Asymmetric Cost Behavior in the Neighborhood:
Evidence from Natural Disasters

ABSTRACT

Using a sample of publicly listed U.S. companies covering the period 1992-2019, we examine how managers respond in terms of asymmetric cost behavior when their firm is located in the neighborhood of a county hit by any type of natural disasters. Because natural disasters induce uncertainty , they constitute a suitable setting to explore managerial behavior in order to predict whether these neighbor firms would assume a sticky cost behavior. We find that neighbor firms of disaster areas react expecting an increase of future demand lowering the same SG&A costs (*anti-sticky behavior*). Further we assess if our first results are driven by an empire building behavioral approach, exploring specific characteristics of the CEOs (*CEO tenure, CEO age* and *CEO compensation*) of neighboring firms. We find a positive relation between anti-sticky cost behavior and neighbor firms when CEOs are younger and have lower compensation and finally for CEOs with shorter tenure. Overall, our results suggestthat corporate anti-sticky cost behavior is determined by a mitigated CEOs empire building approach.

Keywords: Asymmetric cost behavior, Empire building behavior, Natural disasters.

JEL Classifications:

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1. Introduction

Asymmetric cost behavior (also termed cost stickiness) arises from differential responses to changes in sales: costs increase more when activity rises than they decrease when activity falls by an equivalent amount[1]. While documenting the first evidence of sticky cost behavior, Anderson et al. (2003) identify also managerial deliberate decisions as the main reason of cost stickiness. Based on the fact that managerial discretion is a significant determinant of cost stickiness (e.g., Chen *et al.*, 2012; 2013; Banker *et al.*, 2014; Balakrishnan *et al.*, 2014), we intend to complement prior research by showing how managers respond in terms of asymmetric cost behavior to unpredictable bad events, like natural disasters, when their firms are located in the neighborhood of a disaster area. Additionally, we investigate whether this behavior is affected by specific managerial characteristics.

We explore a setting of US companies located in areas hit or not by natural disasters, because the exogenous shock induced by a natural disaster represents a valid setting to investigate changes in managerial behavior. Hence, we e observe firms located in the neighborhood of a disaster area instead of firms directly stroke by natural disasters. Dessaint and Matray (2017) argue that managers of firms located in the neighborhood of a hurricane strike area react to salient risk and temporarily hold more cash. Similarly, Cortes and Strahan (2017) show that banks reallocate capital when local credit demand increases after the natural disasters in a neighbor area.

Although cost stickiness is one of the most studied topics in management accounting literature, the association between managerial discretion and cost stickiness presents still much room to investigate because of mixed findings. On one hand, managers balance weighting

[1] Anderson et al. (2003) find that selling, general, and administrative (SG&A) costs increase on average 0.55% per 1% increase insales but decrease only 0.35% per 1% decrease in sales.

adjustments instead of holding costs on the base of their own estimation of the future demand conditions (Chen *et al.*, 2013; Banker *et al.*, 2014). On the another hand, managers can also refrain from cutting costs in periods of downturn for personal motives related to empire building incentives (Chen *et al*., 2012) and behavioral implications like power (Jensen 1986; Williamson, 1963), reduction of employment risk due to more diversification (Amihud and Lev 1981; Shleifer and Vishny 1989), and finally increased compensation (Jensen 1986; Murphy 1985; Shleifer and Vishny 1989; Williamson, 1963). Recently, some studies have proposed a shift from firm-level to country-level determinants as key drivers of corporate asymmetric cost behavior, where the institutional settings identified in specific country regulations instead of national features affect managerial decisions (Banker *et al.*, 2013; Kitching *et al.*, 2016). Doubtless, natural disasters provoke uncertain market conditions, where the related unexpected consequences become an interesting area of investigation about how natural disasters affect security analysts' earnings forecasts (Kong *et al.*, 2020); whether exposure to natural disasters relates to managers' time horizon for their investments (Paugam *et al.*, 2020); whether firms located in natural disaster area would improve their environmental performance (Dal Maso *et al.*, 2020). Notwithstanding that managers of firms in disasters areas deal with costs associated with damages, we see that the cost behavior of firms in the neighborhood of a disaster area is not univocal and can be interpreted via different channels. The first channel through which natural disasters induce a reaction from managers of neighbor firms can be identified through salience theory (Bordalo, Gennaioli and Shleifer, 2012). Managers of neighbor firms might overweight the salient payoffs relative to the objective probabilities motivated by the panic of paying much higher costs as consequences of natural disasters. Since corporations are connected to each other's (Audretsch and Stephan, 1996; Almazan *et al*., 2007; Kedia and Rajgopal, 2009), natural disasters might generate adjustment costs also for firms located in the neighbor of disaster areas, which would prevent managers from adapting capacity when demand is decreasing with the following consequence to obtain a greater asymmetric cost behavior (*altruism perspective* suggested by Leana and van Buren, 1999; Droege and Hoobler, 2003). The second channel through which natural disasters induce a reaction from managers of neighbor firms relies on the optimistic perspective (Banker *et al.*, 2008; Chen *et al.*, 2019[2]). Because of their optimism, managers would be more likely to increase capacity when demand conditions improve, and less likely to cut resource capacity when demand conditions worsen. Indeed, the greater the anticipated demand, the more optimistic the managers will be regarding the decision to acquire resources. Furthermore, optimistic demand expectations stand at odds with cutting resources, as these resources are likely to be required for supplying future demand.

Aware that managers make gradual adjustments to capacity based on expectations about future demand when they face demand uncertainty (Dixit and Pindyck, 1994), we first test the association between cost stickiness and firms in the neighborhood because of the reaction in expecting a probable adjustment of the same SG&A costs (*asymmetric cost behavior hypothesis*)[3].

Managerial decision-making process can be determined by several CEO's incentives, like empire-building incentives indicating managers' propensity to establish or even to increase a prestigious and powerful position beyond the corporation's optimal size-level and unutilized

[2] While Anderson *et al.* (2003) focus on that managerial intervention only affects changes in costs when sales decrease, Banker *et al.* (2008) consider asymmetric cost behavior by showing how managerial intervention affects cost changes in both directions. They find that managers' optimistic demand expectations are a key source of asymmetric cost behavior. When managers are optimistic with respect to future demand, the stickiness in SG&A costs is stronger than that reported in Anderson *et al.* (2003). Moreover, in contrast with Anderson *et al.* (2003), if managers are pessimistic, then costs decrease more when sales fall than they increase when sales rise by an equivalent amount, because pessimism magnifies the downward adjustment to costs, which results in a reversal of stickiness. Finally, Chen *et al.* (2019) examine the role of unused resources and find that when the degree of unused is high, pessimistic expectations result in anti-stickiness, while optimistic expectations is associated with stickiness. This evidence suggests that managerial expectations can reverse the anti-sticky cost behavior imposed by a high degree of unused resources.

[3] Anti-sticky costs are those that show less of an increase when sales rise than a decrease when sales fall by an equivalent amount (e.g., Kama and Weiss, 2013; Banker *et al.*, 2014).

resources. Theory supports that managers are motivated by self-interests when they are contracted to act in the economic interests of the firm and yet are motivated to reach decisions which maximize their own economic interests (the conflict of interest in the agency theory, Jensen and Meckling, 1976 [4]). Notwithstanding this, a new branch of literature explores how CEOs react to bad events affecting their companies. For example, Bernile *et al.* (2017) find a nonmonotonic relation between the intensity of CEOs' early-life exposure to fatal disasters and corporate risk-taking. CEOs experiencing fatal disasters without extremely negative consequences lead firms that behave more aggressively, whereas CEOs witnessing the extreme downside of disasters behave more conservatively. Consequently, we assess whether our first results are driven by specific characteristics of the CEOs (*CEO tenure, CEO age* and *CEO compensation*), when they are CEOs of the neighbor firms not directly affected by the natural disasters. The identification of these characteristics reflect potential empire building behavior in the way that older CEOs as well as CEOs with more local knowledge and connections could assume more economically aggressive behavior. Thus, these three characteristics become our focus to understand more about asymmetric cost behaviors. Again, on the base of these arguments, we test the association between corporate cost stickiness behavior and neighbor firms splitting the sample according to CEO's tenure, age, and compensation in line with the statement of the empire building incentives (*empire-building hypothesis*).

