Does stakeholder orientation improve firms' operations? Evidence from inventory management

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Abstract

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Keywords: constituency statutes; stakeholder orientation; inventory efficiency; supply chain uncertainty; firm performance

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We investigate whether and how firms' stakeholder orientation affects their inventory efficiency. Using U.S. state legislatures' staggered adoption of constituency statutes over a 24-year period (1984–2007) as a quasi-natural experiment, we demonstrate that greater stakeholder orientation significantly increases manufacturing firms' inventory efficiency. Further channel analysis reveals that stakeholder orientation improves inventory efficiency by shielding firms from the negative impact of supply chain uncertainty. Its effect strengthens for firms exposed to higher levels of uncertainty, and firms' perceived supply chain risk exposure decreases following the statutes' adoption. Additionally, we find that the importance of stakeholder relations significantly moderates the stakeholder orientation-inventory efficiency relationship: firms with higher human capital intensity or those operating in customer-focused industries and industries with low elasticity of supplier substitution benefit more. Finally, our mediation analysis suggests that the improvement in inventory efficiency serves as an important channel through which stakeholder orientation enhances firm value: more than 16% of the increase in firm value after the statutes' adoption can be explained by the increase in inventory efficiency.

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Introduction

The value relevance of stakeholder-friendly actions has been subject to longstanding debate over the past few decades. The shareholder expense view (Friedman, 1970; Pagano and Volpin, 2005; Cronqvist et al., 2009) argues that firms engage in socially responsible activities at the expense of shareholders, reducing firm profitability. In contrast, the stakeholder view contends that various stakeholders (e.g., employees, customers, suppliers) possess critical resources supporting firms' business operations, and therefore catering to their interests contributes significantly to firm value (Freeman et al., 1984; Jawahar and McLaughlin, 2001; Jensen, 2001). Consistent with the latter argument, recent studies show that stakeholder orientation tends to alleviate information asymmetry (Ni, 2020), reduce cost of capital (Gao et al., 2021), promote innovation (Flammer and Kacperczyk, 2016, Cook et al., 2019), increase investment efficiency (Cook et al., 2019), and improve firm value (Jo and Harjoto, 2011; Flammer and Kacperczyk, 2016). However, the literature largely neglects an important channel through which stakeholder orientation can affect firm value: firms' operations.[1] In this study, we fill the gap by investigating the association between stakeholder-friendly actions and firms' inventory management.

Stakeholder orientation facilitates information exchange between firms and their stakeholders and secures stakeholder support; it thus reduces the ex-ante probability of stockout (Uzzi, 1997; Lieberman et al., 1999; Branco and Rodrigues, 2006; Caligiuri et al., 2013). Additionally, it helps firms secure social capital from their stakeholders and provides an insurance-like protection benefit when negative events (i.e., stockouts) occur, thus reducing the ex-post cost of stockout (Goll and Rasheed, 2004; Godfrey, 2005; Luo and Bhattacharya, 2006;

[1] Barcos et al. (2013) appears to be the only study that utilizes a comprehensive sample to examine the relationship between socially responsible actions and corporate inventory policy. However, their study treats these actions as a simple reflection of the interests of various stakeholder groups and examines whether the political processes among them affect corporate inventory holdings. It does not view stakeholder orientation as a strategic choice firms make to increase inventory efficiency, which is the focus of our study.

Godfrey et al., 2009; Cachon and Olivares, 2010; Shiu and Yang 2017). Taken together, stakeholder orientation minimizes the impact of supply chain uncertainties, leading to lower expected stockout costs. According to the classical inventory theory, this results in a lower optimal inventory level or, equivalently, higher inventory efficiency.

A major challenge in empirically verifying the causal influence of stakeholder-friendly actions on inventory efficiency is to solve endogeneity problems since the two are likely to be jointly determined during firms' decision-making process. For example, several unobservable firm characteristics, including higher managerial ability, could lead to both an efficient inventory level and more stakeholder-friendly actions. If this is the case, an apparently positive relationship between the two could be spurious. A reverse causality issue could also occur, wherein higher inventory efficiency may lead to better firm performance. This, in turn, may enable firms to devote more resources to the pursuit of stakeholders' interests.

To address the problems mentioned above, we exploit the staggered adoption of constituency statutes in the United States—that is, state-level laws that allow firms' boards of directors to consider stakeholders' interests when making business decisions. Using this law change to measure stakeholder orientation constitutes a quasi-natural experiment, wherein the variations in the level of firms' devotion to stakeholders are exogenous. To further alleviate endogeneity concerns, we conduct the analysis in a rigorous way by adding both "industry × year" and "(operating) state × year" fixed effects. The former controls for unobserved time-varying heterogeneity across industries, which is essential, given that inventory management practices are industry-specific (Eroglu and Hofer, 2011). The latter controls for time-varying differences in local conditions (e.g., economic and political conditions) that could influence firms' stakeholder and inventory policy simultaneously.

Focusing on a sample of 5,026 U.S. manufacturing firms from 1979 to 2012, we perform a difference-in-

differences (DID) analysis, wherein the treatment sample consists of firms incorporated in states that adopted constituency statutes. Our evidence supports the view that stakeholder orientation improves firms' operational efficiency. Our baseline result shows that the enactment of the statutes leads to an economically significant 4.2% increase in inventory turnover for the treatment firms relative to firms incorporated in states that did not pass such statutes. The result remains intact after a battery of robustness tests, namely when we use different measures of inventory efficiency, focus on different subsamples, control for different combinations of fixed effects, address the potential concern on time-varying treatment effects (Baker et al., 2022), and consider the potential effects of other important law changes during our sample period. We further document that the turnover of disaggregated inventory components (raw material, work-in-process, and finished goods) all increases after the passage of constituency statutes. Additionally, our baseline findings hold if we switch our focus from manufacturing to retailing firms, given the increased attention to these firms' inventory policies in recent years (Chuang et al., 2019).

We next examine the underlying channel driving our results. We start by investigating the moderating effect of industry uncertainty on the stakeholder orientation-inventory efficiency relationship. Consistent with the argument that supply chain uncertainty could be the underlying factor through which stakeholder orientation affects inventory efficiency, the results show that its effect is most evident in firms operating in a dynamic industry environment. Importantly, we also directly examine the effect of stakeholder orientation on firms' supply chain risk exposure. We first follow Wu (2024) and construct a firm-level supply chain risk exposure measure by applying machine learning techniques (a combination of word-embedding and sentiment analysis) to the Management Discussion and Analysis (MD&A) section texts of firms' 10-Ks. Building on this measure, we confirm that firms incorporated in constituency adoption states experience a significant reduction in supply chain risk exposure, which enables them to hold less optimal inventory to improve efficiency.

We also investigate the heterogenous effect of stakeholder orientation across different firms. We find that its influence is conditional on how important stakeholder relations are for the firms. Specifically, firms relying more on human capital (and thus, employee relations), firms operating in business-to-consumer (B2C) industries (for which customer relations are important) and industries with lower elasticity of supplier substitution (for which supplier relations are important) benefit more from the adoption of constituency statutes.

Before concluding the paper, one important question remains: Is the increase in inventory efficiency caused by the adoption of constituency statutes value-enhancing? To address this, we perform a mediation analysis. After confirming that stakeholder orientation improves manufacturing firms' financial performance, we demonstrate that one important channel through which its value-enhancing role manifests is improvement in inventory efficiency. Notably, more than 16% of the increase in firm value after the statutes' adoption can be explained by the increase in inventory efficiency.

Our study makes several contributions to the literature. First, by employing a quasi-natural experiment regarding constituency statutes adoption, we uncover the causal impact of stakeholder attention on inventory efficiency, which is typically hard to identify due to the endogenous nature of stakeholder policy. In doing so, we add to the literature on the value-relevance of stakeholder orientation. This literature has focused on various channels through which stakeholder orientation improves firm value such as innovation (Flammer and Kacperczyk, 2016; Cook et al., 2019), cost of capital (Gao et al., 2021), and investment efficiency (Cook et al., 2019). Our study uncovers another important channel: stakeholder orientation can increase firm value through the production process (i.e., by improving operational efficiency).

Second, understanding the determinants of inventory efficiency is an important research question in economics, accounting, and operations management literature. Existing studies have focused on an extensive list

of internal and external factors including capital structure (Carpenter et al., 1998), demand uncertainty (Rumyantsev and Netessine, 2007), production technology (Lieberman et al., 1999; Mishra et al., 2013), customer and supplier concentration (Ak and Patatoukas, 2016; Casalin et al., 2017), corporate governance (Elsayed and Wahba, 2013; Feng et al., 2015), and product market competition (Olivares and Cachon, 2009; Gao et al., 2015), among many others. We extend this line of research by emphasizing the role of institutional factors, particularly stakeholder legislation, in shaping firms' inventory efficiency levels.

Finally, our study is related to the strand of empirical studies on the determinants and consequences of supply chain risk, which is especially important nowadays given the increasing uncertainties in global supply chains caused by geopolitical disputes (like the trade war between U.S. and China), natural disasters (like the Tohoku earthquake and tsunami), and epidemic outbreaks (like the COVID-19 outbreak). Unlike existing studies that primarily relies on different proxies of supply chain risk exposure (e.g., Hendricks and Singhal (2003)), we focus on a comprehensive measure constructed from textual analysis of firms' 10-Ks and show that stakeholder orientation could be a critical strategy for firms to handle supply chain risk, which we believe can lead to valuable managerial implications.

The remainder of the paper is organized as follows. "Literature Review and Hypotheses Development" section presents a brief literature review and develops our research hypothesis. "Data, Sample, and Methodology" section describes the data, sample, and empirical design. "Empirical Results" section presents and discusses our empirical results. Finally, "Conclusion" concludes the paper.

Literature Review and Hypothesis Development

Inventory management is a critical component of business strategy. The ability to maintain optimal stock levels—ensuring products are available when needed, meeting quality specifications, and minimizing costs—is essential

for sustaining efficient operations. Not surprisingly, the factors driving firms' inventory investment have been extensively studied in the economics, accounting, and operations management literature.

One stream of the literature focuses on the influence of different stakeholders in firms' production networks. For example, Olivares and Cachon (2009) investigate the role of competitors and document that intensified product market competition increases the buffer stock firms need to hold. Conversely, Gao (2015) shows that when firms face less market competition, they tend to hold more inventory because they can sell excess stock without lowering price. Ak and Patatoukas (2016) explore how customer concentration affects inventory management through two lenses: bargaining power and collaboration. Their findings reveal that firms with concentrated customer bases maintain higher inventory efficiency, suggesting that close customer collaboration, rather than power dynamics, drives inventory decisions. In contrast, Casalin et al. (2017), relying on a sample of Chinese manufacturing firms, document evidence that customer concentration is negatively associated with inventory efficiency. It is supplier density, not customer, that reduces the inventory level.

We explore another aspect of the stakeholder relationship from a firm-centered perspective—stakeholder orientation—as an important determinant of inventory efficiency. The reasons are two-fold. First and most importantly, catering to stakeholders' interests lowers the ex-ante probability of stockout and, thus, the safety stocks that firms need to hold. Specifically, stakeholder orientation reduces the supply chain uncertainties that firms face, which is the major reason for holding just-in-case stock.

According to Davis (1993), uncertainty in the supply chain takes on three forms: supply uncertainty, process uncertainty, and demand uncertainty. Stakeholder orientation enables firms to deal with all three kinds of uncertainties. Building on stakeholder theory and the resource-based view, a large body of literature shows that stakeholder-friendly actions facilitate information exchange between firms and their various stakeholders (Uzzi,

1997; Branco and Rodrigues, 2006). This is especially valuable in a dynamic environment, in which information processing is difficult (Milliken, 1987). Additionally, stakeholder orientation leads to better stakeholder support (Caligiuri et al., 2013). In the context of operational decisions, this means that firms with good relationships with their stakeholders can reduce supply chain uncertainty and the probability of stockout. For example, better employee relationships lead to a higher level of employee engagement, reducing worker errors (even machine failures) and process uncertainty (Lieberman et al., 1999). Better communication with suppliers and customers can synchronize the scheduling of upstream and downstream production, leading to lower supply and demand uncertainty (Milgrom and Roberts, 1988). Preferred treatment from suppliers ensures priority in obtaining raw materials when suppliers' capacity is limited (probably owing to disruptions), further leading to lower supply uncertainty.

Second, better relationships with stakeholders can also reduce the ex-post cost of supply chain uncertainty. An extensive body of strategy literature shows that, by catering to the interest of stakeholders, firms can accumulate a certain form of goodwill that acts as "insurance-like" protection when facing negative events (Goll and Rasheed, 2004; Godfrey, 2005; Godfrey et al., 2009; Shiu and Yang, 2017). That is, stakeholder-friendly actions help firms obtain critical resources from different stakeholders (e.g., employees, customers, and suppliers) in highly volatile environments and reduce the risk of losing these resources amid unpredictable events that could hurt the interests of some stakeholder groups (e.g., product quality problems, stockouts). For example, stakeholder-friendly initiatives help develop customer loyalty (Luo and Bhattacharya, 2006). The longer waiting period by these customers enables firms to hold less safety stock even when facing higher uncertainty levels (Cachon and Olivares, 2010). Improved employee engagement levels lead to higher labor productivity and substantial improvement in production cycle times (Manz and Sims, 1987; Versteeg, 1990). This means a stockout,

even if it does occur, lasts for a shorter duration. Higher supplier satisfaction enables firms to receive preferred customer treatment from their suppliers, who are willing to supply in a timely manner in the event of a stockout (Baxter, 2012; Schiele et al., 2012). This again reduces the duration of the stockout.

