behavior include prior activity changes (Banker and Byzalov 2014), managerial incentives (Dierynck et al. 2012; Kama and Weiss 2013; Banker and Byzalov 2014) and organizational capital (Venieris et al. 2015) (see Banker et al. 2018; Guenther et al. 2014 for detailed reviews of the cost management literature). Despite the significance of 'availability of resources' as a driver of cost management, very little research as of yet has investigated the extent to which firm-level financial constraints affect cost asymmetry. This is surprising, since cost behavior is driven by the availability of resources; and the availability of resources, in turn, depends on the availability of, and accessibility to, finance.

Lamont et al. (2001) define financial constraints as frictions that prevent firms from funding their desired investments. In a frictional environment, investment and growth depend largely on the availability of internal capital, as the cost of raising outside capital can be high relative to that of internally generated funds. This is particularly true for financially constrained firms that face severe agency and transaction costs in accessing external capital markets (Korajczyk and Levy 2003). As constrained firms have to pay high interest rates on loans, they rely heavily on other sources of finance to finance their continued operation, e.g., trade credits and internal funds (Mulier et al. 2016). Consequently, constrained firms with attractive growth opportunities but without access to external financing may invest less into optimal value-increasing investment projects, resulting in lower future growth and firm value.

Young and small firms tend to be financially constrained because such firms suffer from high information asymmetry (Beck et al. 2006; Arslan et al. 2006; Hadlock and Pierce 2010). Firms that pay dividend (Fazzari et al. 1988), have affiliation with business groups (Hoshi et al. 1991; Kato et al. 2002), and are politically connected (Poncet et al. 2010; Shen and Lin 2016; Cull et al. 2015) are found to be financially unconstrained. Prior research documents several consequences of financial constraints, including increased earnings management (Kurt 2018), high engagement in corrupt activities (Lopatta et al. 2017), and aggressive tax planning (Edwards et al. 2016; Law and Mills 2015). To generate and sustain profit, efficient cost management is crucial for managers. Additionally, cost management has wider repercussions for both debt and equity investors in the areas of risk assessment, trust of customers, employees (with respect to job security) and other stakeholders in the community. Thereby, we choose cost behavior as the appropriate lens for understanding the effects of financial constraints.

Firms incur various costs such as costs of goods sold (COGS) and SG&A costs, in order to maintain their regular course of business. Such costs are incurred even when firms are faced with financial constraints, because some of those costs are contractual, and failing to pay those could lead to bankruptcy (Chen et al. 2019). Prior studies also document that U.S. firms are becoming increasingly reliant on knowledge-intensive human capital and have been investing more in research and development (R&D) activities. Such investments are retained even during downturns (Loy and Hartlieb 2018). Therefore, it is not unlikely that financially constrained firms may choose to retain slack resources, even when sales decline: a choice that leads to higher cost asymmetry. However, from a resource adjustment cost perspective, we posit that financial constraints will result in lower cost asymmetry for both SG&A and operating costs. When sales decrease, financially constrained firms suffer a relatively greater reduction in the present value of revenue; thereby, forcing them to cut back on unutilized resources. Moreover, the use of temporary labor, which has a relatively lower adjustment cost, is becoming common in firms, especially young firms (Loy and Hartlieb 2018). Consequently, it is likely that financially constrained firms will decrease costs by a higher amount; thus, exhibiting lower cost asymmetry. Said differently, financially constrained firms may put less weight on future adjustment costs, and more weight on the costs of unused capacity, thus altering the trade-offs involved in their resource allocation decision.

Our sample consists of U.S. listed firms from 1976 to 2016. We deploy three well-established measures of financial constraint, namely, the Size-Age index (*SA*) of Hadlock and Pierce (2010), the accounting based measure (*WW* index) of Whited and Wu (2006), and the text-based measure of Bodnaruk et al. (2015) (*BLM*) based on constraining words from all 10-K filings. We use alternative proxies as there is yet to be any consensus on the best proxy for measuring financial constraints. We document that financially constrained firms do, indeed, exhibit lower cost asymmetry. However, such low cost asymmetry is observed only for SG&A costs. Our results are robust to two different models of cost asymmetry, namely, Xu and Zheng (2020) and Balakrishnan et al. (2014). In terms of economic magnitude, our baseline results imply that a one percent decrease in sales leads to 14.9 percentage points *more* reduction in SG&A costs for constrained firms compared to their unconstrained counterparts for the *SA*-based financial constraint proxy. Similar results are obtained for the two other financial constraint proxies. Based on our findings we can conclude that the association between financial constraint and cost asymmetry is also economically meaningful.

Examining the association between financial constraint and cost stickiness provides only a partial picture. Therefore, we use three contextual settings, namely, future value-creating potential of SG&A expenses, investment opportunities, and earnings management, to further examine the moderating effects of these settings on the relationship between financial constraint and cost stickiness. We find that financial constraint leads to a decrease in both low and high future value-creating SG&A costs. The magnitude of the decrease is greater for low future value-creating SG&A costs, as compared with their high value-creating counterparts. However, the difference in coefficients between the two groups is not economically significant. Therefore, we cautiously conclude that, as financially constrained firms are exposed to high opportunity costs associated with retaining unutilized resources; they may have fewer options when deciding which kind of SG&A costs to decrease, as surviving the constraint period by decreasing resources takes precedence over the long term benefits of retaining value-enhancing SG&A expenditures. For the investment opportunity test, we find evidence that financially constrained firms with low investment opportunities dispose slack resources. Contrary to our expectation, we find some evidence that constrained firms with good investment opportunities also engage in downward resource adjustments. However, the difference in coefficients between the high versus the low investment opportunity group is insignificant. For the earnings management test, we document that constrained firms without incentives for earnings management exhibit less asymmetric cost behavior. This is consistent with the conjecture that constrained firms cut down on resources to reduce costs to send positive signal about the future survival prospects of these firms. In addition, we find evidence that financial constraints lead to lower cost asymmetry even when managers receive optimistic signals about future sales. This finding strengthens the argument that financially constrained firms encounter higher costs of capital from both equity and debt providers; thereby, costs increase less with an increase in sales.

This study makes several contributions to the extant literature. First, we fill the void in the literature on how resource availability affects cost behavior. Since costs are driven by resources, and resource availability depends on access to capital, studying the cost behavior of constrained firms makes a valuable contribution to the existing cost asymmetry literature. By using three different firm-level measures of financial constraint, we examine the first order effect of financial constraint on asymmetric cost behavior. Second, we document that the relationship between financial constraints and cost behavior varies across cost categories, with SG&A (COGS) cost categories exhibiting low (high) cost asymmetry, while operating cost category documenting the weakest association. We attribute this finding as indirect evidence of managerial engagement in cost classification shifting, or the “SG&A shell game” (Hartlieb et al. 2020), where managers move expenses from SG&A to COGS. This is done possibly to inflate income from operations when faced with financial constraint, as income from operations is considered to be a better indicator of firm performance than the gross profit margin. Third, we contribute to the literature by documenting managerial short-termism for financially constrained firms, as they reduce even future value-generating SG&A costs, irrespective of the availability of the investment opportunities. This could be consistent with the argument that, delaying downward resource adjustments until the arrival of new information that might mitigate future uncertainties, could be more onerous for already constrained firms.

One of the key implications of this research for managers is that they should conduct cost–benefit analysis prior to making resource adjustment decisions related to value-creating SG&A costs. Particularly, the resource-constrained managers should assess whether the benefits derived from decreasing value-creating SG&A costs as a potential survival tool, outweigh the costs associated with missed future investment opportunities. The reduction in value-creating SG&A costs (e.g., R&D and human capital-related investment costs) might increase the severity of financial constraints in the future, because of reduced firm growth. For investors, our findings provide indirect evidence that managers of financially constrained firms might engage in SG&A shell game. It would be beneficial for investors to be aware of managerial motives behind reduction in SG&A costs while making investment decisions. Thereby, we encourage investors when evaluating a firm’s performance based on financial ratios, to use both gross profit and income from operations, in order to get a better comparative picture of firms’ financial health and SG&A shell game.

Our paper differs from the Cheng et al. (2018) which document anti-sticky cost behavior for a sample of Chinese private firms using a regional financial development index as a proxy for access to finance. Cheng et al. (2018) use a sample consisting of only small and private Chinese companies. These firms, compared to listed firms, have access to the debt market only. Moreover, Chinese state-controlled listed firms benefit from preferential treatment when borrowing from banks; whereas, private firms rely heavily on informal finance (Wu et al. 2014). Therefore, the findings of Cheng et al. (2018) are unlikely to be generalizable to U.S. listed firms, which have access to both debt and public equity markets and are much larger in size. In addition, prior research shows that in emerging markets government plays a role in allocation of financial resources (Cull et al. 2015; Chen et al. 2017). Cheng et al. (2018) use regional financial development as a proxy for financial constraints. However, such a macroeconomic variable fails to incorporate firm-specific idiosyncrasies that can affect the magnitude of financial constraints differentially. For instance, not all firms operating in regions with high levels of financial development have equal access to capital; therefore, can be considered as unconstrained. We overcome this problem by deploying well accepted firm-specific financial constraint measures.[1]

The remainder of the paper proceeds as follows. The second section reviews the related literature and develops the hypotheses. The research methods and sample selection procedure are described in the third section and descriptive statistics and test results are reported in section four. The fifth section concludes the paper.

2 Literature review and hypotheses development

2.1 Financial constraint and asymmetric cost behavior

In the seminal paper of Anderson et al. (2003) on cost stickiness, the authors propose two theories underlying cost stickiness: adjustment cost theory and agency theory. The former relies on the notion that many costs, arise from managers' deliberate resource commitment decisions. Once committed, it is not easy to scale back resources without incurring some kind of adjustment costs. Therefore, to the extent that managers recognize the trade-offs arising because of adjustment costs, they will reduce costs to a lesser extent when activity decreases than they will expand costs when activity increases and, thereby, generate cost stickiness. Agency theory-based arguments for cost stickiness consider the self-serving behavior of managers, who tend to engage in empire building by retaining unutilized resources in order to grow the firm beyond its optimal size (Loy and Hartlieb 2018; Chen et al. 2012; Hope and

[1] Li and Zheng (2017) find that the positive relation between product market competition and cost stickiness is more pronounced for firms having strong financial positions (an inverse proxy of financial constraints). Their test considers financial constraints as a moderating variable. We, on the other hand, consider financial constraints as the primary driver of cost stickiness. Costa and Habib (2020) document that trade credit lowers cost stickiness, arguing that suppliers are likely to monitor customers' actions related to downward resource adjustment, because the retention of unutilized resources would affect the current cash flows of customers adversely, with a detrimental effect on suppliers' finances and overall operation. However, the Costa and Habib (2020) paper differs from ours as their paper is theoretically grounded on the monitoring role of trade credit.

Thomas 2008; Jensen 1986; Masulis et al. 2007; Stulz 1990). Such actions induce cost stickiness, as slack resources are not disposed of when sales decline. In addition, managerial expectation has also been used to explain asymmetric cost behavior (Banker and Byzalov 2014; Banker et al. 2014). If managers are optimistic about future demand, they are likely to retain slack resources even when sales decrease; whereas, if managers are pessimistic about future demand then they are likely to dispose slack resources when sales decline.

Cost behavior is driven by the availability of resources; and the availability of resources, in turn, depends on the availability of finance. Firms face financial constraints for various reasons, such as capital market imperfections stemming from information asymmetry, weak institutional settings (Chen et al. 2017), agency problem (Pawlina and Renneboog 2005) and risk (Senbet and Wang 2012); as a result, firms' are unable to borrow or issue equity (Lamont et al. 2001). If firms operated under frictionless capital markets then managers did not have to make trade-off decisions regarding which projects to invest in and which projects to forgo, as the availability of abundant resources would have enabled managers to invest in all positive NPV projects. However, in the real-world frictional markets, investment and growth depend largely on the availability of internal capital, as the cost of raising outside capital could be high relative to that of internally generated funds. Consequently, firms with attractive growth opportunities but without access to external financing may invest less into optimal value-increasing investment projects. Financial constraints; therefore, will require managers to carefully consider retaining or disposing slack resources for optimizing future growth and firm value.

From the resource adjustment cost perspective, we posit that when sales decrease it becomes more costly to maintain unutilized resources for constrained firms, because such resources incur additional costs which, in turn, place further constraints on the financial health of the firm. Maintaining unutilized resources decrease the present value of sales, and increases the opportunity cost of keeping unused resources; thereby, decreases profitability. Especially, successive decreases in sales make it more costly, at a given time, for constrained firms to maintain slack resources for future periods. Moreover, constrained firms are more likely to hold on to cash instead of non-cash assets, in order to fund future expansion through internal finance. Therefore, when sales decrease, financially constrained firms are more likely to dispose of unutilized resources, to reduce avoidable costs. This proposition can also be supported from a real option theory framework. Such framework posits that, when a firm cuts its slack resources, it gives up the real option to wait for the arrival of new information that might affect the desirability or timing of downward resource adjustments (Kim et al. 2019). We posit that for financially constrained firms, the option value of waiting for the arrival of new information falls short of the NPV of reduction in future costs from downward resource adjustments, since the propagation of financial constraints could lead to corporate bankruptcy.

Popov and Rocholl's (2015) study of the German market shows that firms that had credit relation with at least one global financial crisis (GFC)-affected bank, had to decrease both the number of employees and the average compensation of the remaining employees. Fernandes and Ferreira (2017) show that, in the post-GFC era, financially constrained Portuguese firms hired more fixed-term workers compared to permanent workers, than their unconstrained counterparts.[2] Fernandes and Ferreira (2017) conclude that increased proportions of fixed-term employees enable the flexibility needed to adjust future employment rates without incurring additional firing costs. Constrained firms also face more *upward resource adjustment costs*, as they incur higher transaction costs and have available loans that come with stricter conditions, including stringent collateral requirements. All these heighten for constrained firms during an increase in sales or an expansion of the business (Cheng et al. 2018). Therefore, constrained firms rely heavily on other sources of finance, e.g., trade credits and internal funds to finance their operation (Mulier et al. 2016).

However, the adjustment cost theory posits that, once committed, resources are not easy to scale down without incurring additional (future) adjustment costs; such as severance pay, search and training costs for new employees and transaction costs associated with purchasing new equipment (Cheng et al. 2018). This could be more applicable to constrained firms, who face difficulty in raising capital when demand increases after a slump and, thereby, are inhibited from procuring critical resources, for example, skilled employees. Venieris et al. (2015) and Loy and Hartlieb (2018) find evidence that U.S. firms are investing more in intangible assets, such as knowledge-intensive human capital and R&D, which managers of financially constrained firms might tend to retain, even during downturns. Therefore, managers of constrained firms might prefer to retain unused resources in the short run to minimize the adjustment costs. Banker et al. (2013) document that at country-level, stricter employment protection regulation results in higher firing costs, which could be more onerous for financially constrained firms, as saving costs and/or conserving cash in the present are the key priorities for these firms (Caggese et al. 2019). Therefore, in a well-developed country like the U.S., adjustment costs associated with labor are high compared with those in China and other emerging economies, owing to the availability of more highly-skilled human capital and the enforcement of minimum wage regulations (Banker et al. 2013). Thus, laying off human capital, which comes with high adjustment costs, might threaten the future growth of firms. However, based on the more rational premise that financially constrained firms will reduce unutilized resources as a survival strategy, we hypothesize the following:

H1: Financially constrained firms will exhibit less cost asymmetry.