In order to test our hypotheses, we employ a sample of data from publicly listed U.S. firms covering the time period 1992-2019 (data source: Compustat North America) and we measure natural disasters with data from the Federal Emergency Management Agency (FEMA)[5]. The county-level FEMA dataset indicates the number of major natural disasters

[4] Several studies are focused on the motivation inducing CEOs/managers to assume an "empire building" behavior, such as the increase of personal utility from status, power, compensation and prestige (Jensen, 1986; Stulz, 1990; Malmendier and Tate, 2005; Masulis et al., 2007; Hope and Thomas, 2008).
[5] The FEMA was created in 1979 under President Jimmy Carter to help the federal government in preparing for, preventing, mitigating, and recovering from important disasters including natural disasters.

impacting local economies. We consider a full sample of U.S. firms and then we distinguish those firms hit by natural disasters (*HIT*) from those not directly hit (*NEIGHBOR*) on the base of the following considerations. The first one is that location matters because of local labor market conditions and social interactions with neighboring firms (Kedia and Rajgopal, 2009). Moreover, industries tend to be geographically concentrated and the same industry clusters are likely to be associated with greater investment in human capital and greater labor mobility. Finally, strong ties between firms are determined by the presence of executive interlocks (Brown and Drake, 2014), when the connecting director is a CEO or CFO of either firm, from non-executive interlocks. Prior research suggests that executive interlocks may have a stronger effect on the diffusion of innovations, relative to non-executive interlocks, because the directors creating executive interlocks are more willing and able to serve as representatives for the firms they connect (Palmer *et al.*, 1993; Haunschild 1993; Palmer *et al.*, 1995).

To analyze the relation between asymmetric cost behavior and those firms in the neighborhood, we employ the asymmetric cost behavior model proposed by Anderson *et al*., 2003; Chen *et al*., 2012; Banker *et al.*, 2013; Kitching *et al.*, 2016; Hartlieb *et al.*, 2020, enabling measurement of the SG&A response to contemporaneous changes in sales revenue and discriminating between periods when revenue increases and revenue decreases. We find that neighbor firms of disaster areas react expecting an increase of future demand lowering the same SG&A costs (*anti-sticky behavior*). Furthermore, we find a positive relation between anti-sticky cost behavior and neighbor firms when CEOs are younger and have lower compensations and finally when the CEO's is in the board since less time. Taken together our findings, we interpret these firms in the neighborhood of a disaster area show the propensity to gather new markets replacing the hit firms. These neighbor firms assume an anti-sticky cost behavior going to use those unutilized resources and contemporarily increasing the sales and downsizing the costs. Moreover, we find that this anti-sticky cost behavior is associated with

CEO's characteristics, where CEOs appear to be very dynamic to capture new growth opportunities for their own companies once natural disasters affect specific areas in their neighborhood. We explain this showing that the main empire building incentives can be attenuated when CEOs are not just young, but also when they see an evident opportunity to growth. In other words, it seems that CEOs of these neighbor firms assume an inverse cost stickiness behavior contrary to the altruism perspective.

Accordingly, our paper makes several contributions to the literature related to the asymmetric cost behavior over the empire building incentives. First, our paper is related to studies investigating the asymmetric cost behavior documenting economic, behavioral and agency explanations for the cross-sectional variation in the degree of cost stickiness (e.g., Anderson *et al*., 2003; Kama and Weiss, 2013; Banker *et al.*, 2014; Hartlieb *et al.*, 2020). Second, we provide new evidence documenting that managerial characteristics affect significantly cost stickiness (e.g., Banker *et al.*, 2008; Chen *et al.*, 2012; 2013; Banker *et al.*, 2014; Balakrishnan *et al.*, 2014). Third, this article is also closely related to the literature that studies how the identity and characteristics of the top management, particularly the CEO, can influence corporate decisions and following performance (e.g., Bertrand and Schoar, 2003; Malmendier and Tate, 2005).

Adding new evidence to papers that focus on firm managers' characteristics and cost stickiness, we show that CEOs play a significant role in terms of discretional decision-making process. According to the empire building incentives, the CEOs of the firms in the neighborhood of the disaster areas contribute more and more to the growth and the profitability of the firms they belong to. Several prior studies document natural disasters' consequences in capital markets investigating corporate managerial behaviors (Dessaint and Matray 2017); financial fragility (Klomp, 2014); response of the banking industry (Cortés and Strahan, 2017);

household wealth allocations (Shi *et al.*, 2015); analysts' response (Kong *et al.*, 2020). Despite the difficulty and the limitations in directly investigating how natural disasters affect the managerial decision-making process of the neighbor firms, finally our study intends to contribute to this strand of literature providing further empirical evidence about economic consequences of natural disasters from a managerial internal perspective.

The remainder of this study is organized as follows. Section 2 describes the prior contributions of cost stickiness and managerial characteristics and the developed hypotheses, Section 3 presents the data, methodology and descriptive statistics. Section 4 reports the main findings and adds further sensitivity and robustness tests. Section 5 concludes.

2. Hypotheses development

2.1. The link between cost stickiness and natural disasters.

The traditional view of cost behavior distinguishes between fixed and variable costs regarding changes in the activity level of a firm. Fixed costs are independent of the activity level, when variable costs are assumed to be proportional with respect to the changes in the activity level (Noreen, 1991). In contrast to the traditional cost model in accounting, which assumes that variable costs (but not fixed costs) change proportionally with the level of business activity, empirical research generally shows that costs increase more with increasing activity than they decrease with decreasing activity (e.g., Anderson *et al*., 2003; Balakrishnan *et al*., 2004). In 2003, Anderson *et al*. show that SG&A costs increase by 0.55% if sales increase by 1%, but costs decrease by only 0.35% if sales decrease by 1%. In other words, cost stickiness materializes, when managers delay or restrain downward resource adjustments more during periods of decreasing sales than upward adjustments in periods of increasing sales.

A growing body of academic literature documents that corporate and managerial decisions do not emerge in a societal vacuum, but that they are influenced by the social environment (Nahapiet and Ghoshal, 1998; Droege and Hoobler, 2003; Hasan *et al*., 2017). We decide to investigate more the asymmetric cost behavior in relation with natural disasters which accounting and financial consequences are not fully explored, particularly the managerial accounting effects at corporate level. Dessaint and Matray (2017) show that managers of firms located in the neighborhood of a hurricane strike area temporarily hold more cash, while Cortes and Strahan (2017) find that banks reallocate capital when local credit demand increases after the natural disasters. Doubtless, natural disasters are defined as unpredictable events able to provoke notable damages as well as to increase market conditions' uncertainty. Moreover, natural disasters represent a valid scenario suitable to examine managerial discretion relative to the "neighbor" firms not directly damaged (Dal Maso *et al.*, 2020)[6]. We focus on the neighbor areas because natural disasters can be interpreted from different perspectives in spite of the univocal reactions of firms directly hit, where managers deal with costs arisen from damages. The *salience theory* proposed by Bordalo *et al*. (2013) demonstrate that irrational reactions driven by the panic of paying much higher costs as consequences of natural disasters lead managers of the neighbor firms to overweight the salient payoffs relative to the objective probabilities[7]. In that sense, two potential consequences could

[6] There are further studies considering the effects of natural disaster. Particularly, Alok *et al.* (2020) examine whether professional money managers misestimate climatic disaster risk, in the way that the risk associated with climatic disasters can enter a manager's portfolio if a disaster affects portfolio firms. They find that funds closer to the disaster zone reduce their portfolio holdings of firms located in the disaster area. Consistent with the fund managers overestimating the adverse impact of disasters on stocks located in the disaster zone, they find that the bias in their trading response is transitory and vanishes with time and distance.