Taken together, firms maintaining good relationships with their stakeholders are less exposed to supply chain uncertainties and have a lower level of expected stockout cost. According to the classical inventory theory, this leads to our first hypothesis:

Hypothesis 1: Stakeholder orientation lowers firms' optimal inventory level or, equivalently, increases their inventory efficiency.

If we confirm a causal effect of stakeholder orientation on inventory efficiency, a related question is as follows: How does stakeholder orientation influence disaggregated inventory components, that is, raw materials, work-in-process, and finished goods? The question is important because these components have different determinants, show different trends over time, and contribute differently to overall firm performance. For example, the raw material inventory is determined by supplier relations and communications, transaction costs, quality problems, and obsolescence, among others (Lieberman et al., 1999; Eroglu and Hofer, 2011; Hopp and Spearman, 2011); work-in-process inventory mainly relies on firms' production capabilities, including machine layout, employee skills, and process fragility (Lieberman et al., 1999; Hopp and Spearman, 2011); and finished goods inventory depends primarily on customer responsiveness, forecast errors, and production variability (Lieberman et al., 1999; Cachon and Olivares, 2010; Hopp and Spearman, 2011). As a result, while overall inventory efficiency has improved over the past several decades, the improvement levels have differed across different inventory components. Most of the reduction in overall inventory holding has been found to come from improvements in work-in-process inventories, followed by raw materials; finished goods inventories have barely changed (Chen et

al., 2005; Capkun et al., 2009). In terms of value relevance, previous studies find that the efficiency of all three components positively correlates with financial performance. The correlation is highest for raw materials, followed by finished goods and work-in-process (e.g., Capkun et al., 2009; Eroglu and Hofer, 2011).

We argue that stakeholder-friendly actions can have positive effects on the efficiency of all three components by encouraging firms to cater to the interests of suppliers, employees, and customers. An improved relationship with suppliers can improve communication and promote supplier satisfaction, thus enhancing firms' resilience to negative supply side shocks and allowing them to carry lower levels of raw materials; a better relationship with employees can also increase employee engagement, attract skilled labor, and increase production capability, thus reducing the need to hold more work-in-process inventory owing to process uncertainty (Lieberman et al., 1999; Chen et al., 2005); catering to customers' interest can facilitate information exchange and increase customer loyalty, thus enabling firms to hold fewer finished goods even when facing higher demand uncertainty (Cachon and Olivares, 2010). This leads to our second hypothesis:

Hypothesis 2: The positive effect of stakeholder orientation holds for all three disaggregated components of overall inventory, namely, raw materials, work-in-process, and finished goods.

Additionally, if stakeholder orientation does improve inventory efficiency by reducing the influence of supply chain uncertainties, its effect should be heterogeneous across different firms, as they operate in different environments and face different uncertainty levels. Specifically, firms dealing with a higher level of uncertainty could benefit more from stakeholder orientation. We focus on the uncertainty at the industry level following the literature (Kovach et al., 2015; Chuang et al., 2019), and have the following hypothesis:

Hypothesis 3a: Compared with firms operating in a stable environment, firms operating in industries with higher uncertainty levels benefit more from stakeholder orientation.

We also expect stakeholder orientation to have a direct effect on firms' own supply chain uncertainty exposure, that is:

Hypothesis 3b: Stakeholder orientation lowers firms' overall supply chain uncertainty exposure.

Another implication from the above discussion is that the resources that stakeholders possess (e.g., customer loyalty, employee engagement, supplier satisfaction, and information-sharing motive) must be of critical importance to firms. It is unlikely that catering to stakeholders who have little influence over firms' operations can result in a real change in corporate behavior, including inventory performance. This leads to the following hypothesis:

Hypothesis 4: The positive effect of stakeholder orientation is conditional on how important stakeholder (e.g., employee, customer, and supplier) relations are for the firms; that is, the more important the relations, the stronger the influence.

Finally, a strand of literature investigates the relationship between inventory efficiency and financial performance—that is, the value-relevance of inventory efficiency (Chen et al., 2005; Eroglu and Hofer, 2011). These studies generally find a positive relationship between the two, albeit a nonmonotonic one. For example, Eroglu and Hofer (2011) find an inverted U-shaped relationship between inventory efficiency and ROA (ROS), suggesting the existence of an optimal inventory level. Given this literature, one important question that remains is whether the improvement in inventory efficiency caused by better stakeholder orientation (if we find any) is optimal, in the sense that it further leads to better financial performance. This leads to the following hypothesis:

Hypothesis 5: The improvement in inventory efficiency (**Hypothesis 1**) should be value-enhancing, that is, reduction in inventory represents an important channel through which stakeholder orientation increases firm value.

As mentioned earlier, our study tests these hypotheses by using the exogenous adoption of state-level constituency statutes.[2]

Data, Sample, and Methodology

Data and Sample

We obtain financial data from Compustat and stock price information from the Center for Research in Security Prices (CRSP). Information on firms' historical incorporation is acquired from two data sources: the Compustat-CRSP merged database for the period after 2008 and the 10K/Qs header section data from Bill McDonald's website for the period between 1993 and 2007.[3] For the period before 1993, we assume firms did not change their state of incorporation.[4]

Given the importance of inventory policy for manufacturing firms, we focus on all the publicly listed U.S. firms in the manufacturing sector (SIC codes 2000–4999) following the literature. Our sample period spans from 1979, five years before the first adoption of constituency statutes (in Ohio in 1984), to 2012, five years after the re-enactment of the statutes by Nebraska in 2007.[5] We exclude firm-year observations with negative total assets, sales, and cost of goods sold (COGS). To prevent our results from being driven by outliers, we winsorize all firm-level variables at the 1% and 99% levels. This leaves us with a final sample of 5,026 unique firms, with 63,604

[2] Section 1 of our Internet Appendix provides some institutional background on constituency statutes in the U.S.
[3] https://sraf.nd.edu/data/augmented-10-x-header-data/.
[4] We believe this is a valid assumption because changes of incorporation are rare. For example, none of the 587 Forbes 500 companies changed their state of incorporation between 1984 and 1991.
[5] We also experiment with different sample periods, including three years before the first and three years after the last adoption of constituency statutes (1981–2010) and one year before the first and one year after the last adoption of constituency statutes (1983–2008). Our results (available upon request) remain intact.

firm-year observations.

Our primary variable of interest, $Constituency\ Statutes$ is an indicator variable equal to one for firms incorporated in states that adopted constituency statutes and zero otherwise. The key dependent variable is $Inventory\ Efficiency$ defined as the ratio between COGS and average inventory.[6] Here, average inventory is the arithmetic mean of inventory levels at the current and previous fiscal year-end. For firms that use Last In, First Out (LIFO) accounting, we convert the LIFO inventory into First in, First Out (FIFO) inventory by adding the LIFO reserve to the LIFO inventory (FIFO Inventory = LIFO Inventory + LIFO Reserve). [7]

We control for several firm characteristics that are known determinants of inventory efficiency. Specifically, we include firm size to control for the potential effect of economies of scale or differing levels of inventory fluctuation between large and small firms (Carpenter et al., 1998; Eroglu and Hofer, 2011). Leverage is also controlled for, as high leverage might diminish firms' ability to finance inventory investments (Carpenter et al., 1998). Gross margin is added to account for inventory underage cost, where higher margins indicate greater profit loss from insufficient inventory (Silver et al., 1998). We also control for sales growth which captures growth opportunity and lead time, another important indicator of higher inventory (Rumyantsev and Netessine, 2007). Detailed definitions of the variables are reported in the Appendix.

Panel A of Table 1 shows the descriptive statistics of the main variables. For example, the mean value of inventory efficiency is 5.287; that is, the COGS is, on average, 5.287 times the average inventory level. The constituency statutes adoption indicator $Constituency\ Statute$ has a mean value of 0.257. Also, the sample firms have an average size of 4.662 (corresponding to a book asset value of 105.8 million dollars) and a book leverage

[6] Untabulated analyses (available upon request) show that the results remain intact if we scale inventory using sales instead of COGS, or use current fiscal year-end inventory instead of the average value.

[7] Unlike several studies (e.g., Chen et al. 2005; Mishra et al., 2013), we do not adjust our inventory efficiency measure at the industry level in the main analysis, as we control for industry × year fixed effects to address the fact that inventory management practices can be industry-year-specific (while controlling for other time-variant, industry-specific shocks). Nonetheless, in one of our robustness tests, we use an alternative inventory efficiency measure that is standardized at the four-digit SIC code level.

ratio of 0.546.

Panel B presents the pairwise correlation matrix. There appears to be a negative association between inventory efficiency and the constituency statutes indicator (with a correlation coefficient of -0.027), contradicting our argument. However, the simple correlation coefficient provides limited insight into the actual relationship between stakeholder orientation and inventory efficiency, as firm and year-fixed effects are not controlled for.[8] Therefore, to tease out the real effect of stakeholder orientation, we use the multivariate regression design outlined below.

Empirical Design

We use the staggered adoption of constituency statutes across 35 U.S. states to assess the effect of stakeholder orientation on inventory efficiency; these states passed the statutes at different points in time. This process enables us to exploit the exogenous variation in stakeholder orientation among firms incorporated in different states, and thus compare the before/after effect of statutes adoption in the treatment group and the before/after effect in the control group (firms incorporated in non-constituency-statutes-adopting states). Essentially, we closely follow Bertrand and Mullainathan (2003), and perform a DID analysis with multiple treatment groups and multiple time periods by estimating the following regression:

$$Inventory\ Efficiency_{i,s,l,j,t} = \alpha_0 + \alpha_i + \alpha_l\alpha_t + \alpha_j\alpha_t + \beta Constituency\ Statutes_{s,t} + \theta' Firm\ Characteristics_{i,s,l,j,t} + \varepsilon_{i,s,l,j,t} \quad (1)$$

where i indexes firm, s indexes state of incorporation, l indexes state of operation, j indexes industry, and t indexes year. α_i, $\alpha_l\alpha_t$, and $\alpha_j\alpha_t$ denote the firm, state of operation × year, and industry × year fixed effects,

[8] Additionally, if we decompose inventory into its three separate components (raw materials, work-in-process, and finished goods), the results are highly inconsistent: While raw material efficiency maintains a negative correlation with the constituency statutes indicator, work-in-process efficiency has a positive correlation. For finished goods, the correlation coefficient is insignificant. These results further suggest that the simple correlation results could be spurious.

respectively. $Firm\ Characteristics_{i,s,l,j,t}$ stands for a set of time-variant firm characteristics, namely, *Size*, *Leverage*, *Gross Margin*, *Sales Growth*, and *Lead Time*. $\varepsilon_{i,s,l,j,t}$ denotes the error term. Standard errors are clustered at the incorporation state level to address the potential serial correlations among firms incorporated in the same state. The coefficient of interest is the β, which measures the effect of stakeholder orientation on inventory efficiency. [9]

As illustrated by Bertrand and Mullainathan (2003), this type of specification possesses at least two appealing features that can help us identify the causal effect of constituency statutes adoption. First, given that different states passed the statutes at different times, we have multiple treatment and control groups in our analysis. According to Angrist and Pischke (2008), this helps reduce the potential bias and noise when relying on static treatment/control groups. Second, in addition to firm and industry × year fixed effects, we also include operating state × year fixed effects to address potential local political, social, and economic conditions in a given year that may influence both inventory efficiency and the passage of constituency statutes. This is possible owing to the incongruence between the state of incorporation and the state of operation (i.e., the headquarters location) for a large proportion of U.S. public firms (Bertrand and Mullainathan, 2003).

Empirical Results

Stakeholder Orientation and Inventory Efficiency

Baseline Regression and Subsample Analysis

We begin our main analyses by examining whether the adoption of constituency statutes affects firms' inventory efficiency. The regression results of Equation (1) are presented in Table 2. In Column 1, we do not control for firm

[9] The above identification strategy relies on two critical assumptions: 1) constituency statutes adoption is not related to the prevailing inventory efficiency of firms incorporated in the same state; and 2) constituency statutes adoption leads to significant changes in firm behavior regarding stakeholder orientation. Section 2 of our Internet Appendix provides evidence that these assumptions are valid.

characteristics and include only the fixed effects. The coefficient of $Constituency\ Statutes$, the indicator of law change, is positive and statistically significant at the 1% level. Our baseline result is presented in Column 2. After controlling for firm characteristics, the coefficient of $Constituency\ Statutes$ is 0.219 and significant at the 1% level, suggesting that statutes adoption improves inventory efficiency. Importantly, the economic significance is meaningful: following the adoption of constituency statutes, the inventory efficiency of firms incorporated in the adoption states increases by 4.2% at the mean value of 5.287 (0.219/5.287).