2.2 SG&A future value creation, financial constraint and asymmetric cost behavior

A number of prior studies (Banker et al. 2011, 2019; Chen et al. 2012; Huson et al. 2012) document that SG&A costs are related to long-term future economic benefits e.g., product promotion, brand development, customer-relationship and distribution channel management, and that investment in such intangible assets, in turn,

[2] Fixed-term workers have a flexible fixed-term contract and, therefore, can be laid off without incurring the severance payment that is required to lay off permanent workers (Fernandes and Ferreira 2017).

impacts upon future firm performance positively. Empirical research shows that value-creating SG&A costs exhibit greater cost asymmetry (Banker et al. 2011; Chen et al. 2012; Lev and Sougiannis 1996), and decreasing value-creating SG&A costs involves higher resource adjustment costs (Liu et al. 2017). Chen et al. (2012) predict, and find, that SG&A costs can create greater future value, and SG&A cost stickiness is influenced by economic considerations. The latter implies that constrained firms would trade-off the benefits derived from retaining value-creating resources against the costs of maintaining those resources.

On the other hand, if SG&A costs generate low future value, then managers do not have a legitimate reason to retain such resources in the event of a sales decline. However, Caggese et al. (2019) document that the employee layoff decisions of constrained firms are inefficient compared with those of their unconstrained counterparts, for a sample of Swedish companies. The authors show that constrained firms fire recently-hired workers having high expected productivity growth, in order to take advantage of their low firing costs. Laying off long-tenured workers who are considered less productive, may expose firms to significantly larger firing costs, e.g., higher severance payments, as compared to firing recently-recruited workers. In sum, their evidence suggests that constrained firms make the wrong firing decisions in order to conserve cash in the short term. Additionally, Musso and Schiavo (2008) posit that, to alleviate financial constraints, firms are likely to shed long term investments, giving rise to detrimental implications for their long-term growth prospects. Therefore, based on the aforementioned arguments we hypothesize:

H2: Financially constrained firms with low (high) SG&A future value-creating potential will exhibit lower (higher) cost asymmetry.

2.3 Investment opportunities, financial constraint and asymmetric cost behavior

The association between financial constraint and asymmetric cost behavior could be conditional on future investment opportunities. A firm's investment opportunity comprises projects that allow the firm to grow; thus, investment opportunity is considered as the growth prospect of the firm (Kallapur and Trombley 1999). Prior study documents that firms with good investment opportunities suffer from high degrees of information asymmetry (Gaver and Gaver 1995). Access to debt markets or bank loans is difficult for such firms, because they lack collateralizable assets. One major trait of firms with high investment opportunities is their possession of soft assets, e.g., human capital and innovation (Demir et al. 2017). Thus, access to the equity market, too, becomes expensive, owing to high information asymmetry. Kim et al. (2019) document that when firms are faced with high information uncertainty, they tend to delay the downward resource adjustments by using their option to wait until more uncertainty-mitigating information becomes available. Therefore, we conjecture that when investment opportunities are low, financially constrained firms with declining sales are likely to dispose slack resources, i.e., to exhibit lower cost asymmetry. However, if such firms have good investment opportunities then they are likely to delay the downward resource adjustments: an act that will result in higher cost asymmetry. Thus, we develop the following hypothesis:

H3: Financially constrained firms with low (high) investment opportunities will exhibit lower (higher) cost asymmetry.

2.4 Earnings management, financial constraint and asymmetric cost behavior

Prior studies (Burgstahler and Dichev 1997; Degeorge et al. 1999; Roychowdhury, 2006) document that firms engage in earnings management to avoid small losses and earnings decreases which, in turn, would enable them to avoid breaching debt covenants, or to exhibit a steady trend in earnings. Dierynck et al. (2012) and Kama and Weiss (2013) suggest that managerial incentives should influence their decisions about resource adjustments. When managers have incentives to avoid loss or earnings decrease, or to meet financial analysts' earnings forecasts, they may engage in immediate downward resource adjustments that would lead to lower cost asymmetry. During declining sales, downward resource adjustment decisions that are made by managers, based on the above-mentioned motives, are driven by agency problem (Kama and Weiss 2013). In line with this view, Kurt (2018) predicts and finds that *constrained firms* engage in income-increasing earnings management more aggressively, around seasoned equity offerings, and Linck et al. (2013) document that *constrained firms* overstate earnings during the quarters prior to investment.

However, when sales decline, constrained firms suffer a relatively greater reduction in the present value of revenue. Thus, such firms are also likely to cut down slack resources to reduce costs and, hence, to survive the current constrained period. This should also provide a positive signal about the future survival prospects of these financially constrained firms. Therefore, we conjecture that, if firm survival takes precedence over the agency problem, we would expect a scaling down of resources in the event of a sales decline for financially constrained firms *without* earnings management incentives. However, similar finding for constrained firms *with* earnings management incentives will support the agency argument. Thus, we develop the following hypothesis:

H4: Lower cost asymmetry exhibited by constrained firms without (with) earnings management incentives will support the survival (agency) motive.

3 Research design

3.1 Empirical models

The extensive literature on cost asymmetry uses the following popular model developed by Anderson et al. (2003) to test for the presence or absence of cost asymmetry (Chen et al. 2012; Dierynck et al. 2012; Venieris et al. 2015):

$$LN\frac{SG\&A_t}{SG\&A_{t-1}} = \beta_0 + \beta_1 LN\left[\frac{SALE_t}{SALE_{t-1}}\right] + \beta_2 DECDUM * LN\left[\frac{SALE_t}{SALE_{t-1}}\right] + \varepsilon \quad (1)$$

where *SG&A* (Compustat data item XSGA) is selling, general and administrative expenses, and *SALE* (Compustat data item SALE) is sales revenue. *DECDUM* takes the value of 1 if sales in year t are less than sales in year $t-1$, and 0 otherwise. The coefficient β_1 measures the percentage increase in SG&A expenses, for a 1% increase in sales. The sum of coefficients β_1 and β_2 measures the percentage decrease in SG&A expenses for a 1% decrease in sales. A significant positive β_1 and a significant negative β_2 confirm cost asymmetry. According to Anderson et al. (2003), the degree of SG&A costs asymmetry is affected by various economic factors; thus, we expand the equation as follows:

$$\begin{aligned} LN\frac{SG\&A_t}{SG\&A_{t-1}} &= \beta_0 + \beta_1 LN\left[\frac{SALE_t}{SALE_{t-1}}\right] + \beta_2 DECDUM * LN\left[\frac{SALE_t}{SALE_{t-1}}\right] \\ &+ \sum_{m=3}^{7} \beta_m ECONVAR_{m,t} * DECDUM \\ &* LN\left[\frac{SALE_t}{SALE_{t-1}}\right] + \sum_{n=8}^{12} \beta_n ECONVAR_{n,t} + \varepsilon \end{aligned} \quad (2)$$

where *ECONVAR* are the economic variables, which include successive decrease (*SUDEC*), asset intensity (*AIN*), employee intensity (*EIN*), stock performance (*RET*) and GDP growth rate (*GDP*) (all variables are defined in "Appendix"). Both *SUDEC* and *GDP* are proxies for managerial expectations regarding future sales, whilst *AIN* and *EIN* are standard proxies for magnitude of adjustment costs. *RET* is measured as the raw stock return, and proxies for stock price performance.

In this study we use the following regression specifications to test H1 where Eq. (3) below is a comprehensive model that incorporates all the three-way, two-way and standalone variables following the recent literature on cost asymmetry (Xu and Zheng 2020; Golden et al. 2020; Kim et al. 2019).[3] We then include financial constraints (FC), our primary independent variable, into the regression specification and develop the following comprehensive model:

[3] The original Anderson et al. (2003) version did not include *DECDUM* as a standalone variable. Chen et al. (2012) used a variation of the Anderson et al. (2003) model; whereas, Banker et al. (2013) did not incorporate any standalone variable. Holzhacker et al. (2015) and Golden et al. (2020) used a version by incorporating *DECDUM* as a standalone variable. Kim et al. (2019) used a model with two-way interaction with changes in sales, but did not incorporate *DECDUM* as a standalone variable.

$$
\begin{aligned}
LN\left[\frac{SG\&A_t}{SG\&A_{t-1}}\right] &= \beta_0 + \beta_1 LN\left[\frac{SALE_t}{SALE_{t-1}}\right] + \beta_2 DECDUM \\
&+ \beta_3 DECDUM * LN\left[\frac{SALE_t}{SALE_{t-1}}\right] + \beta_4 FC + \beta_5 FC \\
&* LN\left[\frac{SALE_t}{SALE_{t-1}}\right] + \beta_6 FC * DECDUM + \beta_7 FC * DECDUM * LN \\
&\left[\frac{SALE_t}{SALE_{t-1}}\right] + \sum_{l=8}^{12} \beta_l ECONVAR_{l,t} \\
&* LN\left[\frac{SALE_t}{SALE_{t-1}}\right] + \sum_{m=13}^{17} \beta_m ECONVAR_{m,t} * DECDUM \\
&+ \sum_{n=18}^{22} \beta_n ECONVAR_{n,t} * DECDUM * LN\left[\frac{SALE_t}{SALE_{t-1}}\right] \\
&+ \sum_{o=23}^{27} \beta_o ECONVAR_{o,t} + \varepsilon
\end{aligned}
\tag{3}
$$

Our coefficient of primary interest is the sign and significance of the interactive variable, β_7. A positive and significant β_7 will support H1. We also use operating costs (Compustat data item SALE minus OIADP) instead of SG&A expenses, as an alternative cost proxy.[4]

3.2 Measurement of the independent variable: financial constraints (FC)

As there is no consensus on which is the best proxy for financial constraint measurement, and the majority of studies use more than one constraint measure as a proxy, we use three different measures in this study i.e. SA index (*SA*); one accounting based measure, WW index (*WW*); and a text-based measure developed by Bodnaruk et al. (*BLM*). We use the normalized version of all three financial constraint measures to make them comparable, since these measures vary largely along their respective distributions.

Fazzari et al. (1988) in their seminal paper used investment cash-flow (ICF) sensitivity as a measure of financial constraint. However, this measure has been criticized as failing to truly capture the construct of financing constraints (Kaplan and Zingales 1997; Moshirian et al. 2017). Deng et al. (2019) document that ICF sensitivity measures investment thirst, not financial constraint. Among other criticisms are, that large firms show high sensitivity (Kadapakkam et al. 1998), whereas less creditworthy and more constrained firms exhibit low sensitivity (Cleary 1999). Financially strong and high dividend paying firms demonstrate high sensitivity (Cleary 2006).

[4] We assess the sensitivity of our results related to operating costs by calculating *OC* as the difference between Compustat data item SALE and IB. Results remain the same.

Another widely used measure is the KZ index, based on five accounting variables developed by Kaplan and Zingales (1997). The major weakness of the KZ index is that it was constructed using a small sample of only 49 U.S. firms (Chan et al. 2013; Fazzari et al. 2000). Another major shortcoming of the KZ index is a modelling flaw, in which the same quantitative information is incorporated as both the dependent and independent variables (Hadlock and Pierce 2010). Below, we explain our chosen financial constraint measures:

(i) SA index (***SA***) The index has been developed by Hadlock and Pierce (2010) using firm size and age. Higher SA indices indicate higher financial constraint. The SA index is calculated as follows:

$$SA_{it} = -0.737SIZE_{it} + 0.043\left(SIZE_{it}\right)^2 - 0.040AGE_{it} \tag{4}$$

where *SIZE* is the natural log of total assets, and *AGE* is the number of years the firm is listed on Compustat.

(ii) WW index (***WW***) WW index has been constructed by Whited and Wu (2006), and higher WW indices mean higher financial constraint. The index is composed of six components and is calculated as follows:

$$\begin{aligned} WW_{it} = & -0.091CF_{it} - 0.062DIVPOS_{it} + 0.021TLTD_{it} \\ & - 0.044LNTA_{it} + 0.102ISG_{it} - 0.035SG_{it} \end{aligned} \tag{5}$$

where *CF* is cash flow (Compustat data item IB plus DP) divided by total assets (Compustat data item AT), *DIVPOS* is a dummy variable equal to 1 if the firm pays dividends (Compustat data item DVC plus DVP) and 0 otherwise, *TLTD* is long-term debt (Compustat data item DLTT) divided by total assets, *LNTA* is the natural log of total assets, *ISG* is the firm's three-digit SIC code industry annual sales growth, and *SG* is the firm's annual sales growth.

The underlying notion of traditional accounting-based measures of financial constraint is that larger firms are less likely to be financially constrained; whereas, owing to financial meltdown, larger and older firms can become financially constrained (Bodnaruk et al. 2015). This inherent shortcoming of traditional measures may result in misclassifying financially constrained firms. Thus, the text-based measure can identify the financially constrained firms more accurately.

(iii) Bodnaruk et al. (2015) Text-Based Financial Constraint Measure (***BLM***) Bodnaruk et al. (2015) developed a list of 184 constraining words from all 10-K filings. The commonly used constraining words from their list include *required*, *obligations*, *impairment*, *covenants*, *requirements*, *permitted*, *comply*, *imposed*, and the index uses the percentage of constraining words as a measure of financial constraint. Bodnaruk et al. (2015) show that the more managers are concerned about future financial constraints, the more they will disclose through the text of 10-K filings. Higher BLM values indicate higher financial constraint.

Table 1 Sample selection and industry distribution

Selection process	N
Panel A: Sample selection procedure	
Total observations produced for 1975 to 2016	462,735
Drop: observations for SIC codes between 4800 to 4999	(30,397)
Drop: observations for SIC codes between 6000 to 6999	(139,254)
Drop: observations for SIC codes between duplicate observations	(1149)
	291,935
Drop: observations with missing data on sales and SG&A for current period and previous period; sales and SG&A values are zero; sales and SG&A are negative; sales smaller than SG&A	(83,966)
	207,969
Drop: observations for 1975	(24,796)
Preliminary sample for the baseline regression without ECONVAR for the SA version of the financial constraint	183,173
Merging with non-missing economic variables	124,839

Code	Industry	Observations	% observations
Panel B: Industry distribution			
1–14	Agriculture and mining	17,164	9.37
15–17	Building construction	2923	1.60
20–21	Food and kindred products	6361	3.47
22–23	Textile mill products and apparels	4261	2.33
24–27	Lumber, furniture, paper and printing	9434	5.15
28–30	Chemical, petroleum, rubber and allied products	15,760	8.60
31–34	Metal	10,874	5.94
35–39	Machinery, electrical, computer equipment	50,568	27.61
40–47	Railroad and other transportation	4828	2.64
50–52	Wholesale goods, building materials	10,512	5.74
53–59	Store merchandise, auto dealers, home furniture stores	15,537	8.48
70–79	Business services	25,305	13.81
80–99	Other	9646	5.27
	Total	183,173	100.00

This table reports sample selection procedure (Panel A) and the distribution of the sample across the 2-digit industry groups (Panel B)

3.3 Sample selection and descriptive statistics

Financial data were collected from Compustat, whilst the stock return data were collected from the CRSP (Center for Research in Security Prices) for the years 1975 to 2016. We deliberately chose a long sample period to provide a richer analysis of the cost behavior. Panel A, Table 1, illustrates the sample selection process, which