[7] *Salience bias* is the tendency to overweight probabilities based on the ease with which events can be recalled (i.e., irrationally overweighting more readily available information). In the presence of such a bias, subjects overestimate the risk of salient events based on vividness, proximity, or emotional impact (Tversky, A., & Kahneman, D. (1973). Availability: A heuristic for judging frequency and probability. *Cognitive psychology*, *5*(2), 207-232.). Following Kahneman and Tversky ((1979) *On the interpretation of intuitive probability: A reply to Jonathan Cohen*.), the impact of additional losses following large losses is perceived to be marginal due to the convexity of the loss value function. Firms experiencing a natural disaster tend to suffer heavy damage, recognizing additional charges beyond the true cost of the disaster would not be as severely punished by investors.

figure out. First, employing the *altruism perspective* proposed by Leana and van Buren, (1999) and Droege and Hoobler, (2003), because corporations are linked to each other's (Audretsch and Stephan, 1996; Almazan *et al.*, 2007; Kedia and Rajgopal, 2009), natural disasters might increase adjustment costs, which would prevent managers to adapt capacity when demand is decreasing and then to obtain higher sticky costs. Second, employing the *optimistic perspective* suggested by Banker *et al*., (2008) and Chen *et al*., (2019) unexpected weather events resulting in significant increases in long run uncertainty (Rehse *et al.*, 2019; Bourveau and Law, 2020; PwC, 2020) could induce individuals to react differently[8]. While managers of areas hit by disasters often resort to short termism to realize more certain short-term benefits, managers of the neighbor firms would assume an optimistic approach deciding to cut less resources, as these resources are likely to be required for supplying future demand. In detail, Banker *et al.*, (2008) explore the role of managers' optimism with respect to future demand in shaping decisions to adjust resources in both favorable and unfavorable scenarios, such as when sales rise as well as when sales fall. We see that the impact of managers' incentives on the degree of cost stickiness is likely to be stronger in the pessimistic case than in optimistic case.

According to the mechanism for adjusting costs, if we assume a high-capacity utilization, the response to a decrease in activity level will be smaller than the response to a similar increase in activity level resulting in sticky costs. By contrast, if we suppose the same firm experiences excess capacity, managers might use the slack to absorb the demand from an increase in activity level. However, an additional decrease in activity level is interpreted as

[8] The *optimistic perspective* might be overlapped within the *overestimation perspective* suggested by De Carolis and Saparito (2006, Social capital, cognition, and entrepreneurial opportunities: A theoretical framework. *Entrepreneurship theory and practice*, *30*(1), 41-56.). Indeed, Chen *et al.* (2013), based on psychology literature, predict that overconfident managers are more likely to overestimate future demand and therefore less likely to cut SG&A costs when sales decline. They document that SG&A costs stickiness increases in the degree of CEO overconfidence. Thus, the notable demand uncertainty provoked by any negative events such as natural disasters drive us to employ the *optimistic perspective*, in the way that affecting managers' commitments of "fixed" activity resources are chosen before actual demand is realized (Banker *et al.*, 2014).

confirming a permanent reduction in demand and triggers a response. Nevertheless, if we assume excess capacity, the cost response to an activity level decrease exceeds the cost response to a similar increase in activity level, resulting in anti-sticky costs.

In particular, managers of the neighbor firms will be more willing to overreact adjusting SG&A costs driven by panic as well as by the greed to acquire new slices of market. If so, given that the level of capacity utilization affects managers' response to a change in activity level, then the results should include a lower (higher) degree of cost asymmetry. Hence, we articulate the following hypothesis:

> **H1:** *The degree of Sg&A cost asymmetry is associated with firms located in the neighborhood of a disaster.*

2.2. The link between cost stickiness and empire building incentives.

Doubtless, the environmental uncertainty driven by natural disasters affects the CEOs' decision-making process. Theorists have long assumed that CEOs have heterogeneous talents and abilities that map into firm performance (e.g., Rosen, 1981; Murphy and Zabojnik, 2004; and Gabaix and Landier, 2008), until Kaplan *et al.* (2012) arguing that more resolute and overconfident CEOs perform better than CEOs who are better listeners and communicators in situations requiring greater coordination. Thus, they find that resoluteness and overconfidence should be positively correlated with performance. Focusing more on the link between CEOs and natural disasters, Bernile *et al.* (2017) show a U-shaped relation between firms' propensity to hold cash and CEO disaster experience. CEOs experiencing fatal disasters without extremely negative consequences lead firms that behave more aggressively, whereas CEOs witnessing the extreme downside of disasters behave more conservatively. Traumatic experiences predict high stress levels long after the events (Holman and Silver, 1998), with exposure to natural disasters in particular shown to have large and lasting effects on individuals (Elder, 1999).

Closer to our focus, prior evidence also shows that natural disaster exposure affects the short-run financial decision of both individuals (Cameron and Shah, 2013; Cassar *et al.*, 2011) and firms (Ramirez and Altay, 2011; Dessaint and Matray, 2017), and that natural disaster experiences have long-lasting effects on investor portfolio decisions (Bucciol and Zarri, 2013). Another strand of literature considers CEO managerial styles explaining a large part of the variation in firm capital structure, investment, compensation, and disclosure policies (Bertrand and Schoar, 2003; Bamber *et al.*, 2010; Graham *et al.*, 2012). Thus, the heterogeneity in CEOs' managerial styles reflects variation in individual life and career experiences (Graham and Narasimhan, 2005; Dittmar and Duchin, 2016).

After testing the first hypothesis focused on the content information of cost stickiness between firms located in U.S. counties hit by the natural disasters and those firms located in the neighborhood of the devastated areas, we intend to investigate more about the guidance for the role sticky (or anti-sticky) cost behaviors driven by CEO managerial characteristics. While the behavior explanation of asymmetric cost behavior can be accounted for the failure of management, according to agency explanation cost stickiness arises through the operations of quite able and competent managers, but who are motivated by their own interests. Self-interested managers maximize their own utility even if their actions diverge from the interests of stockholders (Jensen and Meckling, 1976) and thus are irrational from a firm's perspective. Previous literature has identified two main agency drivers of asymmetric cost behavior: empire building incentives and earnings management incentives. We focus on the first one: the empire building incentives since Schumpeter (1911) postulated that managers are empire builders.

Motivations for the construction of empires presumably reflect executives' hunger for status, power, compensation, and prestige (e.g., Baumol, 1959; Marris, 1964; Jensen, 1986). At this stage we focus on those CEO's characteristics and differences emerged as topics of considerable interest, where *CEO tenure, age, compensation* have been under the lens of the researchers to capture the output of decision-making process at firm-level as well as the propensity to assume empire-building behaviors. Weisbach, (1988), Murphy and Zimmerman (1993) argue that there is an inverse relation between the likelihood of CEO turnover and firm performance: when firm performance is poor, a CEO would be replaced because of her inefficiency in terms of strategies' implementation and firm value's policies. Notwithstanding this, we see that managers behave under empire building incentives, because investors are less capable of linking managerial decisions to firm performance when the quality of monitoring mechanisms, such as financial disclosures, is reduced (Jensen, 1986; Hope and Thomas, 2008). For example, more tenure increases, more a CEO tends to change the strategies (Grimm and Smith, 1991, Hambrick *et al.*, 1991) provoking a loss of interest in implementing organizational changes as their outside interests increase and the novelty of CEO's job decreases. Miller (1991) explains that because of long tenure CEOs may lose touch with their organizations' environments and therefore may not make the changes and investments desires to keep the firm evolving over time. Additionally, we see that CEO's tenure is strongly connected with the career experience. Dearborn and Simon (1958) argue that experience with the goals, rewards, and methods of a particular functional area causes managers to perceive and interpret information in ways that suit and reinforce their functional training. Finally, older executives tend to be more conservative (Hambrick and Mason, 1984): older top managers follow lower-growth strategies (Child, 1974) and tend to be risk averse and may have greater difficulty grasping new ideas and learning new behaviors (Hambrick and Mason, 1984).

Making a step forward, Brüggen and Zehnder (2014) review and test the notion of entirely "good" cost stickiness with the CEO acting in the interest of the firm and the notion of cost stickiness being to some extent "bad" with the CEO engaging in empire building. In detail, the firm growth propensity is driven by the empire building incentive built on executives' status (Schumpeter, 1911; Williamson, 1963), power (Jensen, 1986; Williamson, 1963), reduction of employment risk due to more diversification (Amihud and Lev, 1981; Shleifer and Vishny, 1989), and increased compensation (Jensen, 1986; Murphy, 1985; Shleifer and Vishny, 1989; Williamson, 1965). Moreover, cost asymmetry is partially caused by managerial empire building and certain corporate governance mechanisms, such as board size, board independency and CEO/chairman separation reduce cost stickiness (Chen *et al*., 2012). Stronger empire building incentives (as measured by free cash flow), more managers determine cost stickiness. In other words, a certain portion of asymmetry in costs is due to the CEO maximizing her personal utility through empire building and hence are "bad". If the empire building incentive might be associated with an increase of asymmetric cost behavior, it is also notable that the empire building incentive could boost the growth propensity of firms decreasing the sticky costs. The above considerations leads to our second hypothesis:

H2: *The asymmetric cost behavior of these firms in the neighborhood of a disaster area is influenced by CEO's empire building behavior.*

3. Data and Methods

3.1. Sample selection

To test our conjecture, we rely on data from multiple databases. We use data on natural disasters from FEMA, while accounting data are from Compustat North America. Our sample begins with all firms operating in the U.S. with data available in Compustat between 1991 and 2019.