In the remaining columns of Table 2, we repeat the baseline regression to see if our results hold for different subsamples. We first exclude firms incorporated in the state of Delaware from our initial sample. As shown in Column 3, a large proportion of our sample firms are incorporated in Delaware.[10] Since Delaware never introduced constituency statutes, firms incorporated in that state always enter the control group. Accordingly, if Delaware firms hold more inventories over time, our main results shown in Column 2 could be spurious and simply reflect this Delaware trend. The results in Column 3 suggest that this is not the case: after excluding Delaware-incorporated companies, the coefficient of $Constituency\ Statutes$ remains positive and significant at the 5% level.

Second, as Table IA1 of the Internet Appendix shows, most constituency statutes (27 out of 35) were adopted before 1990. Given that our sample period ranges from 1979 to 2012, our sample is imbalanced, with more "after" than "before" years. To alleviate the concern that our main results are driven by firms incorporated in states that adopted the statutes before 1990, we exclude them from our sample and re-estimate the baseline regression. Column 4 shows the results. After excluding the pre-1990-adoption states, we have 45,518 firm-year observations or 68.4% of our initial sample. The coefficient of $Constituency\ Statutes$ remains positive and highly significant

[10] This is consistent with previous findings that more than half of public firms in the United States are Delaware incorporated (Bebchuk and Cohen, 2003).

(at the 5% level), suggesting that our results are not affected by the inclusion of the early-adoption states.

Third, our sample covers the post-2000 period, which witnessed the massive use of computer technology in inventory management. Given that information technology improves inventory efficiency (Mishra et al., 2013), the positive coefficient of $Constituency\ Statutes$ might merely reflect this information technology effect in the latter half of our sample period. To alleviate this concern, we limit our sample to the pre-2000 period, and the results are shown in Column 5. With this smaller sample, the coefficient of $Constituency\ Statutes$ is still positive and statistically significant at the 1% level. Moreover, the magnitude of the coefficient is larger than that of the entire sample. Thus, it is unlikely that our result is driven by the information technology factor.

Fourth, firms may make re-incorporation decisions in response to the passage of constituency statutes. Companies that are more stakeholder-friendly may re-incorporate in adoption states, and companies that care more about shareholders' interests may re-incorporate in non-adoption states. This behavior may give rise to self-selection problems. We address this concern by excluding firms that made re-incorporation decisions during our sample period. The results are shown in Column 6. Consistent with the literature, firms that changed their state of incorporation represent a small fraction of our sample (less than 6%). The coefficient of $Constituency\ Statutes$ is 0.343 and statistically significant at the 1% level, confirming that our initial result is not driven by the potential selection issue caused by re-incorporation.

Finally, we address the potential concern that some of the states never passed constituency statutes during our sample period (i.e., firms incorporated in these states remain in the control group). Our results could thus be driven by unobservable differences between the treatment and control groups. To alleviate this concern, we focus only on the subsample of firms that eventually receive treatment. The results in Column 7 show that the coefficient of $Constituency\ Statutes$ stays positive and significant despite the sample size decreasing by more than half,

indicating that our results are not sensitive to the unobservable differences between firms incorporated in adoption versus never-adoption states.

A closer analysis of the results also shows that the control variables generally have the expected effects. First, firm size has a negative and significant coefficient across all samples, suggesting that larger firms face greater inventory fluctuations (Elsayed and Wahba, 2013). Second, leverage is negatively associated with inventory holdings, providing evidence that higher leverage may weaken firms' ability to finance inventory investment (Carpenter et al., 1998). Third, firms' profitability, as proxied by gross margin, shows a negative and significant coefficient. This finding is in line with the argument that firms with higher gross margins are more likely to experience larger profit losses when failing to hold sufficient inventories (underage cost) and, therefore, stock more inventory (Silver et al., 1998; Rumyantsev and Netessine, 2007). Fourth, firms with higher growth opportunities are shown to have higher levels of inventory efficiency, as evidenced by the positive and significant coefficient of sales growth. Finally, as expected, more lead time, or delay, is shown to have a negative effect on inventory efficiency.

Overall, the results in Table 2 provide evidence that strengthened stakeholder orientation, as measured by the passage of constituency statutes, improves manufacturing firms' inventory efficiency.[11] These results, significant from both the statistical and economic perspectives, provide strong support for the main hypothesis of our study (**Hypothesis 1**).

The Pre-treatment Trends

In gauging the causal influence of stakeholder orientation using the DID research design, one critical identifying

[11] In the Section 3 of the Internet Appendix, we also investigate the effect of stakeholder orientation on the inventory efficiency of retailing firms. The result is even stronger: constituency statute adoption leads to a 9.55% increase in inventory turnover for retailers, compared with 4.2% for manufacturers.

assumption is the parallel trends assumption, whereby the outcome variable (inventory efficiency) is expected to exhibit similar trends in the treatment and control groups in the absence of the treatment (the adoption of constituency statutes). Therefore, to further examine the validity of the causal interpretation of stakeholder orientation's effect, we assess the dynamics of the treatment effect. Specifically, we follow Gao et al. (2021) and re-estimate Equation (1) by introducing three additional explanatory variables: $Constituency\ Statutes^{0}$, $Constituency\ Statutes^{-1}$, and $Constituency\ Statutes^{-2}$, which are indicator variables capturing the years relative to the year of constituency statutes adoption. For example, $Constituency\ Statutes^{-1}$ is set to one to indicate one year before the passage of the statutes and zero otherwise. To assess whether parallel trends exist, one should focus on the coefficients of these three variables: a significant coefficient of any of these variables would indicate significant differences between the treatment and control groups even before the adoption years.

The results are presented in Table 3. Column 1 shows the results for the entire sample. While the coefficient of $Constituency\ Statutes$ remains positive and significant, the coefficients of $Constituency\ Statutes^{0}$, $Constituency\ Statutes^{-1}$, and $Constituency\ Statutes^{-2}$ are small in magnitude (-0.014, 0.06, and 0.034, respectively) and statistically indistinguishable from zero. Therefore, no difference in inventory efficiency between the treatment and control groups is identified before the state-level law change.

In Columns 2 to 6, we replicate the subsample analyses in Table 2, where we exclude Delaware-incorporated firms, firms incorporated in pre-1990-adoption states, post-2000 observations, re-incorporated firms, and firms incorporated in states that never passed constituency statutes. The results are similar to those in Column 1. First, the coefficients of $Constituency\ Statutes$ maintain their statistical significance (as in Table 2), and the magnitudes of the coefficients do not change much. Second, the coefficients of $Constituency\ Statutes^{0}$, $Constituency\ Statutes^{-1}$, and $Constituency\ Statutes^{-2}$ are statistically insignificant.

Robustness Tests

We conduct a number of robustness tests to further check the validity of our main result—that stakeholder attention improves inventory efficiency. The results are reported in Table 4.

In Column 1, we use an alternative measure of inventory efficiency (*Adj. Inv. Eff.*). Following Chen et al. (2005) and Mishra et al. (2013), we standardize our original inventory efficiency measure at the four-digit SIC code level to account for industry-specific inventory management practices. Using this new measure, $Constituency\ Statutes$ still exhibits a positive and significant (at the 5% level) coefficient. Alternatively, we measure inventory efficiency using the empirical leanness indicator (*ELI*) developed by Eroglu and Hofer (2011) in Column 2. Still, the coefficient of $Constituency\ Statutes$ is positive and significant at the 1% level. These results, taken together, suggest that our results are not driven by a specific measure of inventory efficiency.

Columns 3 and 4 further report the results of our baseline regression by sequentially dropping industry × year and operating state × year fixed effects. Again, the coefficients of $Constituency\ Statutes$ remain positive and significant, indicating that our results are not sensitive to the inclusion of certain fixed effects.

Furthermore, our DID analyses exploit variations in treatment timing across different states, which means that a particular firm from an eventual adoption state can belong to both the control and treatment groups in different periods. According to Baker et al., (2022), this staggered design may lead to estimation bias depending on the weights of each group. To alleviate this concern, we first follow Deshpande and Li (2019) and conduct a stacked regression analysis. Specifically, a separate dataset is created for each adoption year using a five-year window before and after the adoption.[12] In each dataset, firms incorporated in states that passed the statutes are selected into the treatment group, and those in states that did not pass the statutes until the end of the time window

[12] The results (available upon request) are highly consistent even if we focus on different time windows: three and four years before and after the statutes adoption.

form the control group. Then, all the datasets are stacked into one and the DID regression is re-conducted. The results are shown in Column 5. With this alternative specification, the coefficient of $Constituency\ Statutes$ remains positive and statistically significant at the 1% level. Importantly, its magnitude barely changes compared with the baseline regression result (0.213 versus 0.219).

Additionally, we apply the Callaway and Sant'Anna (2021) estimator to estimate the static average treatment effect of the treated (ATT). We add control variables and include firm, industry × year, and state × year fixed effects. The result (ATT) is reported in Column 6. Again, the coefficient estimate is comparable to the baseline result both in terms of magnitude (0.245 versus 0.219) and statistical significance (significant at the 1% level). Collectively, these results suggest that our findings are robust to the recent concerns related to the canonical staggered DID model.

Finally, we consider potential confounding events. During our sample period, 36 U.S. states adopted antitakeover-related laws, namely, Business Combination Law, Fair Price Law, and Control Share Acquisition Law. These laws weaken the market's corporate governance role by insulating managers from the threat of hostile takeovers (Bertrand and Mullainathan, 2003). Therefore, if governance plays a role in shaping firms' inventory management policy (Elsayed and Wahba, 2013; Feng et al., 2015), our results could be contaminated by the adoption of these antitakeover laws.

To alleviate this concern, we explicitly include an indicator variable for the aforementioned law changes, one at a time, in our baseline regression to perform three horse-race tests. As shown in the last three columns of Table 4, the coefficients of $Constituency\ Statutes$ maintain their statistical significance at least at the 5% level. Also, the magnitudes of the coefficients remain the same as those in the second column of Table 2, suggesting that the positive effect of constituency statutes is not driven by changes in antitakeover laws.

Efficiency of Different Inventory Components

We also explore the impact of stakeholder orientation on the efficiency of disaggregated inventory components (**Hypothesis 2**). Specifically, we re-estimate Equation (1) by replacing overall inventory efficiency with the efficiency measures of the three inventory components. $RM\ Efficiency$ is computed as the ratio between COGS and the average raw material value, adjusted for LIFO inventory accounting; $WIP\ Efficiency$ and $FG\ Efficiency$ are computed similarly.[13]

The results are shown in Table 5. One immediate observation is that the sample size shrinks by almost half. This is because not all firms disclose detailed information on inventory components, which is typically available from the notes to financial statements. To ensure that our results are not driven by the reduction in sample size, we first replicate our baseline regression using this smaller sample. The results in Columns 1 and 5 show that the coefficients of $Constituency\ Statutes$ are 0.208 and 0.182, respectively, which are fairly comparable to the results in Columns 1 and 2 of Table 2.

We next turn to investigate the effect of constituency statutes adoption on raw material efficiency. As shown in Columns 2 and 6, the coefficients of $Constituency\ Statutes$ are 0.724 and 0.677, and significant at the 5% level. Given $RM\ Efficiency$'s mean of 13.133, this indicates that raw material efficiency improves by 5.2% after the state-level law change if firm controls are included. As for work-in-process, the coefficient of $Constituency\ Statutes$ is 2.092 and significant at the 10% level when we control for firm characteristics (Column 7). That is, relative to control firms, treatment firms' work-in-process efficiency increases by 6.6%. Finally, the results for finished goods efficiency are shown in Columns 4 and 8. The coefficient of $Constituency\ Statutes$ is 2.254 when we add firm controls, suggesting a 14.9% relative increase in finished

[13] Since LIFO reserve disclosures are not available for disaggregated inventory components, we follow Ak and Patatoukas (2016) and allocate the LIFO reserve based on the value of the three components relative to total inventory.

goods efficiency after the law passage. We argue that this is an important finding that could lead to valuable managerial implications. Specifically, given the critical role of finished goods efficiency in improving profitability and reducing overhead costs, a business strategy that enhances finished goods inventory efficiency may have high value relevance. As the results in Table 5 show, one such strategy is catering to stakeholders' interests.

Channel Analysis

After confirming the influence of stakeholder orientation on inventory efficiency, we next investigate the channel underlying its effect, namely, supply chain uncertainty.

Industry Demand Uncertainty and the Effect of Stakeholder Orientation

We argue that the reason for the positive effect of stakeholder attention stems from its strategic function in attenuating the negative influence of supply chain uncertainties firms face. If this is correct, we should observe a different effect of stakeholder orientation across firms facing different levels of uncertainty in their operating environment. To verify this (**Hypothesis 3a**), we focus on demand uncertainty at the industry level.