Table 2 Descriptive statistics and correlation

Variables	Observations	Mean	SD	25%	Median	75%
Panel A: Descriptive statistics[a]						
$LN(SG\&A_t/SG\&A_{t-1})$	183,173	0.11	0.27	− 0.02	0.09	0.21
$(SG\&A_t\text{-}SG\&A_{t-1})/SALE_{t-1}$	183,173	0.04	0.11	− 0.00	0.01	0.05
SG&A (*$mil*)	183,173	317.69	1663.17	6.00	24.61	109.81
$LN(OC_t/OC_{t-1})$	183,018	0.11	0.28	− 0.02	0.09	0.21
$(OC_t–OC_{t-1})/SALE_{t-1}$	183,018	0.15	0.38	− 0.01	0.08	0.21
OC (*$mil*)	183,018	1675.08	9625.61	26.91	119.52	577.19
$LN(SALE_t/SALE_{t-1})$	183,173	0.10	0.29	− 0.03	0.09	0.22
$(SALE_t–SALE_{t-1})/SALE_{t-1}$	183,173	0.16	0.39	− 0.03	0.09	0.24
SALE (*$mil*)	183,173	1845.18	10,499.43	27.81	128.12	632.30
DECDUM	183,173	0.29	0.46	0.00	0.00	1.00
SUDEC	162,949	0.28	0.45	0.00	0.00	1.00
AIN	183,173	1.24	1.22	0.58	0.85	1.36
ASSET (*$mil*)	183,173	1416.38	4447.35	24.12	116.94	613.25
EIN	170,768	0.01	0.01	0.00	0.01	0.01
EMP (*thousands*)	170,768	8.39	35.51	0.21	0.94	4.25
RET	139,396	0.01	0.05	− 0.01	0.01	0.04
GDP	183,173	2.93	1.86	1.90	3.20	4.20
SA	183,173	0.40	0.19	0.27	0.38	0.53
WW	147,701	0.30	0.08	0.25	0.30	0.36
BLM	69,958	0.40	0.20	0.25	0.39	0.53

Table 2 (continued)

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
Panel B: Correlation[b]												
$LN(SG\&A_t/SG\&A_{t-1})$ [1]	1											
$LN(OC_t/OC_{t-1})$ [2]	0.763***	1										
$LN(SALE_t/SALE_{t-1})$ [3]	0.685***	0.888***	1									
$DECDUM*LN(SALE_t/SALE_{t-1})$ [4]	0.425***	0.600***	0.712***	1								
SUDEC [5]	− 0.231***	− 0.211***	− 0.158***	− 0.141***	1							
AIN [6]	0.076***	0.067***	0.021***	− 0.143***	0.030***	1						
EIN [7]	− 0.001	− 0.014**	− 0.026***	− 0.006	0.0012	− 0.091***	1					
RET [8]	0.029***	0.042***	0.145***	0.088***	0.054***	− 0.010*	− 0.023***	1				
GDP [9]	0.164***	0.183***	0.203***	0.177***	− 0.033***	− 0.071***	0.136***	− 0.038***	1			
SA [10]	0.060***	0.045***	0.030***	− 0.112***	0.024***	− 0.070***	0.189***	− 0.004	0.225***	1		
WW [11]	− 0.080***	− 0.112***	− 0.141***	− 0.200***	0.105***	− 0.121***	0.201***	− 0.037***	0.154***	0.797***	1	
BLM [12]	− 0.041***	− 0.040***	− 0.043***	− 0.062***	0.062***	0.062***	− 0.045***	− 0.006	− 0.177***	− 0.027***	0.018***	1

[a]This table reports descriptive statistics of the variables used in the regression models. *SG&A* is selling, general and administrative expenses and *OC* is operating cost. *SALE* is sales or revenue. *DECDUM* takes the value of one when sales in year t are less than those in year t − 1 and zero otherwise. Successive decrease (*SUDEC*), is an indicator variable that is equal to 1 if revenue in year t − 1 is less than revenue in t − 2, and 0 otherwise and asset intensity (*AIN*) is total assets divided by sales revenue for year. *ASSET* is total assets in million dollars. Employee intensity (*EIN*) is the ratio of total number of employees over sales and *EMP* is the number of employees (in thousands). Stock performance (*RET*) is the raw stock return and *GDP* is the GDP growth rate. *SA, WW* and *BLM* are the financial constraint proxies which have all been normalized to make them comparable. Refer to "Appendix" for variable definitions

[b]This table reports pair-wise Pearson correlations between the variables used in the main analysis. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$. Refer to "Appendix" for variable definitions

follows the process used by Anderson et al. (2003). We began with a total sample of 462,735 firm-year observations from 1975 to 2016. We then excluded 30,397 firm-year observations pertaining to utility (two-digit SIC code 48-49), 139,254 firm-year observations pertaining to financial institutions (two-digit SIC codes 60-69), and 1149 duplicate firm-year observations. After excluding observations based on missing data on SALE and SG&A for the current and previous periods, zero SALE and SG&A values, negative SALE and SG&A values, as well as SALE < SG&A, the sample size declines to 207,969 observations. Since both our dependent and independent variables required one-year lagged data, we lost a further 24,796 firm-year observations. Our baseline sample, therefore, consists of 183,173 firm-year observations before considering the control variables.

To avoid the undesirable influence of outliers, we winsorize all the variables in the extreme 1% of their respective distributions. In the regression models, sample size varies depending on the model-specific data requirements. Firm-year observations come from a wide variety of industries, with two-digit SIC codes, 35–39 (27.61%) and 70–79 (13.81%) commanding the largest industry representation in our sample, as reported in Panel B, Table 1.

Missing data on some of the control variables further reduced the sample to 124,839 firm-year observations for our *SG&A*-based baseline regression. The corresponding observations for the *OC* regressions are 124,737 firm-year observations.

4 Empirical results

4.1 Descriptive statistics and correlation analysis

Descriptive statistics of the sample are reported in Panel A of Table 2. Over the study period from 1976 to 2016, the mean (median) of $LN(SALE_t/SALE_{t-1})$, $LN(SG\&A_t/SG\&A_{t-1})$ and $LN(OC_t/OC_{t-1})$ are 0.10 (0.09), 0.11 (0.09) and 0.11 (0.09) respectively. Average sales revenue for the sample is \$1845.18 million (median \$128.12 million). Average SG&A expenses and operating costs are \$317.69 million (median \$24.61 million) and \$1675.08 million (median \$119.52 million), respectively. *SA*, *WW* and *BLM* have means (medians) of 0.40 (0.38), 0.30 (0.30) and 0.40 (0.39), respectively. The average number of employees per firm is approximately 8390. On average, sample firms use 0.01 thousand (median 0.01) employees and \$1.24 million (median \$0.85 million) in assets to support each million dollars in sales. The median firm of the sample has not experienced a decline in sales for two consecutive years (median 0 and mean 0.28).

Panel B of Table 2 presents the correlation results. *SA* is positively correlated with $LN(SALE_t/SALE_{t-1})$, $LN(SG\&A_t/SG\&A_{t-1})$ and $LN(OC_t/OC_{t-1})$. *WW* and *BLM* are negatively correlated with $LN(SALE_t/SALE_{t-1})$, $LN(SG\&A_t/SG\&A_{t-1})$, and $LN(OC_t/OC_{t-1})$. The correlation between *SA* and *WW* is 0.797. Interestingly, the text-based measure, *BLM,* has very low correlations with *SA* (− 0.027) and *WW* (0.018). One plausible reason for such low correlations could be that BLM captures managerial tone, which can reflect managerial optimism and/or managerial conservatism. For example, managers are generally inclined to appear optimistic about their

Table 3 Financial constraints and asymmetric cost behavior: OLS and fixed effect regression results

	OLS	OLS	OLS	OLS	FFE	FFE	FFE	FFE
	Baseline	SA	WW	BLM	Baseline	SA	WW	BLM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Dependent variable LN(SG&A$_t$/SG&A$_{t-1}$)[a]								
β_1: *LN*(*SALE$_t$*/*SALE$_{t-1}$*)	0.739***	0.859***	0.975***	0.739***	0.701***	0.803***	0.947***	0.679***
	[55.69]	[47.84]	[35.44]	[30.55]	[47.05]	[40.08]	[30.41]	[25.12]
β_2: *DECDUM*	− 0.014***	− 0.013**	− 0.022***	− 0.017**	− 0.016***	− 0.014**	− 0.024***	− 0.021***
	[− 3.47]	[− 2.54]	[− 2.76]	[− 2.26]	[− 3.58]	[− 2.57]	[− 2.74]	[− 2.58]
β_3: *DECDUM* * *LN*(*SALE$_t$*/*SALE$_{t-1}$*)	− 0.297***	− 0.383***	− 0.485***	− 0.356***	− 0.265***	− 0.323***	− 0.434***	− 0.333***
	[− 13.59]	[− 14.27]	[− 10.92]	[− 9.08]	[− 10.96]	[− 10.82]	[− 8.77]	[− 7.56]
β_4: *FC*	–	0.054***	0.112***	0.016***	–	− 0.223***	− 0.108***	0.010
		[8.24]	[7.17]	[2.79]		[− 12.73]	[− 3.17]	[1.45]
β_5: *FC* * *LN*(*SALE$_t$*/*SALE$_{t-1}$*)	–	− 0.327***	− 0.913***	− 0.077**	–	− 0.292***	− 0.966***	− 0.079**
		[− 9.37]	[− 10.40]	[− 2.54]		[− 7.42]	[− 9.66]	[− 2.31]
β_6: *FC* * *DECDUM*	–	0.006	0.023	− 0.018*	–	0.008	0.023	− 0.013
		[0.57]	[0.88]	[− 1.75]		[0.67]	[0.83]	[− 1.13]
β_7: FC * DECDUM * LN(SALE$_t$/SALE$_{t-1}$)	–	0.277***	0.803***	0.135**	–	0.170***	0.710***	0.165**
		[5.44]	[6.17]	[2.27]		[2.82]	[4.76]	[2.49]
β_8: *SUDEC* * *LN*(*SALE$_t$*/*SALE$_{t-1}$*)	− 0.214***	− 0.207***	− 0.202***	− 0.209***	− 0.207***	− 0.201***	− 0.195***	− 0.196***
	[− 17.00]	[− 16.59]	[− 14.80]	[− 11.61]	[− 15.10]	[− 14.91]	[− 13.35]	[− 10.02]
β_9: *AIN* * *LN*(*SALE$_t$*/*SALE$_{t-1}$*)	− 0.033***	− 0.039***	− 0.051***	− 0.030***	− 0.033***	− 0.039***	− 0.053***	− 0.030***
	[− 7.76]	[− 9.21]	[− 10.41]	[− 5.28]	[− 6.54]	[− 7.56]	[− 9.16]	[− 4.40]
β_{10}: *EIN* * *LN*(*SALE$_t$*/*SALE$_{t-1}$*)	2.583***	3.762***	5.140***	3.152***	2.754***	4.059***	5.513***	3.179**
	[5.66]	[7.87]	[7.38]	[3.12]	[5.10]	[7.00]	[6.85]	[2.35]
β_{11}: *RET* * *LN*(*SALE$_t$*/*SALE$_{t-1}$*)	0.087	0.135	0.117	0.024	0.027	0.096	0.064	− 0.107
	[0.99]	[1.55]	[1.11]	[0.20]	[0.28]	[1.00]	[0.56]	[− 0.81]

Table 3 (continued)

	OLS	OLS	OLS	OLS	FFE	FFE	FFE	FFE
	Baseline	SA	WW	BLM	Baseline	SA	WW	BLM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
β_{12}: $GDP * LN(SALE_t/SALE_{t-1})$	0.012***	0.015***	0.014***	0.023***	0.013***	0.016***	0.014***	0.031***
	[4.33]	[5.32]	[4.42]	[4.62]	[4.29]	[5.24]	[4.11]	[5.34]
β_{13}: $SUDEC * DECDUM$	− 0.014***	− 0.013***	− 0.011***	− 0.011**	− 0.012***	− 0.012***	− 0.010**	− 0.009*
	[− 4.14]	[− 3.77]	[− 3.09]	[− 2.40]	[− 3.33]	[− 3.34]	[− 2.50]	[− 1.88]
β_{14}: $AIN * DECDUM$	0.008***	0.008***	0.008***	0.013***	0.008***	0.008***	0.008***	0.011***
	[3.42]	[3.53]	[2.97]	[3.54]	[3.19]	[3.29]	[2.88]	[2.90]
β_{15}: $EIN * DECDUM$	0.352*	0.178	0.449*	− 0.043	0.312	0.141	0.478*	− 0.224
	[1.76]	[0.85]	[1.73]	[− 0.12]	[1.43]	[0.61]	[1.70]	[− 0.55]
β_{16}: $RET * DECDUM$	0.050	0.056	0.046	0.043	0.038	0.036	0.023	0.024
	[1.28]	[1.45]	[1.06]	[0.84]	[0.94]	[0.88]	[0.51]	[0.44]
β_{17}: $GDP * DECDUM$	0.004***	0.004***	0.003***	0.007***	0.004***	0.004***	0.003***	0.008***
	[5.17]	[4.82]	[3.78]	[5.73]	[4.45]	[4.58]	[3.29]	[5.99]
β_{18}: $SUDEC * DECDUM * LN(SALE_t/SALE_{t-1})$	0.351***	0.348***	0.340***	0.356***	0.352***	0.340***	0.345***	0.358***
	[18.43]	[18.29]	[16.15]	[13.08]	[17.31]	[16.78]	[15.44]	[12.28]
β_{19}: $AIN * DECDUM * LN(SALE_t/SALE_{t-1})$	0.011	0.015**	0.028***	0.019*	0.017**	0.020**	0.033***	0.027**
	[1.59]	[2.23]	[3.55]	[1.74]	[2.14]	[2.57]	[3.76]	[2.17]
β_{20}: $EIN * DECDUM * LN(SALE_t/SALE_{t-1})$	− 0.523	− 1.700*	− 2.823**	− 2.930*	− 0.072	− 0.903	− 2.074	− 2.513
	[− 0.56]	[− 1.75]	[− 2.37]	[− 1.72]	[− 0.07]	[− 0.80]	[− 1.51]	[− 1.18]
β_{21}: $RET * DECDUM * LN(SALE_t/SALE_{t-1})$	0.304**	0.234	0.317*	0.265	0.367**	0.286*	0.373**	0.467**
	[1.99]	[1.54]	[1.80]	[1.28]	[2.19]	[1.72]	[1.96]	[1.99]
β_{22}: $GDP * DECDUM * LN(SALE_t/SALE_{t-1})$	0.007	0.005	0.006	0.005	0.006	0.005	0.008	0.003
	[1.47]	[1.06]	[1.20]	[0.74]	[1.31]	[1.06]	[1.45]	[0.39]

Table 3 (continued)

	OLS	OLS	OLS	OLS	FFE	FFE	FFE	FFE
	Baseline	SA	WW	BLM	Baseline	SA	WW	BLM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
β_{23}: *SUDEC*	− 0.027***	− 0.028***	− 0.028***	− 0.024***	− 0.022***	− 0.019***	− 0.020***	− 0.016***
	[− 12.47]	[− 12.80]	[− 12.02]	[− 7.93]	[− 9.34]	[− 8.09]	[− 8.26]	[− 5.09]
β_{24}: *AIN*	0.014***	0.014***	0.017***	0.015***	0.026***	0.023***	0.025***	0.034***
	[10.24]	[10.68]	[10.55]	[7.83]	[11.92]	[10.46]	[10.10]	[9.50]
β_{25}: *EIN*	− 0.144	− 0.318***	− 0.505***	− 0.330	0.894***	0.949***	0.605**	0.665
	[− 1.41]	[− 3.01]	[− 3.38]	[− 1.57]	[4.06]	[4.24]	[2.13]	[1.43]
β_{26}: *RET*	− 0.376***	− 0.385***	− 0.329***	− 0.368***	− 0.370***	− 0.357***	− 0.317***	− 0.352***
	[− 15.82]	[− 16.24]	[− 12.13]	[− 11.29]	[− 14.51]	[− 13.98]	[− 10.99]	[− 9.93]
β_{27}: *GDP*	− 0.001	− 0.004***	− 0.004**	− 0.011***	0.008***	0.046***	0.012***	0.006
	[− 0.89]	[− 2.66]	[− 2.26]	[− 3.21]	[4.50]	[15.54]	[5.14]	[1.59]
Constant	− 0.002	0.027***	− 0.020**	0.001	− 0.028***	− 0.058***	0.001	− 0.048***
	[− 0.32]	[3.00]	[− 2.40]	[0.11]	[− 4.37]	[− 8.90]	[0.13]	[− 3.76]
Industry	Yes	Yes	Yes	Yes	No	No	No	No
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm effect	No	No	No	No	Yes	Yes	Yes	Yes
Observations	124,839	124,839	101,031	56,380	124,839	124,839	101,031	56,380
Adj. R-squared	0.52	0.53	0.51	0.55	0.48	0.49	0.48	0.49