We use ZIP Codes to assign the related Federal Information Processing Standard Publication (FIPS) county code (available from the U.S. Department of Housing and Urban Development's Office of Policy Development and Research) to firm headquarters. We follow Chaney et al. (2012) and assume that, on average, plants are located in the same area as a firm's headquarters. We omit observations with missing information for state or ZIP Code information on headquarters location. Following, we remove firms: (a) with the length of the fiscal year less than 12 months, (b) with a negative book value of equity, (c) financial firms and public utilities (SIC 6000–6999 and 4900–4999) due to differences in financial accounting regulations, and (d) with missing accounting and CEO data required to run our primary model.

Furthermore, following previous literature (e.g., Chen *et al*., 2012; Anderson and Lanen, 2009), we remove firms with SG&A costs higher than sales and costs and sales moving in the opposite direction. Finally, we trim the top and the bottom 0.5 percent of the observations with extreme values in accounting data used to run our main model. This results in a final sample of 22,462 firm-year observations, covering 2,510 unique firms from 1992 to 2019. Table 1 presents the information on sample selection.

[Insert Table 1 About Here]

Table 2 reports the sample distribution by State and industry (SIC 1 digit). As shown, California has the largest number of observations (3,562), followed by Texas (2,396) and New York (1,439), while the states of Montana, North Dakota, Wyoming, and New Mexico present the lowest number of observations (from 2 to 6). This distribution is consistent with the economic relevance of the U.S. states. Furthermore, we see that the largest number of observations are in Manufacturing (SIC 2 and 3) and Wholesale & Retail trade sectors (SIC 5). The lowest number of observations reported among the different sectors are exhibited on Public Administration (SIC 9) and Agriculture, Forestry and Fishing (SIC 0) sectors.

[Insert Table 2 About Here]

3.2. Measure of geographical proximity

We measure the degree of salience of natural disasters using the distance between the firm's headquarter address and the area where the event occurs. Information of natural disaster are from the FEMA database. This database includes only large disasters that materially affect local economies and provides information regarding the incident type, beginning date, ending date, and impacted area (identified by state, county, and place code). From the raw declaration summary, we remove events with missing information about the county and events with the same declaration date, event title, and geographical area impacted but a different type of declaration. Following, we count the number of natural disasters on a monthly rolling window for each county. Accordingly, we identify an affected county if the number of natural disasters in the previous 12 months is higher than on 1, 0 otherwise. Following, we identify a neighbour county by matching each affected county with its ten closest non-affected counties according to geographical distance. We measure the distance across counties using the latitude and the longitude reported by the National Weather Service (https://www.weather.gov/gis/ZoneCounty). Those counties non-matched are the control group. Figure 1 shows the average number of annual natural disasters at the county level.

[Insert Figure 1 About Here]

3.3. Empirical Model

Most of the studies considering the asymmetric cost behavior follow the cross-sectional model introduced by Anderson *et al*. (2003), enabling measurement of the SG&A response to contemporary changes in sales revenue and discriminating between periods when revenue increases and revenue decreases. The stickiness of SG&A costs, in its original form (Anderson et al., 2003), is as follows:

$$(a)\ LN\left(\frac{SG\ \&\ A_{i,t}}{SG\ \&\ A_{i,t-1}}\right) = \beta_0 + \beta_1\ LN\left(\frac{Sales_{\ i,t}}{Sales_{\ i,t-1}}\right) + \beta_2\ DEC * LN\left(\frac{Sales_{\ i,t}}{Sales_{\ i,t-1}}\right) + \varepsilon_t$$

where $LN\left(\frac{SG\ \&\ A_{i,t}}{SG\ \&\ A_{i,t-1}}\right)$ denotes the log-change in selling, general and administrative costs for firm *i* at year *t*. $LN\left(\frac{Sales_{\ i,t}}{Sales_{\ i,t-1}}\right)$ is the log-change in sales revenues approximating the firm's activity level and DEC is an indicator variable that equals to 1 if sales decrease between two fiscal years, and 0 otherwise. Applying log-specifications and ratios allows the comparability across firms and moderates potential heteroscedasticity (see Anderson *et al.*, 2003). Moreover, log-specifications enable a comfortable interpretation of coefficient values as percentage changes in selling, general and administrative costs, where SG&A are subject to a more discretionary classification done by managers. The coefficient β_1 consequently measures the average percentage growth in selling, general and administrative costs when sales increase by 1% and the sum of β_1 and β_2 the average percentage decline for a 1% decrease in sales. Accordingly, if β_2 is significantly negative it indicates asymmetric cost behavior, given a positive value of β_1.

To test our first hypothesis, related to the association between salience of natural disasters and firms cost stickiness behavior, we augmented the original Anderson *et al.* (2003)s' model as follows [9]:

[9] All variables are defined in Appendix A.

$$(b)\ LN\left(\frac{SG\ \&\ A_{i,t}}{SG\ \&\ A_{i,t-1}}\right)$$

$$= \beta_0 + \beta_1\ LN\left(\frac{Sales_{\,i,t}}{Sales_{\,i,t-1}}\right) + \beta_2\ DEC * LN\left(\frac{Sales_{\,i,t}}{Sales_{\,i,t-1}}\right)$$

$$+\ (\beta_3\ HIT\ + \boldsymbol{\beta_4\ NEIGHBOR} + \beta_5\ AI\ + \beta_6\ EI\ + \beta_7\ CF\ + \beta_8\ SUC_{DEC}) * DEC * LN\left(\frac{Sales_{\,i,t}}{Sales_{\,i,t-1}}\right)$$

$$+\ (\beta_9\ HIT\ + \beta_{10}\ NEIGHBOR + \beta_{11}\ AI\ + \beta_{12}\ EI\ + \beta_{13}\ CF\ + \beta_{14}\ SUC_{DEC}) * LN\left(\frac{Sales_{\,i,t}}{Sales_{\,i,t-1}}\right)$$

$$+\ (\beta_{15}\ HIT\ + \beta_{16}\ NEIGHBOR + \beta_{17}\ AI\ + \beta_{18}\ EI\ + \beta_{19}\ CF\ + \beta_{20}\ SUC_{DEC}) +\ Year\ \&\ Firm\ FE + \varepsilon_t$$

Where according to the first model we have $SG\ \&\ A_{i,t}$ (selling, general, and administrative costs) and $Sales_{\,i,t}$ (sales revenue) for firm *i* at year *t*. DEC is a dummy variable that takes the value of 1 when sales revenues in year *t* are less than those in $t-1$, and 0 otherwise. The coefficient β_1 measures the percentage increase in SG&A costs with 1 percent increase in sales revenue. Because the value of DEC is 1 when revenue decreases, the sum of the coefficients ($\beta_1 + \beta_2$) measures the percentage decrease in SG&A costs with a 1 percent decrease in sales revenue. When β_1 is significantly positive and β_2 is significantly negative, they denote a consistent cost asymmetric behavior.

We distinguish those firms in the U.S. counties hit by natural disasters (*HIT*) from those not directly hit (*NEIGHBOR*) on the base of the following considerations. As argued by Kedia and Rajgopal, (2009), we see that location matters because of local labor market conditions and social interactions with neighboring firms. Then, sectors are strategically concentrated in the same geographical areas, where the same industrial clusters are associated with greater investment in human capital and greater labor mobility. Another relevant aspect is that strong ties between firms are determined by the presence of executive interlocks (Brown and Drake, 2014), such as the connecting director is a CEO or CFO of either firm, from non-executive interlocks. Because executive interlocks may have a stronger effect on the diffusion of innovations, we can observe that executive interlocks are more willing and able to serve as representatives for the firms they connect (Palmer *et al.*, 1993; Haunschild 1993; Palmer *et al.*, 1995). According to our model, the variable of main interest is $NEIGHBOR$ and its relative three-way interaction term with DEC and change in sales (Δ_SALE). $NEIGHBOR$ is defined as a dummy variable which takes the value of 1 if the firm's headquarter is located in a county close to one hit by a natural disaster in the previous 12 months, 0 otherwise. As shown in mode (b), our coefficient of interest is β_4 which measures the degree of cost stickiness of firms located closely to a landfall area. A negative and significant β_4 coefficient indicates that firms in the neighborhood assume an asymmetric cost behavior, where in case of sales decline, they tend to cut less costs. On the other hand, a positive and significant β_4 coefficient implies that neighbor firms are more likely to cut costs proportionately when sales decreases as well as costs of these firms increase less when activity rises than they decrease when activity falls by an equivalent amount (Balakrishnan *et al.*, 2004).