First, while the vast strategy literature considers demand uncertainty as the dominant force in firms' operating environment, influencing their decisions and performance (e.g., Keats and Hitt, 1988), the inventory theory also suggests that it is a major reason for carrying inventory (Nahmias and Olsen, 2015). Second, unlike process uncertainty or supply uncertainty, the literature has developed a well-established measure of demand uncertainty (Dess and Beard, 1984), enabling us to empirically investigate its moderating role.

Specifically, we regress logged sales value at the four-digit SIC-code level on time (year) over a five-year period and obtain our measure of demand uncertainty by taking the antilogarithm of the slope coefficient's standard error. As argued by Keats and Hitt (1988), a higher standard error proxies for greater instability or sales uncertainty: increased variation in sales makes it more difficult to plan production. Using this measure, we divide

our full sample according to the level of industry-wide demand uncertainty and perform a subsample analysis. Firms in industries with an average demand uncertainty that exceeds the global median during our sample period are placed in the high-demand uncertainty subsample; otherwise, they enter the low-demand uncertainty subsample.

Table 6 presents the results. In Column 1, for firms operating in relatively stable environments (characterized by low demand uncertainty), the coefficient of $Constituency\ Statutes$ remains positive and statistically significant at the 10% level when firm characteristics are not controlled for. However, the magnitude of the coefficient is smaller compared to the baseline regression result. When firm controls are introduced in Column 3, the coefficient becomes statistically insignificant.

In contrast, for firms operating in highly dynamic environments, a markedly different pattern emerges. As shown in Columns 2 and 4, the coefficient of $Constituency\ Statutes$ is highly significant at the 1% level, regardless of whether control variables are included or not. Notably, the magnitudes of the coefficients are more than twice those observed in the low-demand uncertainty group (0.478(0.409) versus 0.230(0.182)). Furthermore, the difference in these coefficients is statistically significant, with an *F*-statistic of 2.92 when firm controls are included.

The economic significance of these results is also notable. For firms in the high-demand uncertainty group, the coefficient of 0.409 corresponds to a 7.8% increase in inventory efficiency (calculated as 0.409 divided by 5.241, the mean value of inventory efficiency for these firms). This is nearly twice the magnitude of the corresponding result reported in Table 2 (4.2%).

The Effect of Stakeholder Orientation on Supply Chain Risk Exposure

To further confirm the supply chain uncertainty channel, we directly investigate the effect of stakeholder

orientation on firms' perceived supply chain risk exposure (**Hypothesis 3b**). Since there is no well-established quantitative measure of supply chain risk, we follow Wu (2024) and resort to the recent advancements in natural language processing to quantify firm-level supply chain risk exposure.

Specifically, we focus on the MD&A section texts of 10-Ks. First, the MD&A section, which provides forward-looking statements about firms' future performance, has been documented as the primary source of risk-related disclosure in 10-Ks (Kravet and Muslu, 2013).[14] As a result, several recent studies use MD&A texts to construct risk-related metrics (e.g., Donovan et al., (2021) use these texts to measure firm-level credit risk). Second, unlike other commonly used textual data that are typically available after 2000 (e.g., earnings conference call texts, which Wu (2024) uses to quantify supply chain risk, are available after 2003), the textual information of 10-Ks have been available since 1993, when the SEC introduced the EDGAR system to make electronic filing possible. This means we can secure a relatively complete part of our initial sample period, which enables us to perform a DID analysis to evaluate the effect of stakeholder orientation on supply chain risk exposure.

When extracting supply chain risk information from MD&A texts, we focus on the joint tabulation of words related to two key topics: "supply chain" and "risk". However, a major challenge is that the discussion about both "supply chain" and "risk" could be diverse, multifaceted, and subtle. For example, discussions of "steel" (a production input) and "shortage" at the same time undoubtedly relate to supply chain risk, but have no direct mention of the terms "supply chain" and "risk". Thus, we need an expanded keyword list to tag supply chain risk content in MD&A texts. To this end, we follow a number of recent studies (Li et al., 2021; Wu, 2024) and use the word embedding model. We start with a collection of "supply chain" as well as "risk" seed words and employ the

[14] Beginning in 2005, the SEC requires all companies to provide a separate section discussing "the most significant factors that make the company speculative or risky" in their annual filings. However, we do not focus on the newly created risk factor disclosure section because it is available only for the latter part of our sample period.

word embedding model to project the synonyms of the seed words (based on the cosine similarity of their word vectors to the seed word vector). This enables us to construct an expanded dictionary of "supply chain" and "risk" keywords, which are used to extract all supply chain risk-related information in MD&A texts.

Additionally, we improve Wu's (2024) procedure by making sentiment adjustments to the supply chain risk exposure measure. This is important because firms' true perceptions about supply chain risk may not be the same, even if they mention the same set of keywords. To measure supply chain risk exposure more accurately, we follow Cen et al., (2024) and distinguish the sentiment underlying each supply chain risk discussion with the Valence Aware Dictionary and Sentiment Reasoner (VADER) algorithm. Using this algorithm, we tag each supply chain risk sentence with a sentiment score and aggregate the sentences to construct the final score of supply chain risk exposure ($SC\ Risk_{sentiment}$) at the firm-year level. For comparison purposes, we also compute a supply chain risk exposure measure without any sentiment adjustment, which is named as $SC\ Risk_{no\ sentiment.}$[15]

The results of regressing the supply chain risk exposure measures on $Constituency\ Statutes$ are presented in Table 7. The first column reports the result on $SC\ Risk_{sentiment}$ without adding any control variables. Consistent with our argument that stakeholder orientation reduces firms' supply chain uncertainty exposure, the coefficient of $Constituency\ Statutes$ is statistically significant at the 5% level. If we further control for firm characteristics, Column 3 shows highly consistent results: the coefficient of $Constituency\ Statutes$ is 0.187 and significant at the 1% level. Regarding economic significance, the passage of constituency statutes reduces supply chain risk exposure of firms incorporated in the adoption states by 8.8% at the mean value of 2.131 (0.187/2.131). Also, if we focus on the supply chain risk exposure measure without sentiment adjustment, $SC\ Risk_{no\ sentiment}$, the results in Columns 2 and 4 show that our conclusion remains intact.

[15] The step-by-step procedure for the construction of the supply chain risk exposure measures is provided in Section 4 of our Internet Appendix, along with validation test results for these measures.

In summary, the results in Tables 6 and 7, which show that the influence of constituency statutes adoption is much stronger for firms operating in highly dynamic environments and firms' supply chain risk exposure decreases after the adoption, provide strong evidence for the view that stakeholder orientation increases inventory efficiency by strengthening firms' resilience against supply chain uncertainties.

The Moderating Role of Stakeholder Importance

If the adoption of constituency statutes increases inventory efficiency by enabling firms to cater to their multiple stakeholders, its positive effect should be conditional on how important stakeholder relations are for the firms (**Hypothesis 4**). Specifically, if improving relationships with certain types of stakeholders helps improve inventory efficiency, then we should observe a stronger effect of constituency statutes adoption for firms where this relationship is important and requires further attention.

We consider three types of critical stakeholders who exert significant influence over firms' operations: employees, customers, and suppliers. First, to gauge the importance of employee relations, we focus on human capital intensity following previous literature (Flammer and Luo, 2017). To measure human capital intensity, we use the ratio of labor and pension expenses to sales, as suggested by Agrawal and Matsa (2013). Specifically, we define high (low) human capital-intensity industries as those with average human capital intensity levels (computed as the arithmetic mean of human capital intensity across all firms operating in the same industry in a specific year) that exceed (fall below) the global median during our sample period. We re-estimate our baseline regression in Table 2 separately for high and low human capital-intensity firms. The first two columns in Panel A (excluding firm controls) and Panel B (including firm controls) of Table 8 present the results. As expected, we observe a marked difference in the coefficients of $Constituency\ Statutes$ between high and low human capital-intensity firms. For firms operating in low human capital-intensity industries, the coefficient of

Constituency Statutes is 0.168 (0.037) and statistically indistinguishable from zero. However, the corresponding coefficient for high human capital-intensity firms is 0.475 (0.451), which is significant at the 1% level. Moreover, the difference in the *Constituency Statutes* coefficient is statistically significant, with an *F*-statistic of 3.01 (6.36) when firm controls are excluded (included).

Second, if improved customer relations are important for the increase in inventory efficiency, the effect of constituency statutes enactment should be stronger for firms whose relationships with their customers need more attention. According to the literature (Lev et al., 2010; Flammer and Kacperczyk, 2016), one such type comprises firms operating in consumer-focused industries, that is, B2C firms. Additionally, these firms typically sell after producing and, thus, are likely to hold large inventory and have greater potential for efficiency improvement (by contrast, non-B2C firms produce after receiving orders and can maintain high inventory efficiency, thus leaving less room for improvement). Therefore, we divide our sample into B2C and non-B2C firms following Lev et al. (2010).[16] The results are shown in Columns 3 and 4 of Table 8. Consistent with our prediction, the coefficient of *Constituency Statutes* appears to be positive and significant only for firms in B2C industries. Furthermore, the *Constituency Statutes* coefficient difference between the two types of firms is significant (marginally significant) when the firm level characteristics are excluded (controlled for).

Finally, we examine the importance of supplier relations. Specifically, we follow Chu (2012) and focus on the elasticity of supplier substitution at the industry level, measured as the average heterogeneity of input goods in firms' industry. Low elasticity (when a firm's industry sources from industries with highly heterogeneous goods) implies that suppliers cannot be easily replaced, and therefore, maintaining good relationships with them could be

[16] According to Lev et al. (2010), B2C manufacturing industries include SIC codes 2000–2399, 2500–2599, 2700–2799, 2830–2869, 3000–3219, 3420–3429, 3523, 3600–3669, 3700–3719, 3751, 3850–3879, and 3880–3999. All the other industries are classified as non-B2C industries.

valuable. We rely on Rauch's (1999) measure of the heterogeneity of input goods and compute the weighted-average input goods heterogeneity for each firm's industry as:

$$\text{H}eterogeneity = \sum_{i=1}^{n}(Heteroteneity\ of\ supplying\ industry_i \times \frac{Value\ of\ input\ by\ supplying\ industry_i}{Value\ of\ total\ inputs}) \quad (2)$$

Here, $Heteroteneity\ of\ supplying\ industry_i$ is the Rauch (1999) heterogeneity of input goods measure in supplying industry i of firm's industry, where each industry's supplying industry (along with their value of input) is identified from the Bureau of Economic Analysis (BEA) Input–Output (IO) Use Table.[17]

We further define the high (low) elasticity of supplier substitution industries as those with average input goods heterogeneity that is higher (lower) than the global median during our sample period. The last two columns in Panel A (excluding firm controls) and Panel B (including firm controls) of Table 8 show the subsample results. Consistent with our expectations, the coefficient of $Constituency\ Statutes$ is small (0.141 and 0.029) and statistically indistinguishable from zero for firms operating in high elasticity industries. In contrast, the corresponding coefficient for low elasticity of supplier substitution firms is 0.535 (0.445), which are significant at the 1% (5%) level. Again, the differences in the $Constituency\ Statutes$ coefficient are statistically significant across all specifications.

In sum, these results suggest that the positive influence of constituency statutes passage is driven primarily by high human capital-intensity firms, and firms in B2C and low elasticity of supplier substitution industries, where the management of employee, customer, and supplier relations is likely to be more important. These results provide evidence supporting **Hypothesis 4**.

[17] We use the BEA IO table in 1997, roughly the midpoint of our sample period, and link BEA data with our firm sample using NAICS code. As for the heterogeneity of input goods, the original Rauch data are organized by Standard International Trade Classification (SITC). We first convert the SITC to Harmonized System (HS) 10 code and then to the NAICS code.

Stakeholder Orientation, Firm Performance, and the Mediating Role of Inventory Efficiency

So far, our results show that catering to the interests of stakeholders increases manufacturing firms' inventory efficiency. An important question that remains is whether this improvement is value-enhancing, or equivalently whether constituency statutes adoption leads to a lower level of optimal inventory that firms need to hold. In this subsection, we try to answer this question by investigating the mediating role of inventory efficiency in the stakeholder orientation–financial performance relationship (**Hypothesis 5**).

While several studies already identify a general positive relationship between stakeholder-friendly actions and firms' financial performance (Jo and Harjoto, 2011; Flammer and Kacperczyk, 2016), we first examine whether this finding holds true for our manufacturing sample. We do this by regressing two extensively used financial performance measures, *ROA* and *Tobin's* Q, on $Constituency\ Statutes$. When *ROA* is the dependent variable, the results in the first two columns of Table 9 show that $Constituency\ Statutes$ has a negative coefficient, albeit statistically insignificant when firm characteristics are controlled for. However, when *Tobin's* Q is used as the dependent variable, the results in Columns 3 and 4 show that the coefficient $of\ Constituency\ Statutes$ is positive and significant (at least at the 5% level). These results are generally consistent with the findings of Flammer and Kacperczyk (2016). One possible explanation is that catering to stakeholders, while increasing firm value in the long run (*Tobin's* Q), could be associated with some costs and show a neutral effect on financial performance in the short term (*ROA*).