Table 3 (continued)

	OLS Baseline	OLS SA	OLS WW	OLS BLM	FFE Baseline	FFE SA	FFE WW	FFE BLM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel B: Dependent variable $\boldsymbol{LN(OC_t/OC_{t-1})}$[b]								
β_1: $LN(SALE_t/SALE_{t-1})$	0.969***	1.038***	1.123***	0.951***	0.959***	1.017***	1.133***	0.941***
	[129.67]	[95.19]	[67.79]	[70.04]	[110.14]	[78.35]	[58.14]	[57.45]
β_2: $DECDUM$	− 0.015***	− 0.021***	− 0.030***	− 0.015***	− 0.018***	− 0.024***	− 0.031***	− 0.019***
	[− 5.21]	[− 5.73]	[− 4.96]	[− 3.12]	[− 5.61]	[− 5.91]	[− 4.66]	[− 3.48]
B_3: $DECDUM * LN(SALE_t/SALE_{t-1})$	− 0.178***	− 0.220***	− 0.173***	− 0.171***	− 0.172***	− 0.198***	− 0.173***	− 0.172***
	[− 12.90]	[− 11.29]	[− 5.25]	[− 7.17]	[− 11.43]	[− 9.28]	[− 4.80]	[− 6.26]
β_4: FC	–	0.023***	0.070***	0.004	–	− 0.148***	0.080***	0.000
		[6.38]	[7.97]	[1.25]		[− 14.00]	[3.43]	[0.05]
β_5: $FC * LN(SALE_t/SALE_{t-1})$	–	− 0.185***	− 0.535***	− 0.016	–	− 0.160***	− 0.594***	− 0.018
		[− 9.07]	[− 10.99]	[− 0.88]		[− 6.54]	[− 10.44]	[− 0.81]
β_6: $FC * DECDUM$	–	0.030***	0.056***	− 0.008	–	0.032***	0.048**	− 0.006
		[4.32]	[3.16]	[− 1.23]		[4.17]	[2.52]	[− 0.80]
$\boldsymbol{\beta_7}$: $\boldsymbol{FC * DECDUM * LN(SALE_t/SALE_{t-1})}$	–	0.145***	0.109	0.018	–	0.082*	0.104	0.030
		[3.92]	[1.14]	[0.45]		[1.91]	[0.97]	[0.68]
β_8: $SUDEC * LN(SALE_t/SALE_{t-1})$	− 0.115***	− 0.111***	− 0.114***	− 0.123***	− 0.110***	− 0.106***	− 0.106***	− 0.119***
	[− 14.44]	[− 14.05]	[− 13.42]	[− 10.28]	[− 12.52]	[− 12.31]	[− 11.44]	[− 8.95]
β_9: $AIN * LN(SALE_t/SALE_{t-1})$	− 0.026***	− 0.029***	− 0.039***	− 0.024***	− 0.029***	− 0.032***	− 0.044***	− 0.030***
	[− 7.31]	[− 8.26]	[− 9.13]	[− 4.98]	[− 6.53]	[− 7.13]	[− 8.15]	[− 4.58]
β_{10}: $EIN * LN(SALE_t/SALE_{t-1})$	1.413***	2.054***	2.064***	2.330***	1.515***	2.216***	2.253***	2.722***
	[6.79]	[9.44]	[7.30]	[6.33]	[5.75]	[7.91]	[6.40]	[5.87]
β_{11}: $RET * LN(SALE_t/SALE_{t-1})$	− 0.004	0.023	− 0.075	− 0.009	− 0.087	− 0.049	− 0.149**	− 0.132
	[− 0.08]	[0.47]	[− 1.28]	[− 0.13]	[− 1.53]	[− 0.88]	[− 2.20]	[− 1.62]

Table 3 (continued)

	OLS	OLS	OLS	OLS	FFE	FFE	FFE	FFE
	Baseline	SA	WW	BLM	Baseline	SA	WW	BLM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
β_{12}: *GDP * LN*($SALE_t/SALE_{t-1}$)	− 0.001	0.000	− 0.001	0.001	− 0.001	0.000	− 0.001	0.002
	[− 0.80]	[0.18]	[− 0.73]	[0.42]	[− 0.77]	[0.12]	[− 0.80]	[0.50]
β_{13}: *SUDEC * DECDUM*	− 0.010***	− 0.009***	− 0.010***	− 0.008***	− 0.009***	− 0.009***	− 0.008***	− 0.009***
	[− 4.63]	[− 4.21]	[− 3.94]	[− 2.67]	[− 3.71]	[− 3.67]	[− 3.18]	[− 2.68]
β_{14}: *AIN * DECDUM*	0.015***	0.016***	0.016***	0.017***	0.016***	0.017***	0.017***	0.017***
	[7.41]	[7.62]	[6.54]	[5.51]	[6.95]	[7.16]	[6.15]	[4.82]
β_{15}: *EIN * DECDUM*	0.574***	0.300***	0.425***	0.313**	0.598***	0.315**	0.513***	0.388**
	[5.28]	[2.63]	[2.99]	[1.97]	[5.12]	[2.54]	[3.40]	[2.10]
β_{16}: *RET * DECDUM*	0.017	0.019	− 0.016	0.049	0.008	0.004	− 0.020	0.033
	[0.66]	[0.74]	[− 0.53]	[1.55]	[0.28]	[0.16]	[− 0.62]	[0.96]
β_{17}: *GDP * DECDUM*	0.002***	0.002***	0.001	0.003***	0.002***	0.001***	0.001	0.003***
	[3.84]	[2.86]	[1.50]	[3.22]	[3.10]	[2.64]	[1.20]	[2.97]
β_{18}: *SUDEC * DECDUM * LN*($SALE_t/SALE_{t-1}$)	0.186***	0.186***	0.199***	0.198***	0.189***	0.182***	0.200***	0.197***
	[13.03]	[13.01]	[12.66]	[11.40]	[12.35]	[11.94]	[11.95]	[10.42]
β_{19}: *AIN * DECDUM * LN*($SALE_t/SALE_{t-1}$)	0.000	0.002	0.004	− 0.006	0.004	0.006	0.008	0.002
	[0.05]	[0.39]	[0.50]	[− 0.64]	[0.58]	[0.79]	[0.93]	[0.20]
β_{20}: *EIN * DECDUM * LN*($SALE_t/SALE_{t-1}$)	1.670***	1.006*	1.502**	− 0.880	1.955***	1.504**	1.931**	− 0.763
	[2.88]	[1.71]	[2.03]	[− 1.07]	[3.06]	[2.31]	[2.31]	[− 0.82]
β_{21}: *RET * DECDUM * LN*($SALE_t/SALE_{t-1}$)	0.470***	0.424***	0.499***	0.157	0.608***	0.562***	0.649***	0.364**
	[4.28]	[3.88]	[3.88]	[1.26]	[5.01]	[4.66]	[4.58]	[2.55]
β_{22}: *GDP * DECDUM * LN*($SALE_t/SALE_{t-1}$)	0.007**	0.007**	0.007**	0.008*	0.007**	0.007**	0.008**	0.006
	[2.51]	[2.25]	[2.36]	[1.83]	[2.39]	[2.22]	[2.44]	[1.36]

Table 3 (continued)

	OLS	OLS	OLS	OLS	FFE	FFE	FFE	FFE
	Baseline	SA	WW	BLM	Baseline	SA	WW	BLM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
β_{23}: *SUDEC*	− 0.014***	− 0.015***	− 0.013***	− 0.012***	− 0.013***	− 0.011***	− 0.011***	− 0.009***
	[− 10.80]	[− 11.07]	[− 9.24]	[− 6.47]	[− 8.73]	[− 7.42]	[− 7.13]	[− 4.59]
β_{24}: *AIN*	0.006***	0.006***	0.007***	0.006***	0.008***	0.006***	0.008***	0.015***
	[5.40]	[5.54]	[5.15]	[3.97]	[4.05]	[2.86]	[3.37]	[4.76]
β_{25}: *EIN*	0.019	− 0.030	− 0.067	− 0.113	0.840***	0.944***	0.805***	0.695***
	[0.41]	[− 0.62]	[− 1.03]	[− 1.38]	[7.19]	[7.88]	[5.35]	[3.03]
β_{26}: *RET*	− 0.442***	− 0.446***	− 0.411***	− 0.426***	− 0.424***	− 0.414***	− 0.396***	− 0.398***
	[− 30.40]	[− 30.90]	[− 24.80]	[− 20.78]	[− 26.68]	[− 26.32]	[− 21.95]	[− 17.67]
β_{27}: *GDP*	0.007***	0.005***	0.007***	− 0.007***	0.007***	0.030***	0.006***	− 0.001
	[6.80]	[5.09]	[5.83]	[− 3.35]	[5.30]	[16.10]	[4.06]	[− 0.43]
Constant	− 0.021***	− 0.024***	− 0.040***	0.022***	− 0.035***	− 0.051***	− 0.056***	− 0.007
	[− 4.51]	[− 5.02]	[− 6.46]	[2.65]	[− 6.96]	[− 9.88]	[− 6.79]	[− 0.83]
Industry	Yes	Yes	Yes	Yes	No	No	No	No
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm effect	No	No	No	No	Yes	Yes	Yes	Yes
Observations	124,737	124,737	101,031	56,380	124,737	124,737	101,031	56,380
Adj. R-squared	0.82	0.82	0.81	0.83	0.80	0.80	0.79	0.81

Table 3 (continued)

Dependent variable—LN(SG&A$_t$/SG&A$_{t-1}$)	Seasoned firms	1980s wave	1990s wave	2000s wave	Seasoned firms	1980s wave	1990s wave	2000s wave	Seasoned firms	1980s wave	1990s wave	2000s wave
	SA	SA	SA	SA	WW	WW	WW	WW	BLM	BLM	BLM	BLM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel C: Financial constraints and cost asymmetry by listing cohort [c]												
β_1: *LN(SALE$_t$/SALE$_{t-1}$)*	0.847***	0.918***	0.858***	0.591***	1.016***	1.077***	1.010***	0.635***	0.604***	0.706***	0.728***	0.739***
	[28.48]	[23.48]	[25.19]	[9.19]	[22.08]	[18.56]	[18.15]	[7.56]	[10.10]	[10.49]	[20.20]	[12.05]
β_2: *DECDUM*	0.000	0.010	− 0.049***	− 0.061***	0.003	0.003	− 0.086***	− 0.068**	− 0.023*	− 0.018	− 0.003	− 0.031
	[0.06]	[0.81]	[− 4.12]	[− 2.65]	[0.30]	[0.15]	[− 4.36]	[− 2.09]	[− 1.78]	[− 1.00]	[− 0.20]	[− 1.25]
β_3: *DECDUM **	− 0.260***	− 0.392***	− 0.527***	− 0.458***	− 0.380***	− 0.493***	− 0.700***	− 0.664***	− 0.144*	− 0.281***	− 0.349***	− 0.565***
LN(SALE$_t$/SALE$_{t-1}$)	[− 6.30]	[− 6.71]	[− 9.40]	[− 4.47]	[− 5.63]	[− 5.18]	[− 7.90]	[− 4.96]	[− 1.69]	[− 3.07]	[− 5.99]	[− 4.37]
B_4: *FC*	0.080***	0.065***	0.063***	0.057*	0.135***	0.127***	0.102***	0.123*	− 0.008	0.013	0.013	0.004
	[8.62]	[4.95]	[3.62]	[1.71]	[5.66]	[3.87]	[2.78]	[1.81]	[− 0.89]	[0.86]	[1.41]	[0.21]
β_5: *FC **	− 0.394***	− 0.391***	− 0.369***	0.204	− 1.127***	− 1.074***	− 1.001***	− 0.085	0.042	− 0.077	− 0.092**	− 0.088
LN(SALE$_t$/SALE$_{t-1}$)	[− 6.94]	[− 6.06]	[− 4.87]	[1.33]	[− 7.40]	[− 6.58]	[− 5.90]	[− 0.28]	[0.64]	[− 0.95]	[− 2.35]	[− 0.82]
β_6: *FC * DECDUM*	0.007	− 0.024	0.071**	0.047	− 0.025	− 0.025	0.184***	0.120	0.010	− 0.020	− 0.042**	0.008
	[0.48]	[− 1.10]	[2.44]	[0.83]	[− 0.67]	[− 0.41]	[3.06]	[1.06]	[0.62]	[− 0.84]	[− 2.36]	[0.19]
β_7: FC * DECDUM *	0.395***	0.249***	0.569***	0.036	0.941***	0.746***	1.236***	0.891*	0.096	0.097	0.131	0.245
LN(SALE$_t$/SALE$_{t-1}$)	[4.95]	[2.64]	[4.72]	[0.15]	[4.63]	[2.79]	[4.71]	[1.94]	[0.88]	[0.68]	[1.50]	[1.21]

Table 3 (continued)

Dependent variable—LN($SG\&A_t$/$SG\&A_{t-1}$)	Seasoned firms	1980s wave	1990s wave	2000s wave	Seasoned firms	1980s wave	1990s wave	2000s wave	Seasoned firms	1980s wave	1990s wave	2000s wave
	SA	SA	SA	SA	WW	WW	WW	WW	BLM	BLM	BLM	BLM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
ECONVAR * *LN*($SALE_t$/$SALE_{t-1}$)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ECONVAR * *DECDUM*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ECONVAR * *DECDUM** *LN*($SALE_t$/$SALE_{t-1}$)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ECONVAR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.003	− 0.048***	− 0.047***	− 0.021	− 0.008	− 0.063***	− 0.051***	− 0.026	0.009	− 0.016	− 0.035***	− 0.012
	[0.53]	[− 4.50]	[− 4.99]	[− 1.37]	[− 0.97]	[− 4.39]	[− 3.83]	[− 1.29]	[0.80]	[− 1.02]	[− 3.43]	[− 0.69]
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	No	No	No	No	No	No	No	No	No	No	No	No
Observations	51,714	28,054	31,944	13,127	46,659	22,497	22,940	8935	13,941	10,962	23,102	8375
Adj. R-squared	0.52	0.50	0.57	0.44	0.51	0.51	0.54	0.40	0.52	0.50	0.58	0.47

[a]This table reports the OLS and FFE regression results of the relationship between financial constraints and cost asymmetry using the SG&A cost variable. Robust t-statistics are in brackets. ***$p<0.01$; **$p<0.05$; *$p<0.10$. Refer to "Appendix" for variable definitions

[b]This table reports the OLS and FFE regression results of the relationship between financial constraints and cost asymmetry using the OC variable. Robust t-statistics are in brackets. ***$p<0.01$; **$p<0.05$; *$p<0.10$. Refer to "Appendix" for variable definitions

[c]This table reports the OLS regression results of the relationship between financial constraints and cost asymmetry using the SG&A cost variable for each listing cohort. Firms listed prior to 1980 are considered as "seasoned firms", and others are classified as "new firms", with three listing waves for each decade, i.e., 1980s wave, 1990s wave and 2000s wave (the 2000s cohort ends in year 2016). Robust t-statistics are in brackets and are based on robust standard errors. ***$p<0.01$; **$p<0.05$; *$p<0.10$. Refer to "Appendix" for variable definitions

firm's future performance to attract investors (Bergman and Roychowdhury 2008; Rogers and Stocken 2005). Such managerial tone is not captured in financial statement-based measures of financial constraint.