Following previous literature (e.g., Cheng *et al.*, 2012; Hartlieb *et al.*, 2020), we include several controls which may affect cost-asymmetry. Precisely, we control for: asset intensity (AI) as ratio of total assets over sales revenue; employee intensity (EI) as ratio of total number employees over sales revenue; free cash flows (CF) measured as cash flow from operating activities minus common and preferred dividend payments scaled by total assets; and successive decrease (SUC_{DEC}) as is a dummy variable that takes the value of 1 when sales revenues in year t are less than those in $t-2$ and 0 otherwise. While asset and employ intensity are crucial variables in determining adjustments costs and consequently asymmetric cost behavior, SUC_{DEC}controls for managers' perceptions since executives are more likely to consider negative demand shocks as more permanent after two consecutive downturns, which mitigates cost stickiness (Banker *et al.*, 2014). Moreover, if managers observe that the direction of demand change is the same in two consecutive periods, they will be more certain about future demand as compared to the case when the direction of demand change in the current year is different from the previous year (e.g., Anderson *et al.*, 2003; Balakrishnan *et al.*, 2004)[10]. Cash flow (CF) indicates opportunistic managerial motivation provoking a sticky-cost behavior (Chen *et al.*, 2012). This agency proxy indicates that managers have more opportunities for empire building when it is high, resulting in greater cost asymmetry. Indeed, prior literature documents a strong positive association between free cash flow and SG&A cost asymmetry, where SG&A costs capture most of the slack resources channeled into overhead and staff expenses and then represent an important aspect of managerial empire building[11].

Finally, all the regressions include year and firm fixed effects to control for any unobserved firm-wide or year-specific variations in costs and sales. Furthermore, we cluster standard errors at firm level as Banker *et al.* (2013).

Regarding the association between corporate governance characteristics and cost stickiness behavior (i.e., HP2), we use the following three CEO's attributes: tenure, age, and compensation (data are from Compustat Executive Compensation). Accordingly, we define *TENURE_HIGH, AGE_HIGH* and *COMP_HIGH* as dummy variables that equal to 1 if the CEO's tenure, age, and compensation above the sample median result, and 0 otherwise. Then, we estimate our regression model (b) by splitting the sample across *TENURE_HIGH, AGE_HIGH* and *COMP_HIGH*.

[10] Two consecutive sales increases may imbibe greater confidence and managers may be more likely to add to capacity (Tversky and Kahneman, 1974). This result is important because it indicates that managerial behavior is not mechanistic also when there is upward adjustments to costs and that managers deliberately adjust capacity not only when sales decrease but also when sales increase.

[11] *Cash flow* the commonly used proxy for the agency problem and the resulting empire building incentives (Jensen 1986; Masulis *et al.* 2007; Richardson 2006; Stulz 1990; Shleifer and Vishny 1997; Titman *et al.* 2004) is defined as cash in excess of that required to fund all available positive NPV projects. Cash flow arises when there is a mismatch between available cash and growth prospects. In 1986 Jensen proposed for the first time the *free cash flow hypothesis* suggesting that managers with high levels of cash flow are likely to invest it in operations or negative net present value projects instead of paying it out to shareholders in order to increase perquisites consumption.

Considering singularly each item inducing an empire building behavior, first we expect to find a significant association between the degree of SG&A cost asymmetry and the interaction term (*DEC # Δ_SALE # NEIGHBOR*), where a negative coefficient on the interaction term (*DEC # Δ_SALE # NEIGHBOR*) would indicate a greater degree of cost asymmetry. Specifically considering CEO tenure, we know that CEOs with long tenures are more likely to be entrenched in their positions because they have more time to build their desirable environment and increase their power day by day. In that case, higher is the tendency to have more control over the board and other internal monitoring mechanisms, higher the asymmetric cost behavior.

Second, when we test the impact of CEO age on the relation between cost stickiness and the neighbor firms, also here we expect to find significance on the interaction term (*DEC #Δ_SALE # NEIGHBOR*). Differently from the oldest CEOs, the youngest one might be less motivated to empire build with the goal to increase their prestige. Third, when we test the impact of CEO compensation on the relation between cost stickiness and the neighbor firms, we see that our expectations are based on the fact that CEOs with an empire-building approach are more likely to obtain higher compensation, especially if they see growth opportunities for their company in the short run. In this case, because we can expect to see that neighbor firms could gather new slices in the market at the expense of firms devasted by natural disasters, it's hard to define a univocal expectation considering particularly the compensation, as determinant of an empire building behavior.

Aware that literature on the interplay between corporate governance and agency theory suggests several other aspects and governance mechanisms able to induce an empire building behavior, we concentrate our efforts on these three aspects (tenure, age, and compensation) because of their immediate relevance, especially when the market conditions become more uncertain as following natural disasters events.

3.4. Descriptive Statistics

Table 3 presents descriptive statistics for the variables used in our main test (see also Appendix A for variable definitions). As shown in Panel A, the average of change in SG&A (Δ_SG&A) is nearly 9% with a standard deviation of 19% and a 75th percentile of 17%. If we consider the change in sales (Δ_SALE) we find an average of 9.4% with a standard deviation of 22% and a 75th percentile of 18%. Moreover, as shown in Table 3 Panel B reporting the correlation matrix, we see that there is a positive and significant correlation between Δ_SG&A and Δ_SALE equal to 0.821*. Another notable result is to see that the correlation between Δ_SG&A and DEC (is a dummy variable that takes the value of 1 when sales revenues in year *t* are less than those in $t-1$, and 0 otherwise) are negatively and significantly correlated (-0.593*).

[Insert Table 3 About Here]

4. Main results

In table 4, we present the regression output for our main model (b). The key coefficient of interest is β_4 (DEC # Δ_SALE # NEIGHBOR) which measures the degree of cost stickiness of firms located closely to a county hit by a disaster area. We find a positive and significant association between the interaction term and the change in SG&A (Δ_SG&A) indicating the level of cost stickiness. When we include in our regression both year fixed effects and firm fixed effects our β_4 is 0.1456*** suggesting an anti-sticky behavior for neighbor firms, while the β_3 (DEC # Δ_SALE # HIT) is still positive, but not significantly associated with SG&A (Δ_SG&A) (0.0608).

In a further regression (Table 4 column 2) we include year fixed effects, state-county fixed effects and industry fixed effects. We see in this case that β_4 coefficient is still positive and significantly (0.1455***) associated with the change in SG&A (Δ_SG&A), while β_3 is again positive but not significantly (0.0483) associated with the change in SG&A (Δ_SG&A). In all these first regressions we include the controls: asset intensity (AI) as ratio of total assets over sales revenue; employee intensity (EI) as ratio of total number employees over sales revenue; free cash flows (CF) measured as cash flow from operating activities minus common and preferred dividend payments scaled by total assets; and successive decrease (SUC_{DEC}), a dummy variable that takes the value of 1 when sales revenues in year t are less than those in $t-2$ and 0 otherwise. These are known as four economic determinants of SG&A cost asymmetry as argued by Anderson et al. (2003). Moreover, we add as control variable cash flow (CF) as agency variable indicating an opportunistic managerial motivation provoking a sticky-cost behavior. The coefficients and t-statistics reported are based on firm-clustered standard errors, which address any heteroskedasticity problems.

Following, we assess whether our first results indicating an anti-sticky cost behavior for the neighbor firms are driven by specific characteristics of the CEOs (*CEO tenure, CEO age* and *CEO compensation*). Table 5, Panel A, reports the results when we test the impact of CEO tenure on the relation between cost stickiness and neighbor firms. We split the sample in *TENURE_HIGH* as a dummy variable that equals to 1 if the CEO's tenure is above the sample median result, and 0 otherwise. In the first column, where we have the subsample based on CEOs' low tenure, we find our variable of main interest β_4 (DEC # Δ_SALE # NEIGHBOR) positive and significantly associated with the change in SG&A (Δ_SG&A) (0.1649**), while β_3 (DEC # Δ_SALE # HIT) is still positive but not significantly associated with SG&A (Δ_SG&A) (0.0593). In column 2 (Table 5 Panel A) we report the results of the subsample based on CEOs' high tenure. In this case we see that both β_4 (DEC # Δ_SALE # NEIGHBOR) and β_3 (DEC # Δ_SALE # HIT) are positive but not significantly associated with SG&A (Δ_SG&A) (β_4= 0.1139; β_3 = 0.0276).