Next, we use mediation analysis to evaluate whether the improved inventory efficiency we observed earlier serves as an important channel for superior financial performance after the statute's adoption. As shown in the path diagram of Figure 1, we decompose the causal relation between stakeholder orientation and financial performance into two channels: an indirect, or mediated, channel of inventory efficiency improvement, and a

direct channel that is not explained by the indirect one. The path arrows represent the assumed relations among variables. Specifically, we estimate the following system of equations:

$$Inventory\ Efficiency_{i,s,l,j,t} = \alpha_0 + \alpha_i + \alpha_l\alpha_t + \alpha_j\alpha_t + \beta Constituency\ Statutes_{s,t} + \theta' Firm\ Characteristics_{i,s,l,j,t} + \varepsilon_{i,s,l,j,t} \quad (3)$$

$$Firm\ Performance_{i,s,l,j,t} = \alpha_0 + \alpha_i + \alpha_l\alpha_t + \alpha_j\alpha_t + \lambda Constituency\ Statutes_{s,t} + \delta Inventory\ Efficiency_{i,s,l,j,t} + \theta' Firm\ Characteristics_{i,s,l,j,t} + \varepsilon_{i,s,l,j,t} \quad (4)$$

We focus on the situation in which constituency statutes adoption significantly improves firm performance: when performance is measured by *Tobin's* Q. The indirect effect of the inventory efficiency channel can be calculated as the product of β and δ, and the magnitude of the direct effect can be measured by λ. The sum of the two equals the total effect of statutes adoption on financial performance.

The results are shown in the last two columns. To save space, we only report the results of Equation (4). In the table, we first observe that the direct effect, as measured by the coefficient on $Constituency\ Statutes$ (λ), is always statistically significant, suggesting that the causal influence of stakeholder orientation on financial performance does not depend on inventory reduction exclusively. However, the coefficients of $Inventory\ Efficiency$ (δ) are also positive and significant. Combined with the statistically significant coefficient on $Constituency\ Statutes$ in Equation (3) (β) and Sobel test statistics, this result suggests the existence of the indirect (inventory efficiency improvement) channel.[18] Importantly, inventory reduction explains more than 16% [=0.0096(Indirect Effect)/0.05778(Total Effect)] of the increase in *Tobin's* Q caused by statutes adoption when firm controls are included.

In sum, the results in Table 9 substantiate the argument that the improvement in inventory efficiency after

[18] The Sobel test examines whether the reduction in the effect of the independent variables is significant after the inclusion of the mediating variable, that is, whether a significant mediation effect exists.

statutes adoption is value-enhancing. The results also confirm that inventory efficiency is an important (although not dominant) channel through which stakeholder-friendly actions can increase financial performance.

Conclusion

Does stakeholder orientation meaningfully affect inventory management—one of the critical components of business strategy? To shed some light on this issue, we exploited the exogenous shocks arising from the staggered adoption of constituency statutes in 35 U.S. states. By employing a DID approach for a primary sample of manufacturing firms, we found a significant increase in inventory efficiency for firms incorporated in states that passed such statutes. In line with the argument that stakeholder orientation improves inventory efficiency by alleviating the negative influence of supply chain uncertainty, our channel analysis reveals that the effect of stakeholder orientation is stronger for firms operating in more dynamic environments. Importantly, firms' perceived supply chain risk exposure decreases after adopting constituency statutes. We further find that stakeholder orientation's effect is conditional on how important stakeholder relations are for firms; firms with higher human capital intensity and those operating in B2C and low elasticity of supplier substitution industries benefit more. Finally, our mediation analysis reveals that improving inventory efficiency is an important channel through which stakeholder orientation enhances firm value.

To the best of our knowledge, our study is the first to integrate stakeholder theory, resource-based view, Godfrey's insurance-like protection theory (2005), and classical inventory theory to empirically demonstrate a causal link between stakeholder orientation and inventory efficiency. In this regard, we respond to Du et al. (2023)'s call for theory-driven quantitative CSR research that incrementally advances current CSR knowledge. Specifically, we identify a new channel through which stakeholder orientation can enhance firm value: the production process. Additionally, we address Du et al. (2023)'s recommendation to employ cutting-edge methods

to reveal patterns and relationships hidden in unstructured data. By utilizing machine learning techniques, we unveil the causal impact of stakeholder orientation on firms' supply chain risk exposure, a novel finding with significant managerial implications.

Our study also has limitations. While our findings encourage firms to prioritize primary stakeholders' (such as employees, customers, and suppliers') interests for operational efficiency, these actions may unintentionally harm other stakeholder groups (e.g., secondary stakeholders). Future research could examine how stakeholder orientation as an operational efficiency strategy impacts secondary stakeholder groups, providing a more comprehensive understanding of its broader implications.

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Figure 1. Mediation analysis

This figure visualizes our mediation analysis that decomposes the effect of stakeholder orientation on firm performance into: 1) an indirect (mediated) channel through improvement in inventory efficiency, and 2) a direct channel that is not explained by the indirect channel.

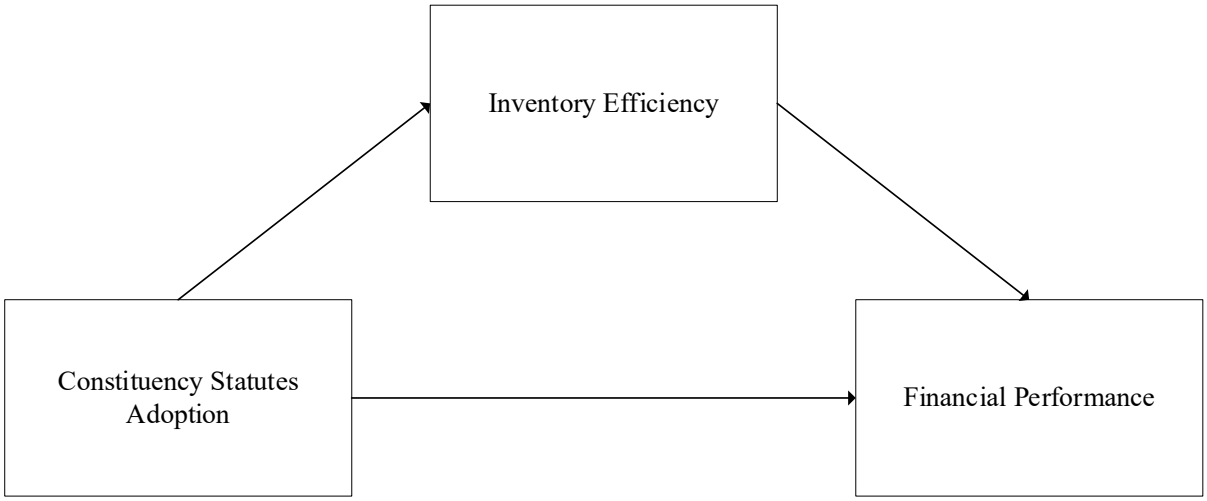

Table 1. Descriptive statistics and correlation matrix

This table presents the descriptive statistics of the main variables used in this study (Panel A), as well as the pairwise correlation matrix (Panel B). Detailed information regarding the construction of the variables can be found in the Appendix. Numbers in bold indicate statistical significance at least at the 10% level.

Panel A: Descriptive statistics

	Obs.	Mean	SD	P^{25}	Median	P^{75}
1. *Inventory Efficiency*	63,604	5.287	5.089	2.552	3.877	5.969
2. *Constituency Statutes*	63,604	0.257	0.437	0	0	1
3. *Size*	63,604	4.662	2.312	3.037	4.579	6.231
4. *Leverage*	63,604	0.546	0.455	0.290	0.478	0.660
5. *Gross Margin*	63,604	0.319	0.489	0.236	0.346	0.481
6. *Sales Growth*	63,604	0.102	0.394	-0.034	0.078	0.209
7. *Lead Time*	63,604	3.763	0.720	3.347	3.723	4.116
8. *RM Efficiency*	37,444	13.133	10.488	6.110	9.886	16.401
9. *WIP Efficiency*	37,444	31.597	39.189	8.965	17.513	36.551
10. *FG Efficiency*	37,444	15.151	15.417	5.649	9.734	18.265
11. *Adj. Inv.Eff.*	63,604	-0.005	0.941	-0.608	-0.254	0.415
12. *ELI*	63,604	0.000	0.999	-0.599	0.004	0.604
13. *BC Law*	63,604	0.702	0.457	0	1	1
14. *CSA Law*	63,604	0.179	0.383	0	0	0
15. *FP Law*	63,604	0.198	0.399	0	0	0
16. *SC Risk*$_{sentiment}$	17,051	2.131	1.611	0.948	1.871	3.035
17. *SC Risk*$_{no\ sentiment}$	17,051	2.338	1.731	1.075	1.970	3.267
18. *ROA*	63,604	-0.065	0.386	-0.049	0.036	0.083
19. *Tobin's Q*	59,807	1.720	1.727	0.799	1.164	1.916

Panel B: Correlation matrix

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
2.	**-0.027**																	
3.	**0.084**	**-0.046**																
4.	**0.084**	**0.010**	**-0.116**															
5.	**-0.281**	**0.008**	**0.100**	**-0.125**														
6.	**0.064**	**-0.032**	**-0.009**	**-0.117**	**0.095**													
7.	**-0.169**	**-0.008**	**-0.147**	**0.259**	**0.119**	**0.080**												
8.	**0.517**	**-0.024**	**0.251**	**0.098**	**-0.183**	**0.030**	**-0.107**											
9.	**0.392**	**0.037**	**0.063**	**0.072**	**-0.110**	**0.011**	**-0.079**	**0.199**										
10.	**0.501**	0.004	**-0.105**	0.007	**-0.211**	**0.091**	**-0.071**	**0.068**	**0.023**									
11.	**0.660**	**-0.036**	-0.003	**0.054**	**-0.240**	**0.105**	**-0.138**	**0.339**	**0.237**	**0.376**								
12.	**0.353**	**-0.021**	**-0.246**	**-0.050**	**0.103**	**0.049**	**-0.114**	**0.123**	**0.156**	**0.278**	**0.489**							

13.	**0.055**	**0.186**	**0.173**	**0.072**	**-0.017**	**-0.027**	**0.075**	**0.080**	**0.089**	**-0.016**	**-0.008**	**-0.040**						
14.	-0.003	**0.572**	**-0.062**	**-0.010**	0.004	**-0.010**	**-0.018**	**-0.032**	**0.026**	**0.020**	**-0.008**	**0.021**	**0.126**					
15.	0.001	**0.599**	**0.041**	**0.010**	**-0.007**	**-0.043**	**-0.063**	0.008	**0.035**	-0.002	**-0.019**	**-0.022**	**0.234**	**0.322**				
16.	**-0.032**	-0.006	**0.055**	**-0.112**	**0.026**	**-0.051**	**-0.034**	**0.049**	-0.016	0.002	-0.011	0.005	**-0.050**	**-0.042**	**-0.025**			
17.	**-0.019**	0.000	**0.070**	**-0.089**	0.011	**-0.045**	**-0.045**	**0.051**	-0.008	-0.010	**-0.015**	-0.001	**-0.029**	**-0.035**	**-0.021**	**0.874**		
18.	**-0.020**	**-0.015**	**0.359**	**-0.515**	**0.284**	**0.105**	**-0.355**	**0.072**	-0.001	0.005	-0.005	**0.056**	**-0.058**	**-0.017**	**0.047**	**0.040**	**0.057**	
19.	**0.024**	**-0.007**	**-0.191**	**0.081**	**-0.036**	**0.209**	**0.260**	**-0.035**	**-0.020**	**0.020**	**0.049**	**0.025**	**0.039**	**0.023**	**-0.069**	**-0.031**	**-0.042**	**-0.280**