4.2 Financial constraints and asymmetric cost behavior

Table 3, Panels A and Panel B report both OLS and firm fixed effect (FFE) (to control for any time-invariant omitted firm characteristics) results for the association between financial constraints and cost asymmetry using Eq. (3) for *SG&A* and *OC*, respectively. To control for unobservable industry and year characteristics associated with financial constraints and cost stickiness, we include year and industry dummy variables in all our regression specifications. Throughout this paper, all reported t-statistics are computed using heteroscedasticity-robust standard errors clustered by firm. Columns (1) and (5) of both Panel A and B report the regression results without financial constraint proxies. Panel A, column (1), reports the coefficient on β_1 ($LN\left[\frac{SALE_t}{SALE_{t-1}}\right]$) as positive and significant (coefficient = 0.739; $p<0.01$), implying that SG&A expenses increase by 0.74% for a 1% increase in sales. The coefficient on β_3 is significantly negative (coefficient = − 0.297; $p<0.01$). The sum of β_1 and β_3 is 0.442, which implies that SG&A expenses decrease by 0.44% for a 1% decrease in sales confirming, thereby, asymmetric cost behavior in our sample.

Columns (2) to (4) of Panel A report regression results for the OLS model after incorporating financial constraints and all the economic variables to test for H1. Our variable of interest is β_7 ($FC * DECDUM * LN\left[\frac{SALE_t}{SALE_{t-1}}\right]$). For H1 to hold, β_7 has to be significant and positive. The coefficient on β_7 is positive and significant for the *SA*-based FC proxy (coefficient = 0.277; t statistic = 5.44; $p<0.01$) (column 2). This supports H1, i.e., financial constraints lead to lower SG&A cost asymmetry. *WW* and *BLM* models produce consistent results as reported in columns (3) and (4) respectively. Using the FFE specification, we find a positive and significant coefficient on β_7 for *SA* (column 6) (coefficient = 0.170, t statistic = 2.82, $p<0.01$). *WW* and *BLM* also show positive and significant coefficients for β_7.

The coefficients on the $ECONVAR*DECDUM*LN(SALE_t/SALE_{t-1})$ are largely consistent with the prior literature. The coefficient on *SUDEC* (β_{18}), our proxy for managerial expectations, is positive and significant, indicating that successive decreases in sales reduce cost asymmetry. However, the coefficient on *GDP* (β_{22}), another proxy for managerial expectations, is insignificant, which is consistent with Holzhacker et al. (2015), Prabowo et al. (2018) and Kim et al. (2019). The coefficient on *EIN* (β_{20}), a proxy for resource adjustment costs, is significantly negative. However, that on *AIN* (β_{19}) is significantly positive. The coefficients on *RET* (β_{21}) are positive and significant, implying that the degree of SG&A cost asymmetry is lower for firms with strong stock performance.

Panel B reports both the OLS and FFE results for the association between financial constraints and operating cost asymmetry using Eq. (3). The coefficient on β_1 is positive and significant (coefficient = 0.969; $p < 0.01$), implying that operating costs increase by 0.97% for a 1% increase in sales (column 1). The coefficient on β_3 is significantly negative (coefficient = −0.178; $p < 0.01$). The sum of β_1 and β_3 is 0.79, implying that operating costs decrease by 0.79% for a 1% decrease in sales and confirming, thereby, asymmetric operating cost behavior in our sample as well.

Columns (2) to (4) report regression results for the OLS model after incorporating financial constraints and all the economic variables to test for H1. The coefficient on β_7 is positive and significant for *SA* (coefficient = 0.145; t statistic = 3.92; $p < 0.01$), thus, supporting lower operating cost asymmetry for financially constrained firms. However, the *WW* and *BLM* models produce insignificant coefficients as reported in columns (3) and (4) respectively. Using the FFE specification, we find insignificant coefficients for β_7, for all the three FC proxies except for *SA*.

Operating costs include both SG&A and COGS. COGS comprises a significant portion of the operating costs that is more variable in nature than SG&A costs.[5] Untabulated results reveal that financially constrained firms exhibit *cost stickiness* for the COGS category (coefficient on $\beta_7 = -$ 0.330; t statistic = −4.12; $p < 0.01$). This stems from the fact that COGS depends on the volume of production, which responds directly to changes in sales volume. In addition, because of the accrual-based accounting system, firms can recognize only the portion of COGS related to the current period's sales, and defer that portion remaining to a future period, unlike SG&A expenses. Thereby, we conclude that (1) financial constraints do not affect all cost types in the same manner,[6] (2) managers will have to retain those resources, and will continue to incur costs related to their maximum acceptable level, and (3) the opposing effect of financial constraint on SG&A costs and COGS could be a plausible explanation for the documented insignificant results related to operating cost asymmetry. Operating costs also include components such as R&D and operating lease. According to Lin et al. (2013) constrained firms tend to rely on operating lease, rather than debt financing. Some components of operating cost move in opposite directions when faced with financial constraints, and this could explain the weaker results for the OC category.

For the remainder of our empirical tests, we focus on SG&A costs only, because (1) SG&A costs comprise a significant portion of total cost, (2) it is evident from prior studies that SG&A costs are associated with the creation of long-term

[5] Chen et al. (2019) document that firms adjust their COGS by 0.86%, but their SG&A expenses by 0.41% only, in response to a 1% decrease in sales revenue.

[6] A plausible explanation for our findings might be related to managers' engagement in cost classification shifting or the "SG&A shell game" (Hartlieb et al. 2020). There is no reason to believe that managers of financially constrained firms do not move cost from SG&A to COGS or vice versa (depending on the stipulations in debt contracts or discussions with lenders). Such potential 'classification shifting' could also explain the lack of results of overall operating costs.

economic benefits, e.g., product promotion, brand development, customer-relationship and distribution channel management (Banker et al. 2011, 2019; Chen et al. 2012; Huson et al. 2012), and (3) investors can earn excess returns in firms with high SG&A intangible asset value (Banker et al. 2019).

Panel C of Table 3 reports the association between financial constraints and SG&A cost asymmetry by listing cohorts. Loy and Hartlieb (2018) show that U.S. firms exhibited more cost stickiness with each additional listing cohort. We test whether the relationship between financial constraints and cost stickiness, discussed above, is affected by Loy and Hartlieb's (2018) findings. We follow the methodology of Loy and Hartlieb (2018) for our sample period from 1976 to 2016 and consider the first year in which a firm's data are available in Compustat as the listing year. Firms listed prior to 1980 are considered as "seasoned firms", and others are classified as "new firms", with three listing waves for each decade, i.e., 1980s wave, 1990s wave and 2000s wave (the 2000s cohort ends in year 2016). Results reported in Panel C support Loy and Hartlieb (2018), as the sum of the coefficients, β_1 and β_3, shows a trend of increasing cost stickiness with additional listing cohorts. However, the coefficient on β_7, our main variable of interest, reveals no discernible trend in response to changes in listing cohorts.

Although the reported results in Table 3 are statistically significant, we are unable to conclude whether they are economically meaningful as well. Hence, following Kama and Weiss (2013) and Hartlieb et al. (2020), we deploy a subsample analysis, whereby firms are classified as financially constrained (unconstrained) if the financial constraint proxies are above (below) median, respectively. We then rerun Eq. (1) for the two sub-groups. Results are reported in Panels A to C in Table 4 for the *SA*, *WW*, and *BLM* proxies, respectively. For the *SA*-based financial constraint proxy, we find that the coefficient of cost stickiness (β_2) is significantly positive (negative) for the financially constrained (unconstrained) subsample: a finding supporting that constrained (unconstrained) firms exhibit less (greater) cost asymmetry. The coefficient on β_2 for the unconstrained subsample is 0.234 greater (in absolute terms) than that of the constrained subsample (significant at $p<0.01$). This implies lower cost stickiness exhibited by financially constrained firms (column 2). Column (3) shows the extent of the slope for sales decreases ($\beta_1+\beta_2$) with changes in activity levels. The slope for sales decreases for the financially constrained sample (0.632) exceeds that for the financially unconstrained sample (0.483) (significant at $p<0.01$), suggesting that a one percent decrease in sales leads to 14.9 percentage points more reduction in SG&A costs by constrained firms compared with their unconstrained counterparts. Results are consistent for the other two financial constraint proxies (Panels B and C). Thus, based on the reported findings in Table 4, we conclude that the association between financial constraint and cost asymmetry is not only statistically significant, but also economically meaningful.

Table 4 Subsample analysis: impact of financial constraints on cost asymmetry

	(1) β_1	(2) β_2	(3) $\beta_1+\beta_2$
Panel A: SA as the financial constraint proxy			
Financially constrained [Obs. = 90,638; Adj. R^2 = 0.50]	0.589*** [80.06]	0.043*** [3.40]	0.632*** [84.80]
Financially unconstrained [Obs. = 91,587; Adj. R^2 = 0.49]	0.675*** [85.25]	− 0.192*** [− 12.33]	0.483*** [46.14]
Difference between the subsamples	− 0.086*** [63.02]	0.235*** [137.18]	0.149*** [135.41]
	(1) β_1	(2) β_2	(3) $\beta_1+\beta_2$
Panel B: WW as the financial constraint proxy			
Financially constrained [Obs. = 73,111; Adj. R^2 = 0.51]	0.518*** [61.99]	0.078*** [5.59]	0.596*** [73.40]
Financially unconstrained [Obs. = 73,850; Adj. R^2 = 0.55]	0.654*** [65.43]	− 0.188*** [− 9.77]	0.466*** [37.04]
Difference between the subsamples	− 0.136*** [108.87]	0.266*** [125.29]	0.130*** [75.11]
	(1) β_1	(2) β_2	(3) $\beta_1+\beta_2$
Panel C: BLM as the financial constraint proxy			
Financially constrained [Obs. = 34,278; Adj. R^2 = 0.50]	0.551*** [41.67]	0.100*** [4.56]	0.651*** [50.09]
Financially unconstrained [Obs. = 34,980; Adj. R^2 = 0.55]	0.663*** [49.50]	− 0.210*** [− 7.51]	0.453*** [23.02]
Difference between the Subsamples	− 0.112*** [35.53]	0.310*** [75.94]	0.198*** [70.32]

This table reports regression results using Eq. (1) for subsamples of firms categorized as financially constrained (above median) and financially unconstrained (below median) using the SG&A cost variable. *Z*-statistics are in brackets, clustered at firm-level. ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$

4.3 SG&A future value creation, financial constraint and asymmetric cost behavior

In order to test H2, we categorize the sample into high versus low future value-creating SG&A groups using the median partition, based on the industry-specific future value creation potential of SG&A costs. We have calculated industry-specific future value-creation potential for our sample duration by following the two-stage least squares (2SLS) regression model specified in Banker et al. (2011: 799). We present the results in Table 5. From columns (1) and (2) we document that the coefficients on β_7 are significant and positive for the *low* (coefficient = 0.217; $p < 0.05$) and insignificant for the *high* (coefficient = 0.134) future value-creating SG&A subsamples, for the *SA* measure. For the *WW* and *BLM* measures, we find the coefficients on β_7 positive and significant for both low and high value-creating groups. The absolute magnitude of the coefficient in the *low* group is higher, indicating that financially constrained firms decrease low value-creating SG&A expenses more than high value-creating SG&A expenses. However, the z-statistic for the difference in coefficients across the two groups is insignificant (untabulated). Therefore, the findings should be interpreted with caution.

Although prior research indicates that SG&A expenditure creates long-term asset value for the firm in the form of intangible assets through human capital, product promotion, brand development, customer-relationship, and distribution channel management (Banker et al. 2019), we find that financial constraint leads to reduction in both value destroying and value creating SG&A expenditure. This finding could be consistent with the fact that constrained firms are exposed to high opportunity costs associated with retaining unutilized resources. When firms suffer from financial constraints, they may have fewer options when deciding which kind of SG&A costs to retain and which to decrease, as their main objective becomes reducing the financial burden and surviving the constraint period, to bounce back later. In addition, firms with high levels of SG&A expenditure experience higher risk than firms with lower levels of SG&A expenditure, when the growth opportunities and future cash flows generated by such SG&A investments fail to materialize (Banker et al. 2019). Therefore, from a firm survival point of view, such behavior can be desirable. However, from an efficiency point of view, such low cost asymmetry could be value destroying in the long run. This finding also confirms empirically the theoretical conjecture by Caggese et al. (2019) and Musso and Schiavo (2008) that, to overcome financial constraint, a firm will eliminate long term investments, and this may have an adverse effect on its long-term growth prospects. In addition, from an 'option theory' perspective, managers of more constrained firms prefer to cut its slack resources, instead of waiting for the arrival of new information that might mitigate uncertainties pertaining to resource retention, by giving up their option to wait, because survival takes precedence over benefits associated with postponing downward resource adjustment for such firms.

4.4 Investment opportunities, financial constraint and asymmetric cost behavior

In order to test H3, we categorize the sample into high versus low investment opportunity groups using median investment opportunity values based on two investment opportunity measures, namely, (1) Kaplan and Zingales (1997) model (*INVEST*)[7] and (2) market value of assets to book value of assets ratio (*MBVA*). We present the results in Table 6 Panels A and B using *INVEST* and *MBVA* respectively. *INVEST* has been used by Linck et al. (2013). *MBVA* is a price-based measure of investment opportunity widely used in the literature (Gaver and Gaver 1995; Kallapur and Trombley 1999; Hutchinson and Gul 2004).

[7] We use $INV_{t+1} = \alpha_0 + \alpha_1\ CFO_t + \alpha_2\ Q_t + \alpha_3\ LEV_t + \alpha_4\ DIV_t + \alpha_5\ CASH_t + \alpha_6\ SG_t + \alpha^j\ IND_j$, to estimate a cross-sectional regression in each period and estimate investment opportunities (*INVEST*) as the predicted value of the regressions. Refer to the appendix for variable definitions.