Table 5, Panel B, reports the results when we test the impact of CEO age on the relation between cost stickiness and neighbor firms. We split the sample in *AGE_HIGH* as a dummy variable that equals to 1 if the CEO's age is above the sample median result, and 0 otherwise. In the first column, where we have the subsample based on CEOs' low age, we find our variable of main interest β_4 (DEC # Δ_SALE # NEIGHBOR) still positive and significantly associated with the change in SG&A (Δ_SG&A) (0.1870**), while β_3 (DEC # Δ_SALE # HIT) is positive but not significantly associated with SG&A (Δ_SG&A) (0.0578). In Colum 2 (Table 5 Panel B) we report the results of the subsample based on CEOs' high age. In this case we see that both β_4 (DEC # Δ_SALE # NEIGHBOR) and β_3 (DEC # Δ_SALE # HIT) are positive but not significantly associated with SG&A (Δ_SG&A) (β_4= 0.0964; β_3 = 0.0814).

Table 5, Panel C reports the results when we test the impact of CEO compensation on the relation between cost stickiness and neighbor firms. We split the sample in *COMP_HIGH* as a dummy variable that equals to 1 if the CEO's compensation is above the sample median result, and 0 otherwise. In the first column, where we have the subsample based on CEOs' low compensation, we find our variable of main interest β_4 (DEC # Δ_SALE # NEIGHBOR) still positive and significantly associated with the change in SG&A (Δ_SG&A) (0.1851**), while β_3 (DEC # Δ_SALE # HIT) is still positive but not significantly associated with SG&A (Δ_SG&A) (0.0320). In column 2 (Table 5 Panel C) we report the results of the subsample CEOs' high compensation. In this case we see that both β_4 (DEC # Δ_SALE # NEIGHBOR) and β_3 (DEC # Δ_SALE # HIT) are positive but not significantly associated with SG&A (Δ_SG&A) (β_4= 0.0776; β_3 = 0.0684).

In all the regressions reported in Table 5 Panel A, B, C we include the control variables and year fixed effects and firm fixed effects. The coefficients and t-statistics reported are based on firm-clustered standard errors, which address any heteroskedasticity problems

5. Conclusion

A salient characteristic of natural disasters is generally causing considerable losses to human society (Kong et al., 2017). In this paper we study whether managers respond in terms of asymmetric cost behavior when their firms are located in the neighborhood of a county hit by a natural disaster.

This question is important if we consider that surely managers of those firms in disaster areas deal with costs associated with damages and consequently, they may respond manipulating real activities as well as adjusting immediately the costs. Nevertheless, in case of those firms located in the U.S. counties in the neighborhood of a disaster area, their response could be interpreted via different channels.

One of the main consequences of catastrophic events, like natural disasters, is the panic of paying much higher costs leading managers of the neighbor firms to overweight the salient payoffs relative to the objective probabilities. Thus, we could expect an increase of adjustment costs, when the demand decreases, and consequently an asymmetric cost behavior. However, it is also plausible that managers of the neighbor firms might be more optimistic, expecting an improvement of demand conditions without cutting resource capacity.

To examine our research question, we employ a sample of publicly listed U.S. companies covering the time period 1992-2019 and the asymmetric cost behavior model proposed by Anderson *et al*., 2003; Chen *et al*., 2012; Banker *et al*., 2013; Kitching *et al*., 2016; Hartlieb *et al*., 2020, enabling measurement of the SG&A response to contemporaneous changes in sales revenue and discriminating between periods when revenue increases and revenue decreases. Furthermore, we measure natural disasters with data from the Federal Emergency Management

Agency (FEMA) and following we split our sample in those firms hit by natural disasters (*HIT*) from those not directly hit (*NEIGHBOR*).

Our first findings show that neighbor firms of disaster areas react expecting an increase of future demand lowering the same SG&A costs (*anti-sticky behavior*). Furthermore, when we assess whether our first results are driven by specific CEOs' characteristics belonging to the stream of empire building incentives (*CEO tenure, CEO age* and *CEO compensation*), we find a positive relation between anti-sticky cost behavior and neighbor firms when CEOs have lower tenure, are younger and have finally lower compensations. Overall, our results indicate that these firms in the neighborhood of a disaster area show a propensity to gather new markets assuming an anti-sticky cost behavior with an attenuation of the empire building incentives.

Our paper intends to contribute to the asymmetric cost behavior literature, documenting economic, behavioral and agency explanations for the cross-sectional variation in the degree of cost stickiness (e.g., Anderson *et al*., 2003; Kama and Weiss, 2013; Banker *et al.*, 2014; Hartlieb *et al.*, 2020). Second, it provides new evidence documenting the relation between cost stickiness and empire building incentives and we find consistency with studies conducted by Banker *et al.*, 2008; Chen *et al.*, 2012; 2013; Banker *et al.*, 2014; Balakrishnan *et al.*, 2014. Finally, this article is also closely related to the literature that studies how the identity and characteristics of the top management, particularly the CEO, can influence corporate decisions and following performance (e.g., Bertrand and Schoar, 2003; Malmendier and Tate, 2005).

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Appendix A. Definition of variables

Name	Description
Change in SG&A (Δ_SG&A)	Natural logarithm of a firm's annual change in selling general and administrative costs (*sale*).
Change in Sale (Δ_SALE)	Natural logarithm of a firm's annual change in sales (*sale*).
Decrease (DEC)	Indicator variable that equals 1 if sales (*sale*) decrease between two fiscal years, and 0 otherwise.
HIT	Dummy variable which takes value of 1 if the firm headquarters is located in a county hit by a natural disaster in the previous 12 months, 0 otherwise.
NEIGHBOR	Dummy variable which takes value of 1 if the firm headquarters is located in a county close to a one hit by a natural disaster in the previous 12 months, 0 otherwise.
Asset Intensity (A.I.)	Total assets (*at*) divided by sales (*sale*).
Employee Intensity (E.I.)	Number of employees (*emp*) divided by sales (*sale*). For easiness of representation, we multiplied this variable by 100.
Cash Flows (C.F.)	Cash flow, measured as cash flow from operating activities (*oancf*) – common (*dvc*) and preferred dividend (*dpv*) payments scaled by total assets (*at*).
Successive decrease (SUC_DEC)	Indicator variable that equals one if sales (*sale*) decrease in two consecutive years, and zero otherwise.
CEO Tenure	Number of years an Executive sit into the board as CEO.
CEO Age	Age of the CEO.
CEO Total Compensation	CEO annual compensation (sum of salary + bonus).

Notes: In parentheses the COMPUSTAT North America code

Figure 1 | Average number of annual natural disasters across counties between 1953 and 2019

Figure 1 presents the total number of disasters by U.S. county over the period 1953 to 2019. Disaster declaration is retrieved from the FEMA dataset.