Table 2. Stakeholder orientation and inventory efficiency

This table presents the results of the DID tests investigating the effect of constituency statutes on manufacturing firms' inventory efficiency from 1979 to 2012. *Inventory Efficiency* is defined as COGS over average inventory. *Constituency Statutes* takes the value of one if a state has adopted a constituency statute by year t, and zero otherwise. Control variables include firm size, leverage, gross margin, sales growth, and lead time. Column 1 and 2 show the results for the full sample. Column 3 excludes Delaware firms. Column 4 excludes early adopters before 1990. Column 5 ends the sample in 2000. Column 6 excludes firms changing state of incorporation. Column 7 only keeps firms incorporated in states that eventually adopted constituency statutes. Detailed variable definitions are in the Appendix. Numbers in parentheses are robust standard errors clustered at the incorporated state level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dependent variable	*Inventory Efficiency*						
	Full Sample		Exclude Delaware	Exclude Pre-1990	Exclude After 2000	Exclude Re-Incorp.	Eventually Treated
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constituency Statutes	0.283***	0.219***	0.363**	0.586**	0.351***	0.343***	0.466**
	(0.078)	(0.081)	(0.171)	(0.245)	(0.113)	(0.083)	(0.233)
Size		-0.143***	-0.147**	-0.112***	-0.176***	-0.151***	-0.003
		(0.021)	(0.071)	(0.026)	(0.049)	(0.032)	(0.085)
Leverage		0.452***	0.457***	0.543***	0.409***	0.429***	0.484**
		(0.061)	(0.140)	(0.065)	(0.097)	(0.055)	(0.233)
Gross Margin		-2.341***	-2.065***	-2.603***	-2.214***	-2.375***	-3.156***
		(0.157)	(0.284)	(0.101)	(0.175)	(0.141)	(0.372)
Sales Growth		1.311***	1.280***	1.292***	1.304***	1.334***	2.984***
		(0.055)	(0.146)	(0.057)	(0.080)	(0.049)	(0.402)
Lead Time		-0.965***	-0.800***	-1.091***	-0.836***	-0.938***	-0.525***
		(0.080)	(0.066)	(0.056)	(0.048)	(0.074)	(0.099)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year × State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year × Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	63,604	63,604	26,095	43,518	39,488	59,988	21,575
R-squared	0.764	0.798	0.833	0.800	0.824	0.801	0.786

Table 3. Pre-treatment analysis

This table examines pre-treatment trends in inventory efficiency around the adoption of constituency statutes. *Inventory Efficiency* is defined as COGS over average inventory. *Constituency Statutes* takes the value of one if a state has adopted a constituency statute by year t, and zero otherwise. Control variables include firm size, leverage, gross margin, sales growth, and lead time. *Constituency Statutes*^{0}, *Constituency Statutes*$^{-1}$, and *Constituency Statutes*$^{-2}$ flag the years relative to the year that a state adopts constituency statutes. Detailed variable definitions are in the Appendix. Numbers in parentheses are robust standard errors clustered at the incorporated state level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dependent variable	*Inventory Efficiency*					
	Full Sample	Exclude Delaware	Exclude Pre-1990	Exclude After 2000	Exclude Re-Incorp.	Eventually Treated
	(1)	(2)	(3)	(4)	(5)	(6)
Constituency Statutes	0.229***	0.403**	0.613**	0.331***	0.365***	0.509*
	(0.084)	(0.194)	(0.265)	(0.108)	(0.090)	(0.282)
Constituency Statutes^{0}	-0.014	0.139	0.117	0.067	0.064	0.081
	(0.093)	(0.139)	(0.323)	(0.081)	(0.068)	(0.259)
Constituency Statutes^{-1}	0.060	-0.018	0.125	0.118	0.096	0.110
	(0.194)	(0.192)	(0.360)	(0.170)	(0.126)	(0.240)
Constituency Statutes^{-2}	0.034	0.072	-0.013	-0.035	-0.026	0.093
	(0.116)	(0.121)	(0.205)	(0.092)	(0.093)	(0.196)
Size	-0.143***	-0.148**	-0.112***	-0.170***	-0.151***	-0.003
	(0.021)	(0.071)	(0.026)	(0.047)	(0.032)	(0.085)
Leverage	0.453***	0.457***	0.543***	0.387***	0.430***	0.484**
	(0.061)	(0.140)	(0.065)	(0.084)	(0.055)	(0.233)
Gross Margin	-2.341***	-2.065***	-2.603***	-1.967***	-2.375***	-3.156***
	(0.157)	(0.284)	(0.101)	(0.127)	(0.141)	(0.372)
Sales Growth	1.311***	1.280***	1.292***	1.186***	1.334***	2.984***
	(0.055)	(0.146)	(0.057)	(0.076)	(0.049)	(0.402)
Lead Time	-0.964***	-0.801***	-1.091***	-0.771***	-0.938***	-0.525***
	(0.080)	(0.066)	(0.056)	(0.053)	(0.074)	(0.099)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year × State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year × Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	63,604	26,095	43,518	39,488	59,988	21,575
R-squared	0.798	0.833	0.800	0.824	0.801	0.786

Table 4. Robustness tests

This table presents the results of additional robustness checks. In Column 1 and 2, we examine alternative inventory efficiency measures. In Column 3 and 4, we control for different levels of fixed effects. In Column 5, we adopt an alternative estimation strategy, stacked regressions following Deshpande and Li (2019), to address the potential biases associated with the staggered DID approach. In Column 6, we report the ATT obtained using the Callaway and Sant'Anna (2021) estimator. In Columns 7 to 9, we control for the potential impacts of other concurrent corporate law changes: Business Combination (BC) Law in Column 7; Control Share Acquisition (CSA) Law in Column 8; and Fair Price (FP) Law in Column 9. *Adj. Inv. Eff.* is the industry-year adjusted inventory efficiency measure. *ELI* is the empirical leanness indicator developed by Eroglu and Hofer (2011). Detailed variable definitions are in the Appendix. Numbers in parentheses are robust standard errors clustered at the incorporated state level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dependent variable	*Adj. Inv. Eff.*	*ELI*	*Inventory Efficiency*						
	Alternative Efficiency Measures		Alternative Fixed Effects		Stacked Reg.	ATT	Concurrent Law Changes		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constituency Statutes	0.039**	0.066***	0.274**	0.242**	0.213***	0.245***	0.223***	0.211**	0.210**
	(0.019)	(0.022)	(0.129)	(0.103)	(0.081)	(0.094)	(0.082)	(0.100)	(0.083)
Size	-0.060***	-0.179***	-0.046	-0.027	-0.271***		-0.140***	-0.140***	-0.140***
	(0.006)	(0.010)	(0.053)	(0.034)	(0.053)		(0.023)	(0.023)	(0.022)
Leverage	0.086***	-0.002	0.367***	0.295***	0.308***		0.400***	0.399***	0.400***
	(0.011)	(0.011)	(0.081)	(0.099)	(0.114)		(0.065)	(0.065)	(0.065)
Gross Margin	-0.321***	0.072***	-3.229***	-3.205***	-2.871***		-2.250***	-2.250***	-2.250***
	(0.008)	(0.006)	(0.227)	(0.221)	(0.246)		(0.194)	(0.193)	(0.193)
Sales Growth	0.333***	0.087***	3.373***	3.316***	1.651***		1.266***	1.267***	1.267***
	(0.014)	(0.017)	(0.243)	(0.232)	(0.092)		(0.059)	(0.059)	(0.059)
Lead Time	-0.195***	-0.271***	-0.469***	-0.531***	-0.999***		-0.966***	-0.966***	-0.966***
	(0.016)	(0.007)	(0.134)	(0.095)	(0.082)		(0.071)	(0.070)	(0.070)
BC Law							-0.105		
							(0.088)		
CSA Law								0.059	
								(0.181)	
FP Law									0.041
									(0.122)
Firm FE	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Year × State FE	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Year × Industry FE	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes
Firm × Stack FE	No	No	No	No	Yes	No	No	No	No
Time × Stack FE	No	No	No	No	Yes	No	No	No	No
Time × Stack × Industry FE	No	No	No	No	Yes	No	No	No	No

Time × Stack × State FE	No	No	No	No	Yes	No	No	No	No
Observations	63,604	63,604	63,604	63,604	181,872	57,766	63,604	63,604	63,604
R-squared	0.685	0.680	0.691	0.726	0.867	-	0.801	0.801	0.801

Table 5. Stakeholder orientation and efficiency of different inventory components

This table presents the results of the DID tests investigating the effect of constituency statutes on the efficiency of different inventory components: raw materials (Column 2 and 6), work-in-process (Columns 3 and 7), and finished goods (Columns 4 and 8). For comparison purposes, the results for total inventory are reported in Columns 1 and 5. Detailed variable definitions are in the Appendix. Numbers in parentheses are robust standard errors clustered at the incorporated state level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dependent variable	*Inventory Efficiency*	*RM Efficiency*	*WIP Efficiency*	*FG Efficiency*	*Inventory Efficiency*	*RM Efficiency*	*WIP Efficiency*	*FG Efficiency*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constituency Statutes	0.208***	0.724**	2.234*	2.244***	0.182***	0.677**	2.092*	2.095***
	(0.069)	(0.321)	(1.235)	(0.565)	(0.065)	(0.332)	(1.202)	(0.556)
Size					-0.088**	0.225	0.077	-0.728***
					(0.040)	(0.155)	(0.536)	(0.148)
Leverage					0.216***	1.013***	2.315*	-0.414
					(0.049)	(0.188)	(1.203)	(0.365)
Gross Margin					-3.111***	-7.407***	-19.111***	-10.757***
					(0.193)	(0.587)	(1.453)	(0.642)
Sales Growth					1.131***	2.650***	4.754***	4.548***
					(0.095)	(0.195)	(0.674)	(0.428)
Lead Time					-0.542***	-1.487***	-4.066***	-1.929***
					(0.026)	(0.146)	(0.272)	(0.227)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year × State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year × Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	37,444	37,444	37,444	37,444	37,444	37,444	37,444	37,444
R-squared	0.801	0.763	0.746	0.721	0.829	0.777	0.751	0.736

Table 6. Industry demand uncertainty and the effect of stakeholder orientation

This table examines how the relationship between constituency statutes adoption and inventory efficiency varies with industry demand uncertainty. Firms are divided into low and high demand uncertainty subsamples based on their industry's average demand uncertainty level (Dess and Beard, 1984) over the sample period. Detailed variable definitions are in the Appendix. Numbers in parentheses are robust standard errors clustered at the incorporated state level. Numbers in brackets are *F* statistics. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dependent variable	*Inventory Efficiency*			
	Low Uncer.	High Uncer.	Low Uncer.	High Uncer.
	(1)	(2)	(3)	(4)
Constituency Statute	0.230*	0.478***	0.182	0.409***
	(0.120)	(0.135)	(0.127)	(0.108)
Size			-0.196***	-0.042
			(0.042)	(0.040)
Leverage			0.376***	0.443***
			(0.079)	(0.093)
Gross Margin			-2.399***	-2.191***
			(0.203)	(0.191)
Sales Growth			1.203***	1.428***
			(0.054)	(0.091)
Lead Time			-0.956***	-1.012***
			(0.074)	(0.088)
Diff. in *Constituency Statute* Coeff.	-0.249		-0.287*	
	[1.82]		[2.92]	
Firm FE	Yes	Yes	Yes	Yes
Year × State FE	Yes	Yes	Yes	Yes
Year × Industry FE	Yes	Yes	Yes	Yes
Observations	36,496	26,730	36,496	26,730
R-squared	0.788	0.760	0.820	0.790

Table 7. Stakeholder orientation and supply chain risk exposure

This table presents the DID regression results of investigating the effect of constituency statutes adoption on supply chain risk exposure. $SC\ Risk_{sentiment}$ and $SC\ Risk_{no\ sentiment}$ are the text-based supply chain risk exposure measures by applying the word embedding model to the MD&A section texts of the 10-Ks (with and without sentiment adjustment). Detailed variable definitions are in the Appendix. Numbers in parentheses are robust standard errors clustered at the incorporated state level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dependent variable	$SC\ Risk_{sentiment}$	$SC\ Risk_{no\ sentiment}$	$SC\ Risk_{sentiment}$	$SC\ Risk_{no\ sentiment}$
	(1)	(2)	(3)	(4)
Constituency Statute	-0.203**	-0.365*	-0.187***	-0.344*
	(0.078)	(0.187)	(0.063)	(0.187)
Size			0.024	0.045
			(0.052)	(0.044)
Leverage			-0.134***	-0.179***
			(0.021)	(0.028)
Gross Margin			0.036*	0.026
			(0.020)	(0.017)
Sales Growth			-0.096***	-0.115***
			(0.015)	(0.020)
Lead Time			-0.032*	-0.032
			(0.016)	(0.023)
Firm FE	Yes	Yes	Yes	Yes
Year × State FE	Yes	Yes	Yes	Yes
Year × Industry FE	Yes	Yes	Yes	Yes
Observations	17,051	17,051	17,051	17,051
R-squared	0.651	0.672	0.652	0.673

Table 8. Stakeholder relationship importance and the effect of stakeholder orientation