Table 5 Financial constraints and cost asymmetry: SG&A future value creation context

Dependent variable—LN(SG&A$_t$/SG&A$_{t-1}$)	Low = 0 (< median) SA	High = 1 (=> median) SA	Low = 0 (< median) WW	High = 1 (=> median) WW	Low = 0 (< median) BLM	High = 1 (=> median) BLM
	(1)	(2)	(3)	(4)	(5)	(6)
β_1: *LN(SALE$_t$/SALE$_{t-1}$)*	0.816***	0.793***	0.996***	0.893***	0.669***	0.671***
	[27.86]	[29.23]	[23.29]	[19.32]	[19.16]	[17.30]
β_2: *DECDUM*	− 0.018**	− 0.009	− 0.024**	− 0.015	− 0.019	− 0.025**
	[− 2.42]	[− 1.20]	[− 2.13]	[− 1.07]	[− 1.61]	[− 2.25]
β_3: *DECDUM * LN(SALE$_t$/SALE$_{t-1}$)*	− 0.345***	− 0.294***	− 0.492***	− 0.374***	− 0.344***	− 0.303***
	[− 7.87]	[− 7.32]	[− 7.43]	[− 5.03]	[− 6.04]	[− 4.63]
B_4: *FC*	− 0.210***	− 0.237***	− 0.065	− 0.136***	0.021**	0.000
	[− 8.90]	[− 9.07]	[− 1.36]	[− 2.73]	[2.34]	[0.03]
β_5: *FC * LN(SALE$_t$/SALE$_{t-1}$)*	− 0.280***	− 0.318***	− 1.102***	− 0.810***	− 0.102**	− 0.065
	[− 5.17]	[− 5.63]	[− 8.03]	[− 5.26]	[− 2.27]	[− 1.28]
β_6: *FC * DECDUM*	0.036**	− 0.022	0.036	− 0.019	− 0.019	− 0.009
	[2.32]	[− 1.36]	[1.00]	[− 0.41]	[− 1.16]	[− 0.55]
β_7: FC * DECDUM * LN(SALE$_t$/SALE$_{t-1}$)	0.217**	0.134	0.832***	0.651***	0.187**	0.167*
	[2.52]	[1.59]	[4.20]	[2.78]	[1.98]	[1.81]
*ECONVAR * LN(SALE$_t$/SALE$_{t-1}$)*	Yes	Yes	Yes	Yes	Yes	Yes
*ECONVAR * DECDUM*	Yes	Yes	Yes	Yes	Yes	Yes
*ECONVAR * DECDUM* LN(SALE$_t$/SALE$_{t-1}$)*	Yes	Yes	Yes	Yes	Yes	Yes
ECONVAR	Yes	Yes	Yes	Yes	Yes	Yes
Constant	− 0.068***	− 0.050***	− 0.024	0.024	− 0.039**	− 0.055***
	[− 7.46]	[− 5.25]	[− 1.61]	[1.55]	[− 2.27]	[− 2.99]

Table 5 (continued)

Dependent variable—LN($SG\&A_t$/$SG\&A_{t-1}$)	Low = 0 (< median) SA (1)	High = 1 (=> median) SA (2)	Low = 0 (< median) WW (3)	High = 1 (=> median) WW (4)	Low = 0 (< median) BLM (5)	High = 1 (=> median) BLM (6)
Industry	No	No	No	No	No	No
Year	Yes	Yes	Yes	Yes	Yes	Yes
Firm effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	61,366	63,371	57,160	43,871	29,001	27,379
Adj. R-squared	0.50	0.48	0.49	0.46	0.53	0.46

This table reports the results from the FFE regressions of the relationship between financial constraints and cost asymmetry for high versus low value-creating SG&A groups. We have calculated industry-specific future value-creation potential for our sample duration by following the two-stage least squares (2SLS) regression model specified in Banker et al. (2011: 799). Robust t-statistics are in brackets and are based on robust standard errors. ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$. Refer to "Appendix" for variable definitions

Financially constrained firms faced with poor investment opportunities are likely to shed unutilized resources to maintain or improve profitability; thus, we expect β_7 for the *low* investment-opportunity group to have a significant and positive coefficient. Whereas, financially constrained firms with good investment opportunities are likely to retain slack resources owing to managerial optimism about future sales, and also because high upward resource adjustment costs would be incurred when redeploying such resources in the future. Therefore, we expect β_7 for the *high* investment-opportunity group to have a significant and negative coefficient.

Using *INVEST* as a proxy for investment opportunities in Panel A of Table 6, we document that the coefficient on β_7 is significant and positive for the low investment-opportunity group for *WW* (column 3) (coefficient = 1.02; $p < 0.01$) and *BLM* (column 5) (coefficient = 0.246; $p < 0.05$). The results are consistent when *MBVA* is used as a proxy for investment opportunities, as reported in Panel B for *SA* (Column 1) (coefficient = 0.171; $p < 0.05$), *WW* (column 3) (coefficient = 0.775; $p < 0.10$) and *BLM* (column 5) (coefficient = 0.318; $p < 0.01$), thus, our expectation is supported.

For the high investment-opportunities group we find some evidence that the coefficient on β_7 is significant but positive in Panel A (Column 4) (coefficient = 1.208; $p < 0.01$), and in Panel B (Column 4) (coefficient = 0.900; $p < 0.01$); contrary to our expectations. However, the evidence is not consistent across all the FC proxies, as some of the coefficients are insignificant in the high investment-opportunities group. Therefore, based on our results as tabulated in Table 6, we find some evidence that managers of financially constrained firms adjust SG&A expenses when future investment opportunities are poor, as retention of unused resources would create a greater financial burden for such firms. However, the z-statistic for the difference in coefficients on β_7 between the high versus low investment opportunity sub-samples is statistically significant only for the *MBVA* measure and the *BLM*–based financial constraint proxy (untabulated).

4.5 Earnings management, financial constraint and asymmetric cost behavior

To test H4, we split the sample observations into 'loss avoidance' (*AVOID*) and 'earnings decrease' (*EDEC*) groups. The *AVOID* group consists of firm-year observations with annual earnings deflated by market capitalization of shareholders' equity at prior year end, in the interval [0, 0.01] (both inclusive). The *EDEC* group consists of firm-year observations with changes in annual earnings deflated by market capitalization of shareholders' equity at prior year end in the interval [0, 0.01] (both inclusive) (Burgstahler and Dichev 1997; Kama and Weiss 2013). Panel A of Table 7 presents the results for the *AVOID* test. The coefficient on β_7 is positive and significant for the subsample *without* incentives to avoid losses (*AVOID* = 0) across all three measures of financial constraints (e.g., the coefficient is 0.165, $p < 0.01$ in column 1), and insignificant for the group *with* incentives to avoid losses (*AVOID* = 1).

Panel B of Table 7 reports the results for the *EDEC* test. The coefficient on β_7 is positive and significant for the subsample *without* incentives to avoid earnings decrease (*EDEC* = 0) for all measures of financial constraints (e.g., the coefficient

Table 6 Financial constraints and cost asymmetry: investment opportunities context

Dependent variable—LN(SG&A$_t$/SG&A$_{t-1}$)	Low = 0 (< median)	High = 1 (=> median)	Low = 0 (< median)	High = 1 (=> median)	Low = 0 (< median)	High = 1 (=> median)
	SA	SA	WW	WW	BLM	BLM
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: INVEST[a]						
β_1: *LN*(*SALE$_t$*/*SALE$_{t-1}$*)	0.561***	0.769***	0.897***	0.910***	0.613***	0.717***
	[9.08]	[23.86]	[9.18]	[20.35]	[8.27]	[22.24]
β_2: *DECDUM*	− 0.036***	− 0.043***	− 0.046***	− 0.090***	− 0.033***	− 0.020
	[− 4.24]	[− 2.90]	[− 3.45]	[− 4.13]	[− 3.10]	[− 1.16]
β_3: *DECDUM* * *LN*(*SALE$_t$*/*SALE$_{t-1}$*)	− 0.093	− 0.355***	− 0.362***	− 0.810***	− 0.232***	− 0.470***
	[− 1.37]	[− 3.78]	[− 3.42]	[− 6.05]	[− 2.77]	[− 4.41]
β_4: *FC*	− 0.343***	− 0.285***	− 0.269***	− 0.011	0.008	0.020*
	[− 8.45]	[− 7.61]	[− 4.52]	[− 0.16]	[0.77]	[1.77]
β_5: *FC* * *LN*(*SALE$_t$*/*SALE$_{t-1}$*)	− 0.217	− 0.236***	− 1.240***	− 0.854***	− 0.114	− 0.101**
	[− 1.42]	[− 3.78]	[− 3.81]	[− 6.18]	[− 1.19]	[− 2.40]
β_6: *FC* * *DECDUM*	0.035*	0.076**	0.073*	0.189***	0.001	− 0.025
	[1.76]	[2.48]	[1.71]	[2.83]	[0.08]	[− 0.97]
β_7: FC * DECDUM * LN(SALE$_t$/SALE$_{t-1}$)	0.175	− 0.072	1.020***	1.208***	0.246**	0.187
	[1.04]	[− 0.39]	[2.91]	[3.01]	[2.13]	[1.06]
ECONVAR * *LN*(*SALE$_t$*/*SALE$_{t-1}$*)	Yes	Yes	Yes	Yes	Yes	Yes
ECONVAR * *DECDUM*	Yes	Yes	Yes	Yes	Yes	Yes
ECONVAR * *DECDUM** *LN*(*SALE$_t$*/*SALE$_{t-1}$*)	Yes	Yes	Yes	Yes	Yes	Yes
ECONVAR	Yes	Yes	Yes	Yes	Yes	Yes
Constant	− 0.006	− 0.130***	0.081***	− 0.068***	0.022	− 0.121***
	[− 0.39]	[− 7.26]	[3.92]	[− 2.74]	[1.22]	[− 5.32]
Industry	No	No	No	No	No	No
Year	Yes	Yes	Yes	Yes	Yes	Yes

Table 6 (continued)

Dependent variable—LN($SG\&A_t/SG\&A_{t-1}$)	Low = 0 (< median)	High = 1 (=> median)	Low = 0 (< median)	High = 1 (=> median)	Low = 0 (< median)	High = 1 (=> median)
	SA	SA	WW	WW	BLM	BLM
	(1)	(2)	(3)	(4)	(5)	(6)
Firm effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	37,808	36,206	34,905	33,979	27,250	25,916
Adj. R-squared	0.31	0.45	0.31	0.44	0.32	0.46

Dependent variable—LN($SG\&A_t/SG\&A_{t-1}$)	Low = 0 (< median)	High = 1 (=> median)	Low = 0 (< median)	High = 1 (=> median)	Low = 0 (< median)	High = 1 (=> median)
	SA	SA	WW	WW	BLM	BLM
	(1)	(2)	(3)	(4)	(5)	(6)
Panel B: MBVA[b]						
β_1: $LN(SALE_t/SALE_{t-1})$	0.824***	0.730***	1.054***	0.844***	0.662***	0.686***
	[33.42]	[22.42]	[25.90]	[17.43]	[13.50]	[20.34]
β_2: *DECDUM*	− 0.022***	− 0.012*	− 0.035***	− 0.023*	− 0.021*	− 0.033**
	[− 2.83]	[− 1.67]	[− 2.74]	[− 1.84]	[− 1.80]	[− 2.33]
β_3: $DECDUM * LN(SALE_t/SALE_{t-1})$	− 0.351***	− 0.246***	− 0.481***	− 0.394***	− 0.313***	− 0.414***
	[− 8.21]	[− 5.39]	[− 6.57]	[− 5.43]	[− 4.95]	[− 4.88]
β_4: *FC*	− 0.222***	− 0.305***	0.102**	− 0.317***	0.018*	0.010
	[− 8.96]	[− 10.38]	[2.15]	[− 6.22]	[1.68]	[1.08]
β_5: $FC * LN(SALE_t/SALE_{t-1})$	− 0.305***	− 0.299***	− 1.187***	− 1.002***	− 0.148**	− 0.064
	[− 6.03]	[− 4.39]	[− 9.16]	[− 6.32]	[− 2.27]	[− 1.49]
β_6: $FC * DECDUM$	0.024	− 0.007	0.048	− 0.001	− 0.014	− 0.021
	[1.57]	[− 0.39]	[1.27]	[− 0.03]	[− 0.86]	[− 1.08]

Table 6 (continued)

Dependent variable—LN(SG&A$_t$/SG&A$_{t-1}$)	Low = 0 (< median)	High = 1 (=> median)	Low = 0 (< median)	High = 1 (=> median)	Low = 0 (< median)	High = 1 (=> median)
	SA	SA	WW	WW	BLM	BLM
	(1)	(2)	(3)	(4)	(5)	(6)
β_7: FC * DECDUM * LN(SALE$_t$/SALE$_{t-1}$)	0.171**	0.169*	0.775***	0.900***	0.318***	− 0.007
	[2.12]	[1.69]	[3.87]	[3.77]	[3.50]	[− 0.05]
*ECONVAR * LN(SALE$_t$/SALE$_{t-1}$)*	Yes	Yes	Yes	Yes	Yes	Yes
*ECONVAR * DECDUM*	Yes	Yes	Yes	Yes	Yes	Yes
*ECONVAR * DECDUM* LN(SALE$_t$/SALE$_{t-1}$)*	Yes	Yes	Yes	Yes	Yes	Yes
ECONVAR	Yes	Yes	Yes	Yes	Yes	Yes
Constant	− 0.067***	− 0.059***	− 0.051***	0.044**	− 0.043*	− 0.078***
	[− 7.99]	[− 4.96]	[− 3.48]	[2.54]	[− 1.91]	[− 4.65]
Industry	No	No	No	No	No	No
Year	Yes	Yes	Yes	Yes	Yes	Yes
Firm effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	62,753	60,879	51,420	48,689	27,190	29,102
Adj. R-squared	0.56	0.40	0.55	0.39	0.45	0.50

[a]This table reports the results from the FFE regressions of the relationship between financial constraints and cost asymmetry for high versus low investment opportunity groups. We use $INV_{t+1} = \alpha_0 + \alpha_1\ CFO_t + \alpha_2\ Q_t + \alpha_3\ LEV_t + \alpha_4\ DIV_t + \alpha_5\ CASH_t + \alpha_6\ SG_t + \alpha^j\ IND_j$, to estimate a cross-sectional regression in each period and estimate investment opportunities (*INVEST*) as the predicted value of the regressions. Refer to the "Appendix" for variable definitions. Robust t-statistics are in brackets and are based on robust standard errors. ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$. Refer to "Appendix" for variable definitions

[b]This table reports the results from the FFE regressions of the relationship between financial constraints and cost asymmetry for high versus low investment opportunity groups. MBVA is the difference between total assets (Compustat data item AT) and total common equity (Compustat data item CEQ) plus market value of equity (Compustat data item CSHO × Compustat data item PRCC_F) divided by total assets (Compustat data item AT). Robust t-statistics are in brackets and are based on robust standard errors. ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$. Refer to "Appendix" for variable definitions

is 0.172, $p < 0.01$ in column 1), and insignificant for the group *with* incentives to avoid earnings decrease ($EDEC = 1$). Taken together, the results suggest that financially constrained firms without incentives for earnings management shed unutilized resources in response to sales decline and, thereby, exhibit less cost asymmetry. This finding supports the survival argument, as opposed to the agency argument. Although this finding is consistent with H4, the findings need to be evaluated cautiously owing to lack of statistically significant difference in coefficients between the sub-samples (untabulated).

4.6 Additional test: prior-period sales change, financial constraint and asymmetric cost behavior

Banker et al. (2014) show that cost stickiness and anti-stickiness is conditional on prior period sales increase and decrease, respectively, owing to the presence of upward and downward resource adjustment costs. Because managers are optimistic about future demand following a prior period sales increase ($sales_{t-1} > sales_{t-2}$), they will be keen on retaining slack resources, resulting in "*cost stickiness*" at period t, and this relation becomes more pronounced in the presence of additional signals of future demand expansion (e.g., GDP growth). On the contrary, managers become pessimistic about future demand following a prior period sales decrease ($sales_{t-1} < sales_{t-2}$), encouraging them to reduce slack resources, resulting in "*cost anti-stickiness*" at period *t*; however, this relation is weakened when there is a signal that indicates future demand expansion (i.e. GDP growth).

Managerial optimism and pessimism are observed through managers' expectations about future sales based on prior period sales patterns (Banker et al. 2014). If managers are optimistic owing to prior sales increases, they are likely to retain slack resources even if sales decrease in the current period, in order to avoid current period adjustment costs (i.e. severance payments), and to reduce future period adjustment costs (i.e. hiring costs) (Banker et al. 2014). As discussed earlier financially constrained firms face high upward resource adjustment costs and, hence, are inhibited from procuring critical resources when demand increases after a slump. This suggest that optimistic managers, although resource-constrained, might retain slack resources. Whereas, if managers are pessimistic then a prior period sales decrease will lead to slashing current period resources. Thus, we incorporate the effect of prior period sales increase and decrease to rule out the possibility that financial constraint is a merely a signal of managerial pessimism. We use the following model from Banker et al. (2014)[8]

[8] We used model C of Banker et al. (2014); thus, excluded *RET* in this model.