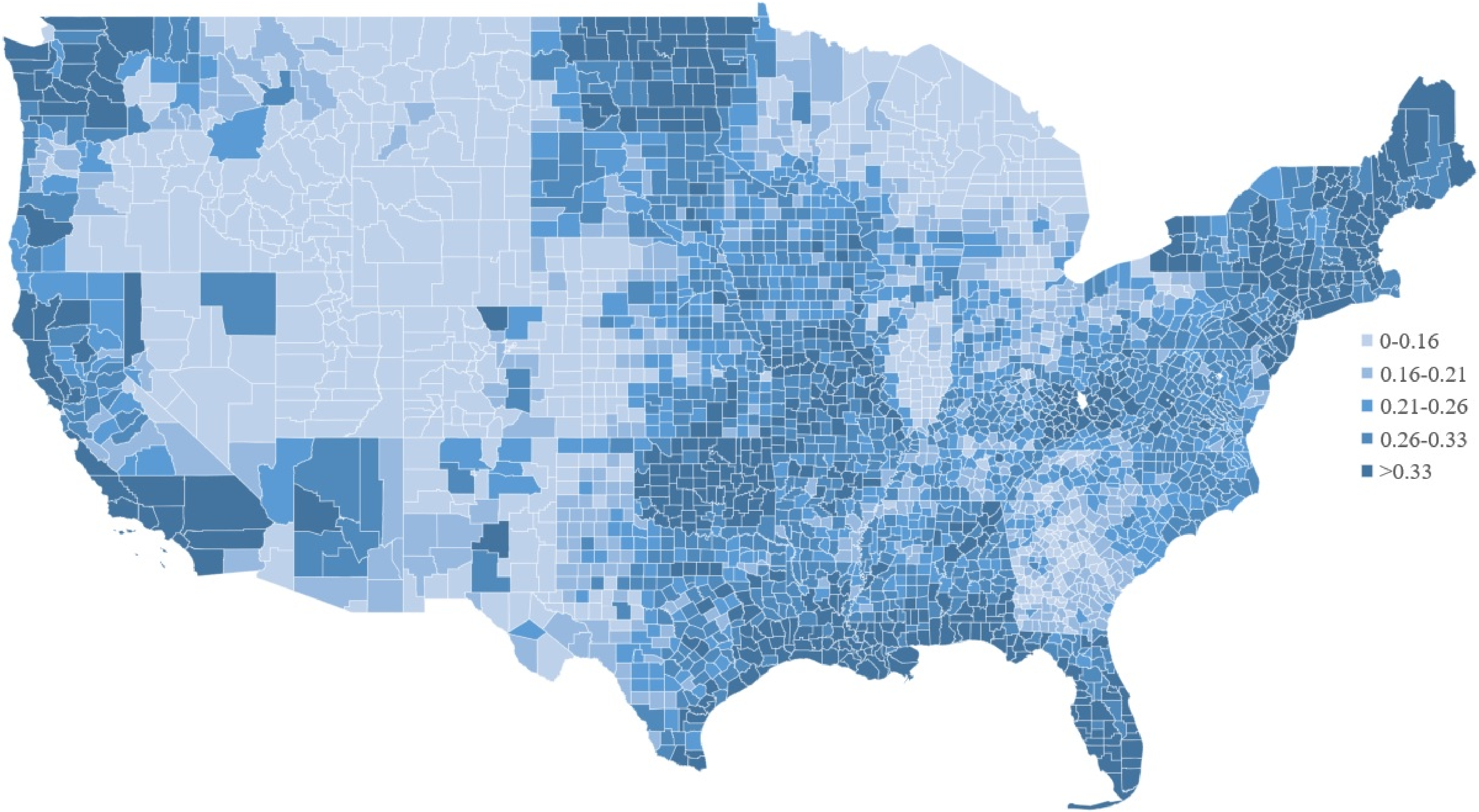

Table 1 | Sample selection

	Sample
The universe of firm-year observations of U.S. incorporated companies with ZIP Code and total assets and total sales data available in COMPUSTAT North America during the period 1991-2019	191,680
Reason for dropping	**Obs. dropped**
Length of the fiscal year less than 12 months	620
Drop if negative equity book value at the beginning of the year	21,794
Drop if SIC is 6000–6999 and 4900–4999	48,666
Missing accounting data	29,412
Missing CEO data	63,766
SG&A higher than Sales	165
SG&A and Sales move in opposite direction	4,795
Final sample	**22,462** [*t* = 1992, 2019] [firms = 2,510]

Table 2 | Sample distribution of observations by state & industry (sic1-digit code)

State Code	State Name	SIC=0	SIC=1	SIC=2	SIC=3	SIC=4	SIC=5	SIC=7	SIC=8	SIC=9	*Total*
AL	Alabama	0	22	13	41	0	42	21	3	0	*142*
AR	Arkansas	0	15	29	10	21	57	0	0	0	*132*
AZ	Arizona	0	34	54	121	13	76	45	26	0	*369*
CA	California	30	73	389	1,851	40	368	707	81	23	*3,562*
CO	Colorado	0	156	80	101	64	39	57	21	0	*518*
CT	Connecticut	0	17	92	286	20	23	81	33	4	*556*
DC	District of Columbia	0	0	3	26	4	0	0	3	0	*36*
DE	Delaware	0	0	53	3	0	3	7	0	0	*66*
FL	Florida	0	48	52	166	65	300	136	38	0	*805*
GA	Georgia	0	41	214	109	26	94	220	20	0	*724*
H.I.	Hawaii	0	0	0	0	26	0	0	0	0	*26*
IA	Iowa	6	0	61	26	0	21	0	0	0	*114*
ID	Idaho	0	10	4	16	0	22	0	9	0	*61*
IL	Illinois	2	44	365	514	89	264	93	56	5	*1,432*
IN	Indiana	2	0	61	152	9	47	22	9	0	*302*
KS	Kansas	0	8	6	1	16	20	14	16	0	*81*
KY	Kentucky	0	0	41	32	0	33	10	26	0	*142*
LA	Louisiana	0	19	0	0	21	20	10	41	0	*111*
MA	Massachusetts	0	0	124	568	5	109	205	57	6	*1,074*
MD	Maryland	0	0	77	29	20	33	22	15	0	*196*
ME	Maine	0	0	17	0	0	7	11	0	0	*35*
MI	Michigan	0	0	134	326	9	28	41	0	11	*549*
MN	Minnesota	0	5	217	270	20	178	70	19	0	*779*
MO	Missouri	13	35	83	115	1	69	69	3	0	*388*
MS	Mississippi	20	0	16	4	0	12	2	0	0	*54*
MT	Montana	0	0	0	0	0	0	2	0	0	*2*

NC	North Carolina	15	22	167	204	10	146	14	54	19	*651*
ND	North Dakota	0	0	0	1	0	0	2	0	0	*3*
NE	Nebraska	0	0	16	32	1	12	0	0	9	*70*
NH	New Hampshire	0	0	25	59	0	27	0	0	0	*111*
NJ	New Jersey	0	4	295	171	22	98	92	63	0	*745*
NM	New Mexico	0	0	0	4	0	1	1	0	0	*6*
NV	Nevada	0	0	6	20	13	0	109	1	0	*149*
NY	New York	0	46	451	311	127	164	300	40	0	*1,439*
OH	Ohio	0	51	263	388	12	222	63	40	0	*1,039*
OK	Oklahoma	0	105	7	19	0	14	6	0	0	*151*
OR	Oregon	0	0	26	138	7	18	19	0	0	*208*
PA	Pennsylvania	0	41	229	347	36	164	107	33	0	*957*
RI	Rhode Island	0	0	0	66	0	44	10	0	0	*120*
SC	South Carolina	0	0	38	17	0	29	12	0	0	*96*
SD	South Dakota	0	0	2	8	0	0	0	0	0	*10*
TN	Tennessee	0	0	101	76	32	155	39	33	0	*436*
TX	Texas	0	753	273	541	130	402	240	48	9	*2,396*
UT	Utah	0	1	54	40	12	11	28	23	0	*169*
VA	Virginia	0	11	96	63	78	101	139	64	0	*552*
WA	Washington	0	0	56	117	54	102	61	0	0	*390*
WI	Wisconsin	0	0	84	319	3	44	44	0	0	*494*
WV	West Virginia	0	0	0	0	0	0	0	9	0	*9*
WY	Wyoming	0	5	0	0	0	0	0	0	0	*5*
Total	-	*88*	*1,566*	*4,374*	*7,708*	*1,006*	*3,619*	*3,131*	*884*	*86*	*22,462*

Notes. SIC = 0 Agriculture, Forestry and Fishing; SIC = 1 Mining & Construction; SIC = 2 & 3 Manufacturing; SIC = 4 Transportation, Communications, Electric, Gas and Sanitary service; SIC = 5 Wholesale & Retail trade; SIC = 6 Finance, Insurance and Real Estate; SIC=7 & 8 Services; SIC = 9 Public Administration.

Table 3 | Descriptive statistics

Panel A: Univariate statistics

Variable	Obs.	Mean	Std. Dev.	Q1	Q25	Median	Q75	Q99
Δ_SG&A	22,462	0.1065	0.1970	-0.4291	0.0211	0.0893	0.1792	0.7655
Δ_SALE	22,462	0.1088	0.2244	-0.5392	0.0227	0.0940	0.1893	0.8310
DEC	22,462	0.1969	0.3977	0	0	0	0	1
HIT	22,462	0.3915	0.4881	0	0	0	1	1
NEIGHBOR	22,462	0.2546	0.4356	0	0	0	1	1
AI	22,462	1.2480	1.0841	0.2571	0.6772	0.9903	1.4819	4.8218
EI	22,462	0.5801	0.8200	0.0344	0.2526	0.4161	0.6492	3.4813
CF	22,462	0.0927	0.0825	-0.1380	0.0510	0.0893	0.1347	0.3054
SUC_DEC	22,462	0.2146	0.4105	0	0	0	0	1

See Appendix A for variable definitions.