This table investigates how the relationship between constituency statutes adoption and inventory efficiency varies with proxies for the importance of employee, customer, and supplier relations. In Column 1 and 2, firms are divided into low and high human capital intensity (proxy for employee relations importance) subsamples based on their industry's average human capital intensity (labor and pension expenses over sales) over the sample period. Column 3 and 4 split our sample firms into B2C and non-B2C industries (proxy for customer relations importance) following Lev et al. (2010). Column 5 and 6 split the sample firms into high and low elasticity of supplier substitution (proxy for supplier relations importance) subsamples based on their industry's average heterogeneity of input goods (Chu, 2012) over the sample period. Detailed variable definitions are in the Appendix. Panel A reports results excluding firm level control variables, while Panel B shows the results with firm controls. Numbers in parentheses are robust standard errors clustered at the incorporated state level. Numbers in brackets are *F* statistics. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dependent variable	*Inventory Efficiency*					
	Human Capital Intensity		B2C Sector		Elasticity of Supplier Substitution	
	Low	High	No	Yes	High	Low
Panel A: No control						
	(1)	(2)	(3)	(4)	(5)	(6)
Constituency Statutes	0.168	0.475***	0.069	0.783***	0.141	0.535***
	(0.112)	(0.144)	(0.142)	(0.269)	(0.145)	(0.156)
Diff. in *Constituency Statute* Coeff.	-0.307* [3.01]		-0.714** [4.23]		-0.394** [6.01]	
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year × State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year × Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	31,020	32,584	35,756	27,655	28,476	30,392
R-squared	0.764	0.785	0.737	0.755	0.723	0.785
Panel B: With controls						
	(1)	(2)	(3)	(4)	(5)	(6)
Constituency Statutes	0.037	0.451***	0.048	0.558**	0.029	0.445**
	(0.108)	(0.152)	(0.146)	(0.247)	(0.136)	(0.172)
Diff. in *Constituency Statute* Coeff.	-0.415** [6.36]		-0.510 [2.56]		-0.416** [5.69]	
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year × State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year × Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	31,020	32,584	35,756	27,655	28,476	30,392
R-squared	0.792	0.822	0.766	0.799	0.778	0.809

Table 9. Stakeholder orientation and firm performance: The mediating role of inventory efficiency

This table examines firms' performance after the adoption of constituency statutes, as well as the mediating role of inventory efficiency. We consider two performance measures: *ROA* and *Tobin's Q*. Detailed variable definitions are in the Appendix. Numbers in parentheses are robust standard errors clustered at the incorporated state level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dependent variable	*ROA*			*Tobin's Q*		
	(1)	(2)	(3)	(4)	(5)	(6)
Constituency Statutes	-0.019**	-0.003	0.083***	0.058**	0.071***	0.048*
	(0.009)	(0.007)	(0.029)	(0.028)	(0.026)	(0.029)
Inventory Efficiency					0.031***	0.025***
					(0.002)	(0.002)
Size		0.049***		-0.276***		-0.274***
		(0.004)		(0.032)		(0.032)
Leverage		-0.339***		-0.204***		-0.213***
		(0.007)		(0.046)		(0.043)
Sales Growth		0.112***		0.606***		0.555***
		(0.007)		(0.025)		(0.024)
Gross Margin				0.068		0.017
				(0.076)		(0.077)
Lead Time		-0.029***		0.157***		0.186***
		(0.004)		(0.019)		(0.019)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year × State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year × Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	63,604	63,604	59,807	59,807	59,807	59,807
R-squared	0.637	0.730	0.598	0.618	0.604	0.621
Indirect Effect					0.012	0.01
Direct Effect					0.071	0.048
Total Effect					0.083	0.058
Mediated Total Effect					0.143	0.166
Sobel Test Statistic					3.072***	3.345***

Appendix. Variable definitions

Variable	Definition
Incorporation state-level variables	
Constituency Statutes	An indicator variable that takes a value of 1 for firms incorporated in states adopting constituency statutes and 0 otherwise.
Constituency Statutes$^{0, -1, -2}$	Indicator variables flag the years relative to the year that a state adopts constituency statutes
BC (CSA, FP) Law	An indicator variable taking a value of 1 for firms incorporated in states that adopted the Business Combination (Control Share Acquisition, Fair Price) Law and 0 otherwise.
Firm-level variables	
Inventory Efficiency	Inventory efficiency of firm i in year t = $\frac{COGS_{i,t}}{[\frac{1}{2}(FIFO\ Inventory_{i,t}+FIFO\ Inventory_{i,t-1})]}$. For firms using LIFO inventory accounting, $FIFO\ Inventory = LIFO\ Inventory + LIFO\ Reserve$.
RM Efficiency	Raw material efficiency of firm i in year t = $\frac{COGS_{i,t}}{[\frac{1}{2}(Raw\ Material_{i,t}+Raw\ Material_{i,t-1})]}$. For firms using LIFO inventory accounting, LIFO reserve is allocated based on the value of raw materials relative to total inventory.
WIP Efficiency	Work-in-process efficiency of firm i in year t = $\frac{COGS_{i,t}}{[\frac{1}{2}(Work-in-Process_{i,t}+Work-in-Process_{i,t-1})]}$. For firms using LIFO inventory accounting, LIFO reserve is allocated based on the value of work-in-process relative to total inventory.
FG Efficiency	Finished goods efficiency of firm i in year t = $\frac{COGS_{i,t}}{[\frac{1}{2}(Finished\ Goods_{i,t}+Finished\ Goods_{i,t-1})]}$. For firms using LIFO inventory accounting, LIFO reserve is allocated based on the value of finished goods relative to total inventory.
Adj. Inv. Eff.	Industry-adjusted inventory efficiency of firm i in year t = $\frac{Inventory\ Efficiency_{i,t}-(\mu_{Inventory\ Efficiency})_{i,t}}{(\sigma_{Inventory\ Efficiency})_{i,t}}$, where $Inventory\ Efficiency$ is our primary inventory efficiency measure, and $(\mu_{Inventory\ Efficiency})_{i,t}$ $(\sigma_{Inventory\ Efficiency})_{i,t}$ are, respectively, the mean and standard deviation of inventory efficiencies for all firms in the same four-digit SIC code industry.
ELI	Empirical leanness indicator developed by Eroglu and Hofer (2011): First obtain the residual of the regression that regresses natural logarithm of sales on natural logarithm of inventory for each 4-digit SIC industry in each year; then, the studentized residual is multiplied by -1.
SC Risk$_{sentiment}$	Firm's text-based supply chain risk exposure measure by applying the word embedding model to the MD&A section texts in 10-Ks, calculated the number of sentences containing both "supply chain" keywords and "risk" keywords in each MD&A section texts divided by the total number of sentences (with sentiment adjustment).
SC Risk$_{no\ sentiment}$	Firm's text-based supply chain risk exposure measure by applying the word embedding model to the MD&A section texts in 10-Ks, calculated the number of sentences containing both "supply chain" keywords and "risk"

Variable	Definition
	keywords in each MD&A section texts divided by the total number of sentences (without sentiment adjustment).
ROA	ROA of firm i in year t = $Net\ Income_{i,t}/Total\ Assets_{i,t}$.
Tobin's Q	Tobin's Q for firm i in year t = $(MVE_{i,t} + PS_{i,t} + DEBT_{i,t})/TA_{i,t}$, where MVE is the market value of common stocks, PS is the market value of preferred stocks, $DEBT$ is the book value of total debt, and TA is the book value of total assets.
Size	Size of firm i in year t = $\ln(Total\ Assets_{i,t})$.
Leverage	Leverage of firm i in year t = $(Total\ Liabilities_{i,t}/Total\ Assets_{i,t})$.
Gross Margin	Gross margin of firm i in year t = $(\text{Sales}_{i,t} - COGS_{i,t})/Sales_{i,t}$.
Sales Growth	Sales growth of firm i in year t = $ln\ (Sales_{i,t}/Sales_{i,t-1})$.
Lead Time	Lead time of firm i in year t = $ln\ (365/(COGS_{i,t}/Accounts\ Payable_{i,t}))$.

Internet Appendix for

"Does stakeholder orientation improve firms' operations? Evidence from inventory management"

1. Institutional Background: Constituency Statutes

The introduction of state-level constituency statutes in the United States started in the 1980s (Ohio was the first state to adopt such a statute, in 1984), when the hostile takeover wave revitalized a longstanding debate on the fundamental role of modern corporations: the "shareholder primacy view" versus the "stakeholder orientation view". The former argument originates from a famous article written by Adolf A. Berle in 1931. Its advocates, including Friedman (1970), believe that the pursuit of shareholder value is the exclusive purpose of the corporation because shareholders are the only residual claimers, while other stakeholders are protected by contractual claims against the firm. Historically, the shareholder primacy argument has received strong support from U.S. courts, such that boards of directors were legally required to perform their fiduciary duties with only the shareholders in mind.

However, the merger wave brought the shareholder view under scrutiny. These transactions, despite their positive influence on shareholders' interests, caused substantial value loss for other stakeholders, including employees, suppliers, and customers. Against this background, the stakeholder orientation view, first proposed by Dodd (1931), attracted renewed attention, as evidenced by the development of stakeholder theories in the 1980s (e.g., Freeman, 1984). In contrast to the shareholder primacy view, the stakeholder view emphasizes that the firm is also a nexus of explicit and implicit contracts with many different stakeholders, whose interests also need to be considered during the firm's decision-making process. The proponents of this argument sought to change corporate law to reflect their belief that corporations are more than just investment vehicles for the owners of financial capital (Bainbridge, 1991). As a result, 35 U.S. states passed constituency statutes between 1984 and 2007 (see Table IA1).

Although not universal across states, the core principle of the constituency statutes is that corporate leaders should consider the interests of both shareholders and stakeholders. For example, Florida's statute states the

following:

In discharging his or her duties, a director may consider such factors as the director deems relevant, including the long-term prospects and interests of the corporation and its shareholders, and the social, economic, legal, or other effects of any action on the employees, suppliers, customers of the corporation or its subsidiaries, the communities and society in which the corporation or its subsidiaries operate, and the economy of the state and the nation.

Though these statutes are only permissive in nature, they provide corporate directors with a solid legal foundation for incorporating stakeholders' interests when running the firm (Flammer and Kacperczyk, 2016; Gao et al., 2021). For instance, as documented by Orts (1992), in the case of Baron v. Strawbridge & Clothier, the court upheld a board's defensive decision to reclassify its stock in response to the threat of a tender offer by applying Pennsylvania's statute. The court decided that "it was proper for the company to consider the effects the… tender offer would have, if successful, on the Company's employees, customers and community."

Table IA1. Adoption of constituency statutes by U.S. states

This table shows the effective year of constituency statutes in different U.S. states based on Karpoff and Wittry (2018).

State	Year
Ohio	1984
Illinois	1985
Maine	1985
Indiana	1986
Missouri	1986
Arizona	1987
Minnesota	1987
New Mexico	1987
New York	1987
Wisconsin	1987
Connecticut	1988
Idaho	1988
Kentucky	1988
Louisiana	1988
Nebraska	1988, 2007
Tennessee	1988
Virginia	1988
Florida	1989
Georgia	1989
Hawaii	1989
Iowa	1989
Massachusetts	1989
New Jersey	1989
Oregon	1989
Mississippi	1990
Pennsylvania	1990
Rhode Island	1990
South Dakota	1990
Wyoming	1990
Nevada	1991
North Carolina	1993
North Dakota	1993
Vermont	1998
Maryland	1999
Texas	2006

2. Validity Test of Adopting Constituency Statutes

One critical assumption of our identification strategy is that the adoption of constituency statutes at the state level is not related to the prevailing inventory efficiency of firms incorporated in the same state. As highlighted earlier, constituency statutes were adopted primarily due to the rise of the stakeholder view in the 1980s, rather than as a response to inventory efficiency at the firm level. Nevertheless, we conduct validity tests to formally address the potential reverse causality issue.

First, to verify that the pre-existing inventory efficiency level does not influence the probability of statute adoption, we perform probit regression analyses at the state level, wherein the dependent variable is an indicator capturing whether a U.S. state adopts constituency statutes in a specific year. Our variable of interest is the one-year lagged inventory efficiency at the state level (the average of inventory efficiency across firms incorporated in the same state). We control for a number of time-variant political, social, and economic factors at the state level: $Log\ State\ Real\ GDP$, $State\ Unemployment\ Rate$, $Log\ State\ Population$, $State\ Real\ GDP\ Growth$, and $Republican\ Governor$ (one if the state has a Republican governor and zero otherwise). The first two columns of Panel A in Table IA2 show the results. The coefficients of the state-level inventory efficiency measure, $Average\ Inventory\ Efficiency$, are small in magnitude and statistically insignificant. The pseudo R-squared is low at 0.002 when $Average\ Inventory\ Efficiency$ is the only independent variable, suggesting little explanatory power of the prevailing inventory efficiency level.

Second, we follow Acharya et al. (2014) and apply a Weibull hazard model to investigate the potential effect of inventory efficiency on the timing of constituency statutes adoption. The dependent variable is the log of the expected time to pass a constituency statute. As in the probit model, the sample consists of all the state-level observations for our sample period, except that states are removed from the sample upon passing constituency statutes. The results in Columns 3 and 4 of Panel A show that $Average\ Inventory\ Efficiency$ enters

insignificantly, suggesting that the timing of the passage of constituency statutes is not affected by corporate inventory efficiency. Collectively, these results provide formal evidence supporting the view that statute adoptions are likely exogenous to local firms' inventory performance before the law change.