Table 7 Financial constraints and cost asymmetry: earnings management context

Dependent variable—LN($SG\&A_t/SG\&A_{t-1}$)	AVOID = 0	AVOID = 1	AVOID = 0	AVOID = 1	AVOID = 0	AVOID = 1
	SA	SA	WW	WW	BLM	BLM
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Incentive to avoid loss[a]						
β_1: *LN*($SALE_t/SALE_{t-1}$)	0.800***	0.977***	0.943***	0.782*	0.675***	1.177***
	[39.32]	[5.60]	[29.99]	[1.85]	[24.46]	[6.75]
β_2: *DECDUM*	− 0.014***	− 0.011	− 0.024***	− 0.214**	− 0.021**	0.017
	[− 2.64]	[− 0.19]	[− 2.65]	[− 2.25]	[− 2.52]	[0.26]
B_3: *DECDUM* * *LN*($SALE_t/SALE_{t-1}$)	− 0.318***	− 0.253	− 0.429***	0.087	− 0.325***	− 0.739**
	[− 10.35]	[− 0.87]	[− 8.52]	[0.14]	[− 7.22]	[− 1.99]
β_4: *FC*	− 0.223***	− 0.071	− 0.114***	− 0.533	0.010	0.153**
	[− 12.55]	[− 0.43]	[− 3.28]	[− 1.28]	[1.48]	[2.32]
β_5: *FC* * *LN*($SALE_t/SALE_{t-1}$)	− 0.286***	− 0.970***	− 0.936***	− 0.889	− 0.081**	− 0.644**
	[− 7.06]	[− 2.91]	[− 9.28]	[− 0.78]	[− 2.33]	[− 2.05]
β_6: *FC* * *DECDUM*	0.009	0.082	0.025	0.675**	− 0.012	− 0.033
	[0.72]	[0.72]	[0.86]	[2.50]	[− 1.03]	[− 0.32]
β_7: *FC* * *DECDUM* * *LN*($SALE_t/SALE_{t-1}$)	0.165***	0.628	0.685***	− 0.519	0.170**	0.972
	[2.70]	[1.02]	[4.55]	[− 0.29]	[2.52]	[1.31]
ECONVAR * *LN*($SALE_t/SALE_{t-1}$)	Yes	Yes	Yes	Yes	Yes	Yes
ECONVAR * *DECDUM*	Yes	Yes	Yes	Yes	Yes	Yes
ECONVAR * *DECDUM* **LN*($SALE_t/SALE_{t-1}$)	Yes	Yes	Yes	Yes	Yes	Yes
ECONVAR	Yes	Yes	Yes	Yes	Yes	Yes
Constant	− 0.057***	− 0.075	0.003	0.086	− 0.045***	1.199
	[− 8.51]	[− 0.88]	[0.28]	[0.57]	[− 3.45]	[1.00]
Industry	No	No	No	No	No	No
Year	Yes	Yes	Yes	Yes	Yes	Yes

Table 7 (continued)

Dependent variable—LN($SG\&A_t/SG\&A_{t-1}$)	AVOID=0	AVOID=1	AVOID=0	AVOID=1	AVOID=0	AVOID=1
	SA	SA	WW	WW	BLM	BLM
	(1)	(2)	(3)	(4)	(5)	(6)
Firm effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	120,924	3915	98,095	2936	54,563	1817
Adj. R-squared	0.49	0.48	0.48	0.44	0.49	0.65
Dependent variable—LN($SG\&A_t/SG\&A_{t-1}$)	EDEC=0	EDEC=1	EDEC=0	EDEC=1	EDEC=0	EDEC=1
	SA	SA	WW	WW	BLM	BLM
	(1)	(2)	(3)	(4)	(5)	(6)
Panel B: Incentive to avoid earnings decrease[b]						
β_1: *LN*($SALE_t/SALE_{t-1}$)	0.797***	0.948***	0.970***	1.033***	0.662***	0.969***
	[37.29]	[16.31]	[33.55]	[12.97]	[23.02]	[12.89]
β_2: *DECDUM*	− 0.013**	− 0.030**	− 0.022**	− 0.035*	− 0.021**	− 0.012
	[− 2.22]	[− 2.03]	[− 2.47]	[− 1.80]	[− 2.35]	[− 0.46]
β_3: *DECDUM* **LN*($SALE_t/SALE_{t-1}$)	− 0.314***	− 0.629***	− 0.470***	− 0.869***	− 0.310***	− 0.614**
	[− 10.06]	[− 3.96]	[− 10.25]	[− 4.95]	[− 6.76]	[− 2.10]
β_4: *FC*	− 0.241***	− 0.047	0.111***	0.127***	0.008	0.017
	[− 12.85]	[− 0.94]	[6.48]	[3.60]	[1.09]	[1.19]
β_5: *FC* * *LN*($SALE_t/SALE_{t-1}$)	− 0.286***	− 0.332**	− 0.913***	− 0.861***	− 0.071**	− 0.100
	[− 6.84]	[− 2.29]	[− 9.99]	[− 3.20]	[− 1.98]	[− 0.96]
β_6: *FC* * *DECDUM*	0.011	− 0.056	0.024	− 0.043	− 0.011	− 0.038
	[0.89]	[− 1.42]	[0.86]	[− 0.61]	[− 0.91]	[− 0.89]
$\boldsymbol{\beta_7}$: ***FC* * *DECDUM* **LN*($SALE_t/SALE_{t-1}$)**	0.172***	− 0.214	0.792***	0.935	0.157**	0.078
	[2.77]	[− 0.51]	[5.90]	[1.60]	[2.31]	[0.18]

Table 7 (continued)

Dependent variable—LN($SG\&A_t/SG\&A_{t-1}$)	EDEC = 0 SA (1)	EDEC = 1 SA (2)	EDEC = 0 WW (3)	EDEC = 1 WW (4)	EDEC = 0 BLM (5)	EDEC = 1 BLM (6)
ECONVAR * *LN*($SALE_t/SALE_{t-1}$)	Yes	Yes	Yes	Yes	Yes	Yes
ECONVAR * *DECDUM*	Yes	Yes	Yes	Yes	Yes	Yes
ECONVAR * *DECDUM* **LN*($SALE_t/SALE_{t-1}$)	Yes	Yes	Yes	Yes	Yes	Yes
ECONVAR	Yes	Yes	Yes	Yes	Yes	Yes
Constant	− 0.055***	− 0.040***	− 0.011	− 0.080***	− 0.054***	0.054
	[− 7.32]	[− 2.99]	[− 1.20]	[− 4.60]	[− 3.78]	[0.38]
Industry	No	No	No	No	No	No
Year	Yes	Yes	Yes	Yes	Yes	Yes
Firm effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	111,251	13,588	90,256	10,775	49,933	6447
Adj. R-squared	0.49	0.54	0.51	0.55	0.49	0.56

[a]This table reports the results from the FFE regressions of the relationship between financial constraints and cost asymmetry for firms without and with earnings management incentives. The *AVOID* group consists of firm-year observations with annual earnings deflated by market capitalization of shareholders' equity at prior year end, in the interval [0, 0.01] (both inclusive). Robust t-statistics are in brackets and are based on robust standard errors. ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$. Refer to "Appendix" for variable definitions

[b]This table reports the results from the FFE regressions of the relationship between financial constraints and cost asymmetry for firms without and with earnings management incentives. The *EDEC* group consists of firm-year observations with changes in annual earnings deflated by market capitalization of shareholders' equity at prior year end in the interval [0, 0.01] (both inclusive). Table reports the results from the fixed effect regressions. Robust t-statistics are in brackets and are based on robust standard errors. ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$. Refer to "Appendix" for variable definitions

$$
\begin{aligned}
LN(SG\&A_t/SG\&A_{t-1}) &= \beta_0 + \beta_1^{PIncr} I_{t-1} * LN(SALE_t/SALE_{t-1}) + \beta_2^{PIncr} I_{t-1} * DECDUM * LN(SALE_t/SALE_{t-1}) \\
&+ \beta_3^{PIncr} I_{t-1} * LN(SALE_t/SALE_{t-1}) * FC + \beta_4^{PIncr} I_{t-1} * DECDUM * LN(SALE_t/SALE_{t-1}) * FC \\
&+ \beta_5^{PIncr} I_{t-1} * LN(SALE_t/SALE_{t-1}) * GDP + \beta_6^{PIncr} I_{t-1} * DECDUM * LN(SALE_t/SALE_{t-1}) * GDP \\
&+ \beta_7^{PDecr} D_{t-1} * LN(SALE_t/SALE_{t-1}) + \beta_8^{PDecr} D_{t-1} * DECDUM * LN(SALE_t/SALE_{t-1}) \\
&+ \beta_9^{PDecr} D_{t-1} * LN(SALE_t/SALE_{t-1}) * FC + \beta_{10}^{PDecr} D_{t-1} * DECDUM * LN(SALE_t/SALE_{t-1}) * FC \\
&+ \beta_{11}^{PDecr} D_{t-1} * LN(SALE_t/SALE_{t-1}) * GDP + \beta_{12}^{PDecr} D_{t-1} * DECDUM * LN(SALE_t/SALE_{t-1}) * GDP \\
&+ \beta_{13} LN(SALE_t/SALE_{t-1}) * AIN + \beta_{14} LN(SALE_t/SALE_{t-1}) * EIN + \varepsilon
\end{aligned} \tag{6}
$$

where $I_{t-1}(D_{t-1})$ is a dummy variable for prior period sales increase (decrease), equal to 1 if sales increased (decreased) in year $t-1$ relative to year $t-2$, and 0 otherwise, and all other variables are as defined in the prior section. Firm fixed effect results are tabulated in Table 8. Our variables of interest are β_4 and β_{10}. We find from column (1) that the coefficients on both β_4 (coefficient = 0.283; $p < 0.01$) and β_{10} (coefficient = 0.727; $p < 0.01$) are significant and positive, indicating that regardless of prior period sales increases or decreases, financially constrained firms reduce slack resources, thereby, generating lower cost asymmetry: a finding that confirms that financial constraint is not merely a proxy for managerial expectation. However, the coefficient on β_4 is greater than β_{10} in all the specifications, implying that managers become more aggressive in shedding unutilized resources as they become more pessimistic about future demand following a prior period sales decrease. This could be also the reason why financial constraint leads to shedding of future value generating SG&A costs. Maintaining resources at an acceptable level to save costs and to survive, becomes a priority for financially constrained firms. The coefficients on *GDP* (β_6 and β_{12}) are insignificant, implying that future demand expansion fails to affect managerial decision-making on the disposal of slack resources when faced with financial constraint.

4.7 Robustness test

In this section we perform additional analysis to check the robustness of our results to alternative measure of cost stickiness. Although the Anderson et al. (2003) model has been widely used in the cost stickiness literature, there are certain limitations associated with it. One such shortcoming relates to their assumption of a homogenous cost structure for all firms. Balakrishnan et al. (2014: 97) argue that "…empirical analysis must correct for the relation between firm size and the propensity for a sales decrease, unless the cost structure (variable cost ratio and the proportion of fixed costs to lagged sales) is the same for all firms in the sample. One way to avoid the non-constant cost response to activity changes is by scaling the dependent variable with lagged sales rather than with lagged total cost". As a robustness test, we use the asymmetric cost behavior model developed by Balakrishnan et al. (2014) and augment this with FC measures to investigate the cost behavior of financially constrained firms.

Table 8 Financial constraints and cost asymmetry: effect of prior-period sales changes

Dependent variable—LN(SG&A$_t$/SG&A$_{t-1}$)	SA (1)	WW (2)	BLM (3)
β_1^{PIncr}: I_{t-1}*$LN(SALE_t/SALE_{t-1})$	0.842***	0.929***	0.664***
	[55.07]	[39.49]	[31.05]
β_2^{PIncr}: I_{t-1}*$DECDUM$*$LN(SALE_t/SALE_{t-1})$	− 0.388***	− 0.366***	− 0.347***
	[− 15.30]	[− 8.41]	[− 8.86]
β_3^{PIncr}: I_{t-1}*$LN(SALE_t/SALE_{t-1})$*FC	− 0.426***	− 0.954***	− 0.021
	[− 14.69]	[− 12.76]	[− 0.84]
β_4^{PIncr}: I_{t-1}*$DECDUM$*$LN(SALE_t/SALE_{t-1})$*FC	0.283***	0.506***	0.062
	[5.26]	[3.71]	[0.90]
β_5^{PIncr}: I_{t-1}*$LN(SALE_t/SALE_{t-1})$*GDP	0.018***	0.017***	0.019***
	[6.94]	[6.08]	[4.03]
β_6^{PIncr}: I_{t-1}*$DECDUM$*$LN(SALE_t/SALE_{t-1})$*GDP	− 0.004	− 0.001	− 0.005
	[− 0.83]	[− 0.27]	[− 0.58]
β_7^{PDecr}: D_{t-1}*$LN(SALE_t/SALE_{t-1})$	0.720***	1.055***	0.450***
	[25.05]	[22.33]	[8.90]
β_8^{PDecr}: D_{t-1}*$DECDUM$ *$LN(SALE_t/SALE_{t-1})$	− 0.111***	− 0.361***	0.063
	[− 3.20]	[− 6.30]	[1.04]
β_9^{PDecr}: D_{t-1}*$LN(SALE_t/SALE_{t-1})$*FC	− 0.645***	− 2.095***	− 0.031
	[− 12.61]	[− 15.20]	[− 0.45]
β_{10}^{PDecr}: D_{t-1}*$DECDUM$*$LN(SALE_t/SALE_{t-1})$*FC	0.727***	1.991***	0.187**
	[11.30]	[12.04]	[2.13]
β_{11}^{PDecr}: D_{t-1}*LN(SALE$_t$/SALE$_{t-1}$)*GDP	0.008	0.006	0.010
	[1.43]	[0.97]	[0.94]
β_{12}^{PDecr}: D_{t-1}*$DECDUM$*$LN(SALE_t/SALE_{t-1})$*GDP	− 0.002	0.003	0.011
	[− 0.26]	[0.40]	[0.91]
β_{13}: $LN(SALE_t/SALE_{t-1})$*AIN	− 0.037***	− 0.045***	− 0.022***
	[− 13.94]	[− 14.96]	[− 4.86]
β_{14}: $LN(SALE_t/SALE_{t-1})$*EIN	4.219***	4.455***	4.284***
	[11.46]	[9.35]	[4.69]
Constant	0.057***	0.053***	0.020***
	[18.84]	[17.31]	[4.55]
Industry	No	No	No
Year	Yes	Yes	Yes
Firm effect	Yes	Yes	Yes
Observations	153,624	124,680	64,900
Adj. R-squared	0.45	0.44	0.46

This table reports the results from the FFE regressions of the relationship between financial constraints and cost asymmetry conditional on prior period sales changes (see Eq. 7 in text). The equation is based on Banker et al. (2014) Model C (p. 234). Robust t-statistics are in brackets and are based on robust standard errors. ***p < 0.01; **p < 0.05; *p < 0.10. Refer to "Appendix" for variable definitions

$$\frac{SG\&A_t - SG\&A_{t-1}}{SALE_{t-1}} = \beta_0 + \beta_1 \frac{SALE_t - SALE_{t-1}}{SALE_{t-1}} + \beta_2 DECDUM + \beta_3 DECDUM * \frac{SALE_t - SALE_{t-1}}{SALE_{t-1}} + \beta_4 FC + \beta_5 FC * \frac{SALE_t - SALE_{t-1}}{SALE_{t-1}} + \beta_6 FC * DECDUM + \beta_7 FC * DECDUM * \frac{SALE_t - SALE_{t-1}}{SALE_{t-1}} + \sum_{l=8}^{12} \beta_l ECONVAR_{l,t} * \frac{SALE_t - SALE_{t-1}}{SALE_{t-1}} + \sum_{m=13}^{17} \beta_m ECONVAR_{m,t} * DECDUM + \sum_{n=18}^{22} \beta_n ECONVAR_{n,t} * DECDUM * \frac{SALE_t - SALE_{t-1}}{SALE_{t-1}} + \sum_{o=23}^{27} \beta_o ECONVAR_{o,t} + \varepsilon \tag{7}$$

Panels A and B of Table 9 report the OLS and the FFE results for the association between financial constraints and cost asymmetry using Eq. (6) for *SG&A* and *OC*, respectively. Columns (1) and (6) of both the panels report the regression results without financial constraint proxies. Columns (2) to (5) report regression results for the OLS model after incorporating financial constraints and all the economic variables to test for H1. From column (2), the *SA* model shows that the coefficient on β_7 is positive and significant (coefficient = 0.039; t statistic = 1.85; $p < 0.10$). When *WW* and *BLM* are used, both the OLS and the FFE results show significant positive coefficients on β_7. This supports H1, i.e., financially constrained firms exhibit lower SG&A cost asymmetry. From panel B, however, we find significant and positive coefficients on β_7 only for *SA* (OLS coefficient = 0.238; $p < 0.01$, and FFE coefficient = 0.244; $p < 0.01$) and *WW* (OLS coefficient = 0.434; $p < 0.01$, and FFE coefficient = 0.673; $p < 0.01$), providing some weak evidence of asymmetric *OC* behavior by constrained firms.