Panel B: Correlation coefficients (main variables of interest)

	Δ_SG&A	Δ_SALE	DEC	HIT	NEIGHBOR	AI	EI	CF	SUC_DEC
Δ_SG&A	1								
Δ_SALE	0.821*	1							
DEC	-0.593*	-0.599*	1						
HIT	0.016	0.004	-0.024*	1					
NEIGHBOR	0.008	0.022*	-0.008	-0.469*	1				
AI	0.094*	0.078*	0.040*	0.001	0.009	1			
EI	0.013	-0.001	-0.020*	0.008	-0.011	-0.108*	1		
CF	0.092*	0.111*	-0.168*	0.022*	0.003	-0.080*	0.027*	1	
SUC_DEC	-0.245*	-0.208*	0.298*	-0.035*	0.022*	0.044*	-0.027*	-0.169*	1

See Appendix A for variable definitions. * indicate statistical significance at the 0.01 level (two-tailed).

Table 4 | Relation between cost stickiness and neighbor firms.

	Column (1) Δ_SG&A	Column (2) Δ_SG&A
Constant	-0.0093	0.0004
	[1.49]	[0.08]
Δ_SALE	0.8033***	0.8003***
	[31.60]	[33.34]
DEC # Δ_SALE	-0.2108***	-0.1997***
	[4.10]	[4.17]
DEC # Δ_SALE # HIT	0.0608	0.0483
	[1.27]	[1.04]
DEC # Δ_SALE # NEIGHBOR	**0.1456*****	**0.1455*****
	[2.63]	**[2.68]**
DEC # Δ_SALE # AI	-0.0024	-0.0032
	[0.23]	[0.32]
DEC # Δ_SALE # EI	-0.0649**	-0.0636**
	[2.36]	[2.46]
DEC # Δ_SALE # CF	0.6973***	0.6167***
	[3.56]	[3.39]
DEC # Δ_SALE # SUC_DEC	0.2112***	0.1986***
	[4.39]	[4.23]
Δ_SALE # HIT	-0.0590**	-0.0549**
	[2.48]	[2.32]
Δ_SALE # NEIGHBOR	-0.0934***	-0.0957***
	[3.42]	[3.44]
Δ_SALE # AI	-0.0224***	-0.0189***
	[5.97]	[7.27]
Δ_SALE # EI	0.0841***	0.0882***
	[4.60]	[5.01]
Δ_SALE # CF	-0.3702***	-0.2800**
	[3.13]	[2.45]
Δ_SALE # SUC_DEC	-0.0906***	-0.0851***
	[3.12]	[2.97]
HIT	0.0117***	0.0106***
	[3.34]	[3.02]
NEIGHBOR	0.0134***	0.0131***
	[3.36]	[3.23]
AI	0.0254***	0.0160***
	[7.17]	[5.79]
EI	-0.0154***	-0.0117***
	[4.09]	[4.99]
CF	0.0667***	0.0709***
	[2.84]	[3.35]
SUC_DEC	-0.0098***	-0.0179***
	[2.82]	[5.24]

Year Fixed Effects	Yes	Yes
Firm Fixed Effects	Yes	No
State-county Fixed Effects	No	Yes
Industry Fixed Effects	No	Yes
Observations	22,462	22,462
Adjusted R^2	0.717	0.699
F	354.9244	493.6043

Table 4 reports the OLS regression estimates of model (1). Variable definitions are in Appendix A. *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels (two-tailed), respectively. t-statistics are presented in parentheses and are based on standard errors clustered at the firm level.

Table 5 | Impact of CEO characteristics on the relation between cost stickiness and neighbor firms.

Panel A: Impact of CEO tenure on the relation between cost stickiness and neighbor firms.

	Column (1) Δ_SG&A	Column (2) Δ_SG&A
Constant	-0.0111	-0.0149
	[1.52]	[1.39]
Δ_SALE	0.8112***	0.7489***
	[26.03]	[11.93]
DEC # Δ_SALE	-0.1965***	-0.2099**
	[2.98]	[2.05]
DEC # Δ_SALE # HIT	0.0593	0.0276
	[0.94]	[0.35]
DEC # Δ_SALE # NEIGHBOR	**0.1649****	**0.1139**
	[2.38]	**[0.99]**
DEC # Δ_SALE # AI	0.0030	-0.0045
	[0.22]	[0.13]
DEC # Δ_SALE # EI	-0.0715**	-0.1008
	[2.37]	[1.44]
DEC # Δ_SALE # CF	0.8270***	0.6122
	[3.58]	[1.43]
DEC # Δ_SALE # SUC_DEC	0.2119***	0.2437***
	[3.46]	[3.05]
Two-way interaction terms	Yes	Yes
Single terms	Yes	Yes
Sample	Low Tenure	High Tenure
Year Fixed Effects	Yes	Yes
Firm Fixed Effects	Yes	Yes
Observations	13,235	9,227
Adjusted R^2	0.745	0.656
F	249.5227	125.9878

Variable definitions are in Appendix A. *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels (two-tailed), respectively. t-statistics are presented in parentheses and are based on standard errors clustered at the firm level.

Panel B: Impact of CEO age on the relation between cost stickiness and neighbor firms.

	Column (1) Δ_SG&A	Column (2) Δ_SG&A
Constant	-0.0190**	-0.0149
	[2.04]	[1.42]
Δ_SALE	0.8210***	0.7999***
	[25.24]	[15.60]
DEC # Δ_SALE	-0.2115***	-0.2667***
	[3.01]	[3.01]
DEC # Δ_SALE # HIT	0.0578	0.0814
	[0.92]	[1.06]
DEC # Δ_SALE # NEIGHBOR	**0.1870****	**0.0964**
	[2.49]	**[1.20]**
DEC # Δ_SALE # AI	-0.0161	0.0250
	[1.12]	[0.73]
DEC # Δ_SALE # EI	-0.0541	-0.0626
	[1.48]	[1.27]
DEC # Δ_SALE # CF	0.5682**	1.0228***
	[2.36]	[2.60]
DEC # Δ_SALE # SUC_DEC	0.2062***	0.2317***
	[3.37]	[2.98]
Two-way interaction terms	Yes	Yes
Single terms	Yes	Yes
Sample	Low Age	High Age
Year Fixed Effects	Yes	Yes
Firm Fixed Effects	Yes	Yes
Observations	12,349	10,113
Adjusted R^2	0.732	0.690
F	212.8178	148.3192

Variable definitions are in Appendix A. *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels (two-tailed), respectively. t-statistics are presented in parentheses and are based on standard errors clustered at the firm level.

Panel C: Impact of CEO compensation on the relation between cost stickiness and neighbor firms.

	Column (1) Δ_SG&A	Column (2) Δ_SG&A
Constant	-0.0015	-0.0097
	[0.18]	[1.12]
Δ_SALE	0.7614***	0.8426***
	[20.59]	[21.92]
DEC # Δ_SALE	-0.1798***	-0.2150***
	[2.62]	[2.67]
DEC # Δ_SALE # HIT	0.0320	0.0684
	[0.52]	[0.91]
DEC # Δ_SALE # NEIGHBOR	**0.1851****	**0.0776**
	[2.35]	**[1.00]**
DEC # Δ_SALE # AI	-0.0043	-0.0035
	[0.36]	[0.13]
DEC # Δ_SALE # EI	-0.1144***	0.0076
	[2.94]	[0.20]
DEC # Δ_SALE # CF	0.8625***	0.3363
	[3.35]	[1.11]
DEC # Δ_SALE # SUC_DEC	0.2151***	0.1903***
	[3.39]	[2.83]
Two-way interaction terms	Yes	Yes
Single terms	Yes	Yes
Sample	Low Compensation	High Compensation
Year Fixed Effects	Yes	Yes
Firm Fixed Effects	Yes	Yes
Observations	11,231	11,231
Adjusted R^2	0.729	0.720
F	196.5769	211.4095

Variable definitions are in Appendix A. *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels (two-tailed), respectively. t-statistics are presented in parentheses and are based on standard errors clustered at the firm level.