5 Conclusion

Although traditional cost behavior identifies all costs as either fixed or variable, the relation between cost and cost driver is more complex (Noreen 1991). Some costs rise more when cost drivers increase, but do not decrease proportionately with a decrease in activity level. A significant number of academic research papers have documented evidence of cost stickiness in the U.S. and in international contexts. In this paper, we examine the association between financial constraint and cost behavior.

We argue that the managers of financially constrained firms have an incentive to reduce slack resources, as an attempt to survive the adversities of financial constraints. Our findings show that financial constraint leads to relatively low cost asymmetry. This prediction is in line with the "efficiency" view of cost asymmetry and implies that firms will decrease unused resources for the right reasons, i.e., for survival. However, such lower cost asymmetry is only evident for the SG&A cost category. Although resource adjustment theory predicts that firms may be better off retaining unutilized resources to avoid resource adjustment costs, our findings suggest that this may not necessarily be true for financially constrained firms. As survival becomes the financially constrained firms' primary goal, such firms even cut back on value-creating SG&A expenditures.

Table 9 Financial constraints and asymmetric cost behavior: OLS and fixed effect regression results for the Balakrishnan et al. (2014) model

	OLS Baseline (1)	OLS SA (2)	OLS WW (3)	OLS BLM (4)	FFE Baseline (5)	FFE SA (6)	FFE WW (7)	FFE BLM (8)
Panel A: Dependent Variable $\boldsymbol{SG\&A_t\text{-}SG\&A_{t-1}/SALE^{a}_{t-1}}$								
β_1: $SALE_t–SALE_{t-1}/SALE_{t-1}$	0.178***	0.131***	0.104***	0.185***	0.169***	0.127***	0.116***	0.166***
	[31.02]	[16.70]	[9.64]	[16.62]	[30.00]	[16.54]	[10.97]	[15.33]
β_2: *DECDUM*	− 0.009***	− 0.008***	− 0.005	− 0.008**	− 0.007***	− 0.007***	− 0.005	− 0.009***
	[− 5.62]	[− 4.08]	[− 1.52]	[− 2.52]	[− 4.27]	[− 3.37]	[− 1.50]	[− 2.73]
β_3: *DECDUM* *($SALE_t–SALE_{t-1}/SALE_{t-1}$)	− 0.066***	− 0.071***	− 0.112***	− 0.080***	− 0.079***	− 0.085***	− 0.152***	− 0.091***
	[− 7.79]	[− 6.75]	[− 7.12]	[− 4.81]	[− 8.32]	[− 7.11]	[− 8.35]	[− 4.88]
β_4: *FC*	–	0.032***	0.066***	0.008***	–	− 0.066***	− 0.012	0.009***
		[9.87]	[9.24]	[2.84]		[− 8.30]	[− 0.86]	[3.26]
β_5: *FC* * ($SALE_t–SALE_{t-1}/SALE_{t-1}$)	–	0.106***	0.170***	− 0.056***	–	0.106***	0.119***	− 0.050***
		[7.02]	[4.87]	[− 3.98]		[7.04]	[3.44]	[− 3.69]
β_6: *FC* * *DECDUM*	–	− 0.012***	− 0.026***	− 0.007	–	− 0.007	− 0.019*	− 0.003
		[− 2.72]	[− 2.58]	[− 1.61]		[− 1.50]	[− 1.74]	[− 0.66]
$\boldsymbol{\beta_7}$: ***FC* * *DECDUM*** *($\boldsymbol{SALE_t–SALE_{t-1}/SALE_{t-1}}$)	–	0.039*	0.170***	0.059**	–	0.007	0.234***	0.048*
		[1.85]	[3.48]	[2.40]		[0.29]	[4.06]	[1.78]
ECONVAR * ($SALE_t–SALE_{t-1}/SALE_{t-1}$)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ECONVAR * *DECDUM*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ECONVAR * *DECDUM** ($SALE_t–SALE_{t-1}/SALE_{t-1}$)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ECONVAR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	− 0.020***	− 0.019***	− 0.029***	− 0.039***	− 0.010***	− 0.014***	− 0.003	− 0.031***
	[− 7.20]	[− 6.65]	[− 8.77]	[− 7.00]	[− 3.74]	[− 5.44]	[− 0.77]	[− 6.32]
Industry	Yes	Yes	Yes	Yes	No	No	No	No
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 9 (continued)

	OLS	OLS	OLS	OLS	FFE	FFE	FFE	FFE
	Baseline	SA	WW	BLM	Baseline	SA	WW	BLM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Firm effect	No	No	No	No	Yes	Yes	Yes	Yes
Observations	124,839	124,839	101,031	56,380	124,839	124,839	101,031	56,380
Adj. R-squared	0.48	0.48	0.46	0.49	0.46	0.46	0.44	0.46

	OLS	OLS	OLS	OLS	FFE	FFE	FFE	FFE
	Baseline	SA	WW	BLM	Baseline	SA	WW	BLM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel B: Dependent Variable $OC_t–OC_{t-1}/SALE^b_{t-1}$								
β_1: $SALE_t–SALE_{t-1}/SALE_{t-1}$	0.893***	0.895***	0.974***	0.868***	0.895***	0.903***	1.020***	0.874***
	[100.27]	[66.35]	[47.96]	[51.53]	[92.96]	[62.01]	[47.63]	[46.09]
β_2: DECDUM	− 0.017***	− 0.032***	− 0.032***	− 0.013**	− 0.020***	− 0.034***	− 0.035***	− 0.019***
	[− 4.48]	[− 6.44]	[− 3.85]	[− 1.98]	[− 4.77]	[− 6.29]	[− 3.95]	[− 2.66]
β_3: DECDUM * ($SALE_t–SALE_{t-1}/SALE_{t-1}$)	− 0.108***	− 0.178***	− 0.210***	− 0.055	− 0.128***	− 0.210***	− 0.309***	− 0.093**
	[− 5.96]	[− 6.53]	[− 4.41]	[− 1.61]	[− 6.50]	[− 7.22]	[− 6.16]	[− 2.41]
β_4: FC	–	0.019***	0.123***	0.009*	–	− 0.187***	0.175***	0.002
		[3.72]	[9.60]	[1.90]		[− 13.41]	[5.23]	[0.38]
β_5: FC * ($SALE_t–SALE_{t-1}/SALE_{t-1}$)	–	− 0.008	− 0.287***	− 0.006	–	− 0.024	− 0.427***	− 0.005
		[− 0.33]	[− 4.83]	[− 0.24]		[− 0.91]	[− 6.93]	[− 0.19]
β_6: FC * DECDUM	–	0.052***	0.045*	− 0.011	–	0.054***	0.047*	− 0.007
		[5.74]	[1.91]	[− 1.27]		[5.51]	[1.88]	[− 0.70]
β_7: ***FC * DECDUM*** *($SALE_t–SALE_{t-1}/SALE_{t-1}$)	–	0.238***	0.434***	0.016	–	0.244***	0.673***	0.025
		[4.36]	[3.05]	[0.27]		[4.04]	[4.44]	[0.39]

Table 9 (continued)

	OLS	OLS	OLS	OLS	FFE	FFE	FFE	FFE
	Baseline	SA	WW	BLM	Baseline	SA	WW	BLM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ECONVAR * ($SALE_t$–$SALE_{t-1}$/$SALE_{t-1}$)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ECONVAR * DECDUM	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ECONVAR * DECDUM * ($SALE_t$–$SALE_{t-1}$/$SALE_{t-1}$)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ECONVAR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	− 0.016***	− 0.015**	− 0.049***	0.021*	− 0.026***	− 0.043***	− 0.070***	− 0.001
	[− 2.77]	[− 2.53]	[− 6.40]	[1.82]	[− 4.28]	[− 7.06]	[− 6.51]	[− 0.09]
Industry	Yes	Yes	Yes	Yes	No	No	No	No
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm effect	No	No	No	No	Yes	Yes	Yes	Yes
Observations	124,737	124,737	101,031	56,380	124,737	124,737	101,031	56,380
Adj. R-squared	0.82	0.82	0.80	0.83	0.80	0.81	0.78	0.80

[a]This table reports the OLS and FFE regression results of the relationship between financial constraints and cost asymmetry following the Balakrishnan et al. (2014) model (see Eq. 6 in text) and using the SG&A cost variable. Robust t-statistics are in brackets. ***$p<0.01$; **$p<0.05$; *$p<0.10$. Refer to "Appendix" for variable definitions

[b]This table reports the OLS and FFE regression results of the relationship between financial constraints and cost asymmetry following the Balakrishnan et al. (2014) model (see Eq. 6 in text) and using the OC variable. Robust t-statistics are in brackets. ***$p<0.01$; **$p<0.05$; *$p<0.10$. Refer to "Appendix" for variable definitions

Our study contributes to the asymmetric cost behavior literature by documenting the cost management behavior of financially constrained firms. As resources drive the cost of a business, and financial constraints affect resource availability, our study also enriches the financing constraints literature. A shortcoming of our research relates to the timing of when firms become financially constrained. It might be construed that firms with resources to shed when facing sales declines, would not have been constrained in the prior period. Severely constrained firms, on the other hand, may not even have had the resources in the first place and, therefore, would not exhibit a decrease in costs. This suggests a nonlinear effect of financial constraints, which might be addressed in future research.

Appendix

Variables	Definition
Cost asymmetry variables	
$LN(SG\&A_t/SG\&A_{t-1})$	Natural log of change in selling, general and administrative expenses (Compustat data item XSGA)
$LN(OC_t/OC_{t-1})$	Natural log of change in operating costs (Compustat data item SALE minus OIADP)
$LN(SALE_t/SALE_{t-1})$	Natural log of change in sales or revenue (Compustat data item SALE)
$(SG\&A_t\text{-}SG\&A_{t-1})/SALE_{t-1}$	Change in selling, general and administrative expenses (Compustat data item XSGA) by sales (Compustat data item SALE)
$(OC_t–OC_{t-1})/SALE_{t-1}$	Change in operating costs (Compustat data item SALE minus OIADP) by sales (Compustat data item SALE)
$(SALE_t–SALE_{t-1})/SALE_{t-1}$	Change in sales (Compustat data item SALE)
DECDUM	A dummy variable which takes the value of one when sales in year t are less than those in year t – 1 and zero otherwise
SUDEC	Successive decrease is a dummy variable which is an indicator variable that is equal to 1 if revenue in year t – 1 is less than revenue in t – 2, and 0 otherwise
AIN	Asset intensity calculated total assets (Compustat data item AT) divided by sales (Compustat data item SALE)
EIN	Employee intensity is the ratio of total number of employees (Compustat data item EMP) over sales
RET	Stock performance or raw stock return from CRSP
GDP	GDP growth in year t. Data available at https://www.bea.gov/
Financial constraint proxies	
SA	We follow Hadlock and Pierce (2010) and use SA Index as our financing constraint measure. They find that leverage, cash flow and, particularly, firm size and firm age are useful predictors of financial constraints. SA index is derived using the formula: $-0.737 * SIZE + 0.043 * SIZE^2 - 0.040 * AGE$ (4)
SIZE	Natural log of total assets (Compustat data item AT)
AGE	Number of years the firm is listed on Compustat

Variables	Definition
WW	The financing constraints measure developed by Whited and Wu (2006). WW index is derived using the formula: $WW_{it} = -0.091CF_{it} - 0.062DIVPOS_{it} + 0.021TLTD_{it} - 0.044LNTA_{it} + 0.102ISG_{it} - 0.035SG_{it}$ (5)
CF	Cash flow (Compustat data item IB plus DP) divided by total assets (Compustat data item AT)
DIVPOS	A dummy variable equal to 1 if the firm pays dividends (Compustat data item DVC plus DVP) and 0 otherwise
TLTD	Long-term debt (Compustat data item DLTT) divided by total assets (Compustat data item AT)
LNTA	Natural log of total assets (Compustat data item AT)
ISG	Firm's three-digit SIC code industry annual sales growth
SG	Firm's annual sales growth
BLM	Bodnaruk et al. (2015) text based measure of financial constraint
Moderating variables	
SG&A_FV	Industry-specific future value creation of SG&A, calculated following the methodology explained on page 799 in Banker et al. (2011). A dummy variable was created that takes the value of one when SG&A_FV > median SG&A_FV and zero otherwise. One indicates high future value-creating SG&A group and zero indicates future value-creating SG&A group
INVEST	Investment opportunities. We follow Kaplan and Zingales (1997) and Linck et al. (2013). We use the following equation to estimate a cross-sectional regression in each period and estimate investment opportunities as the predicted value of the regressions using following regression: $INV_{t+1} = \alpha_0 + \alpha_1 CFO_t + \alpha_2 Q_t + \alpha_3 LEV_t + \alpha_4 DIV_t + \alpha_5 CASH_t + \alpha_6 SG_t + \alpha^j IND_j$
INV	Investment (Compustat data item CAPX scaled by lag PPENT)
CFO	Cash flow (Compustat data item OANCF)
Q	Tobin's Q. Compustat data item [AT + (CSHOxPRCC_F)-CEQ-TXDB]/AT
LEV	Book debt (Compustat data item DLC plus DLTT) divided by total assets (Compustat data item AT)
DIV	Dividend payments. Compustat data item DVC plus DVP scaled by lag PPENT
CASH	Cash holding. Compustat data item CHE scaled by lag PPENT
IND	Dummy variable for two-digit industries
MBVA	Difference between total assets (Compustat data item AT) and total common equity (Compustat data item CEQ) plus market value of equity (Compustat data item CSHO × Compustat data item PRCC_F) divided by total assets (Compustat data item AT)
AVOID	Dummy variable that equals 1 if annual earnings (Compustat data item NI) deflated by market capitalization of shareholders' equity (Compustat data item PRCC × CSHO) at prior year end is in the interval [0, 0.01], and 0 otherwise
EDEC	Dummy variable that equals 1 if the change in annual earnings (Compustat data item NI) deflated by market capitalization of shareholders' equity (Compustat data item PRCC × CSHO) at prior year end is in the interval [0, 0.01], and 0 otherwise

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