A second key presumption underlying our empirical design is that the passage of constituency statutes materially triggers changes in firm behavior regarding stakeholder attention. One potential concern is that these statutes are only permissive in nature, and that there is no guarantee that firms will increase their attention to stakeholders after the passage of the law. Several studies investigate this issue. For example, Luoma and Goodstein (1999) find that companies do increase stakeholder representation on their boards after the adoption of constituency statutes. Flammer and Kacperczyk (2016) rely on the Kinder, Lydenberg, and Domini (KLD) database to examine the influence of the law change on stakeholder-friendly actions. They find that, after the statutes adoption, the level of stakeholder attention, as measured by the KLD score, increases significantly. Given that their study focuses on all publicly traded firms, we follow their analyses to see if the same conclusion holds for the manufacturing firms in our sample. The KLD database reports firms' social performance ratings along several different dimensions. We select four that are closely related to our study: customers, employees, environment, and community. For each dimension, the KLD reports the number of strengths and concerns, which corresponds to the positive and negative actions, respectively, firms take that might influence its stakeholders. Following the literature, we compute two stakeholder-friendly action measures using these data: $KLD - Score$ and $KLD - Score\ (Strength)$. $KLD - Score$ is computed by first obtaining the net score for each dimension (the difference between the number of strengths and concerns), and then summing it up across all the four dimensions. $KLD - Score\ (Strength)$, on the other hand, focuses solely on strengths, as strength and concern scores may measure different constructs (Mattingly and Berman, 2006). Using data from 1991 (first KLD data year) through 2012, we regress these measures on $Constituency\ Statutes$, along with a set of control variables.

The results are shown in Panel B of Table IA2. The coefficients of $Constituency\ Statutes$ are always positive and statistically significant across different specifications, confirming that statutes enactment significantly increases stakeholder orientation levels for the manufacturing firms in our sample.

Table IA2. Validity of constituency statutes adoption

This table presents the validity test results for the adoption of constituency statutes. Panel A investigates whether pre-existing state-level inventory efficiency (*Average Inventory Efficiency*) predicts the probability and time of constituency statutes adoption using two models: Probit Model (Columns 1 and 2) and Weibul Hazard Model (Columns 3 and 4). Specifically, the dependent variable in Column 1 and 2 is an indicator that takes the value of one for adopting states, and zero otherwise. In Columns 3 and 4, the dependent variable is the log of the time until the passage of the law. Control variables include state-level GDP, unemployment rate, population, GDP growth, and political environment (*Republican Governor* equals one for states with a Republican governor, and zero otherwise). Panel B examines the effect of constituency statutes adoption on firms' CSR performance, as measured by *KLD-score* and *KLD-score (Strength).* Numbers in parentheses are robust standard errors clustered at the incorporated state level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Time of passing constituency statutes and pre-existing inventory efficiency

	Probit Model		Duration Model	
	(1)	(2)	(3)	(4)
Average Inventory Efficiency	0.022	0.017	-0.059	-0.037
	(0.028)	(0.030)	(0.085)	(0.073)
Log State Real GDP		2.290***		-7.025***
		(0.623)		(1.631)
State Unemployment Rate		-0.072*		-0.298*
		(0.043)		(0.159)
Log State Population		-2.178***		7.889***
		(0.720)		(1.833)
State Real GDP Growth		-3.649**		3.104
		(1.445)		(6.058)
Republican Governor		0.244		-0.748*
		(0.182)		(0.421)
Observations	1,442	1,442	805	805
Pseudo R-squared	0.00222	0.179	.	.

Panel B: Constituency statutes and stakeholder satisfaction

Dependent variable	*KLD-Score*		*KLD-Score (Strength)*	
	(1)	(2)	(3)	(4)
Constituency Statutes	0.062***	0.047**	0.066***	0.054**
	(0.017)	(0.023)	(0.024)	(0.022)
Size	-0.016*	-0.016**	0.020***	0.024***
	(0.008)	(0.007)	(0.007)	(0.007)
Leverage	-0.029	-0.040**	0.006	0.011
	(0.017)	(0.019)	(0.019)	(0.023)
Gross Margin	-0.001	-0.002	0.020*	0.012
	(0.011)	(0.009)	(0.010)	(0.008)
Sales Growth	0.014**	0.014***	-0.007	-0.002
	(0.006)	(0.004)	(0.006)	(0.005)
Lead Time	-0.001	0.000	-0.015**	-0.015**
	(0.007)	(0.006)	(0.007)	(0.006)
Firm FE	Yes	Yes	Yes	Yes
Year × State FE	No	Yes	No	Yes
Observations	12,258	12,258	12,258	12,258
R-squared	0.575	0.607	0.669	0.704

3. Additional Analysis: Effects of Stakeholder Orientation on Retailers

While the main analysis of this study focuses on manufacturing firms, inventory efficiency for retail firms and its performance relevance have received significant attention in recent years (Chuang et al., 2019). Thus, in the third section of this appendix, we investigate whether our main finding—that stakeholder orientation improves inventory efficiency—holds for retailers. Specifically, we replicate the analysis of Table 2, using the retailer sample (SIC code: 52–59).

The results are shown in Table IA3. Similar to the results in Table 2, the coefficients of $Constituency\ Statutes$ are consistently positive and statistically significant in most specifications. The only exception is in Column 7, where we focus only on the eventually treated sample. While the coefficient in this sample is positive and comparable in magnitude (1.773) with those in other columns, it loses significance possibly owning to smaller sample size. In terms of economic significance, the inventory efficiency of retail firms in the adoption states increases by 9.55% at the mean value of 18.94 following the adoption of state-level constituency statutes, which is stronger compared with their manufacturing counterparts. This result is consistent with Chuang et al. (2019), who argue that retailers face more dynamic environments. They find that the inverse U-shaped relationship between inventory level and firm performance is more pronounced for retailers compared to manufacturers. Indeed, the authors argue that "…the benefits of being lean in retailing are not as widely attainable as in manufacturing…" (owing to higher uncertainty). Thus, these firms can benefit more from improved stakeholder orientation, which attenuates the negative influence of supply chain uncertainties.

Table IA3. Stakeholder orientation and inventory efficiency: Retailing firms

This table reports the DID regression results of investigating the effect of constituency statutes adoption on retailing firms' inventory efficiency. Column 1 and 2 show the results for the full sample. Column 3 excludes Delaware firms. Column 4 excludes early adopters before 1990. Column 5 ends the sample in 2000. Column 6 excludes firms changing state of incorporation. Column 7 only keeps firms incorporated in states that eventually adopted constituency statutes. Numbers in parentheses are robust standard errors clustered at the incorporated state level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dependent variable	*Inventory Efficiency*						
	Full Sample		Exclude Delaware	Exclude Pre-1990	Exclude After 2000	Exclude Re-Incorp.	Eventually Treated
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constituency Statute	1.857**	1.808**	3.053**	2.805*	2.095*	2.703***	1.773
	(0.700)	(0.716)	(1.122)	(1.519)	(1.172)	(0.864)	(3.127)
Size		-1.633***	-0.584	-1.802*	-1.820**	-1.817***	-2.037
		(0.578)	(0.460)	(0.905)	(0.720)	(0.619)	(1.847)
Leverage		0.357	5.105***	1.057	1.191	1.457	1.526
		(1.605)	(1.705)	(0.973)	(1.780)	(1.497)	(5.376)
Gross Margin		-29.157***	-35.249***	-37.340***	-22.023**	-29.663***	1.310
		(4.796)	(4.807)	(8.669)	(8.448)	(4.517)	(10.048)
Sales Growth		-1.369**	-2.306*	-1.511*	-0.229	-0.943*	-1.547
		(0.532)	(1.333)	(0.804)	(0.573)	(0.549)	(1.480)
Lead Time		-3.939***	-4.213*	-2.778**	-3.553***	-4.104***	-5.424**
		(0.692)	(2.181)	(1.343)	(0.901)	(0.661)	(2.440)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year × State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year × Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,034	10,034	4,001	6,844	6,306	9,364	3,414
R-squared	0.907	0.913	0.929	0.923	0.921	0.918	0.926

4. Construction and Validation of the Supply Chain Risk Exposure Measure

We largely follow Li et al. (2021) to construct the supply chain risk exposure measure.[1] The step-by-step procedure used is briefly described in this section.

First, we obtain raw 10-K data (1993-2012) from Bill McDonald's website. We parse the data following standard procedure: removing all elements that impede textual analysis (e.g., ASCII-encoded segments, tags that are part of table definitions, expressions of semantic meaning commonly required for business reporting, SEC headers and footers, and mark-up tags) and re-encoding all reserved HTML characters. We then extract the MD&A (Item 7, "Management discussion and analysis") section texts and retrieve each firm's Central Index Key (CIK) which is later used to merge the supply chain risk exposure measure with Compustat data.

Second, we use the Stanford CoreNLP package to preprocess the MD&A texts. This involves the following steps: 1) sentence segmentation and tokenization (the word embedding model operates at the sentence level); 2) lemmatization (return words to their base forms); 3) name entity recognition (NER)[2]; 4) dependency parsing (learn grammatical relationships in a sentence to provide syntactic clues for understanding word meanings); 5) identify multi-word expression (MWE) and compounds (these are treated as single words, concatenated using "_", in the word embedding model).

Third, we clean the parsed MD&A texts by removing punctuation marks, stop words[3], and single-letter words. We then use the *phraser* module of the *genism* library and the learning algorithm of Mikolov et al. (2013) to identify two- and three-word phrases (co-occurrences of words arising from conventions or real-world events, rather than linguistic rules).

Fourth, we train the word embedding model (*word2vec* by Mikolov et al., 2013) using the genism library.

[1] Please refer to their Internet Appendix for more technical details.
[2] Replace named entities with predefined tag is important because these tags allow us to learn semantic information about neighboring words
[3] https://sraf.nd.edu/textual-analysis/stopwords/

The window size is set to 5, the word vector dimension to 300, the number of iterations over the corpus to 200, and the minimum word count to 5. We use the skip-gram with negative sampling method, following Li et al. (2021).

Fifth, we define the set of seed words for "supply chain" and "risk" dimensions based on the two criteria: 1) the word or phrase appears in the MD&A text vocabulary, and 2) the seed words are unambiguously related to supply chain risks, comprehensively covering supply, process, and demand-side risks. After consulting with several operations management scholars, we use the following seed words for the "supply chain" dimension: *supply_chain*; *supply*, *demand*, *supplier*, *customer*, *inventory*, *raw_material*, *work_in_process*, *finished_good*, and *production*. As for the "risk" dimension, the seed words are *risk* and *uncertainty*.

Sixth, we rely on the trained *word2vec* model to generate the expanded dictionary for the "supply chain" and "risk" dimensions. Specifically, we compute the average vector of the seed words and then use the cosine similarity between each unique word's vector and the average seed word vector to select "supply chain" and "risk" keywords. The top 500 words with the closest associations are selected in to the expanded dictionary. Finally, we manually review the dictionary and remove words that do not fit. The top 50 representative words for the "supply chain" and "risk" dimensions are reported in Table IA4.

Seventh, we score the supply chain risk exposure of each MD&A texts. A sentence is defined as supply chain risk-related if it contains both "supply chain" and "risk" keywords. For such sentences, the supply chain risk score is set to 1. We then use the VADER algorithm from the Natural Language Toolkit (NLTK) to tag each supply chain risk sentence with a sentiment score ranging from -1 to 1 (0 for neutral statements). For sentences with negative sentiment, the final supply chain risk score is set to 0. For sentences with positive sentiment, the final score equals 1 plus the sentiment score. Sentences with neutral sentiment retain a supply chain risk score of 1. The sentiment-adjusted supply chain risk exposure measure, $SC\ Risk_{sentiment}$, is then computed as the sum of the

final supply chain risk scores across all supply chain risk sentences divided by the total number of sentences in each MD&A text (expressed in percentage terms). For comparison, we also define $SC\ Risk_{no\ sentiment}$, the supply chain risk exposure measure without sentiment adjustment, as the total number of supply chain risk sentences divided by the total number of lines.

After constructing the supply chain risk exposure measures, we perform several validation tests, following Wu (2024). First, we examine the association between the two text-based measures and stock return volatility to assess whether these measures capture actual risk. We focus on two commonly used return volatility measures: realized volatility (computed as the 12-month standard deviation of cum-dividend daily stock returns) and implied volatility (the 12-month average of daily option-implied volatility from OptionMetrics). The results of regressing stock return volatility on our supply chain risk exposure measures are presented in the first four columns of Table IA5. After controlling for both firm and year fixed effects, the coefficients of $SC\ Risk_{no\ sentiment}$ and $SC\ Risk_{no\ sentiment}$ are positive and high significant at the 1% level. Notably, the coefficient magnitude of $SC\ Risk_{no\ sentiment}$ is much larger that of $SC\ Risk_{no\ sentiment}$, implying that sentiment adjustment could improve the accuracy of supply chain risk measurement.

Additionally, we investigate whether the text-based supply chain risk exposure measures are associated with firms' operational responses to supply chain risk. Specifically, we focus on firms' inventory turnover and cash holdings. If the measures do capture supply chain risk, they should be negatively related to inventory turnover and positively related to cash holdings, as inventory and cash typically acts as "buffers" to handle supply chain risk. This is exactly what we found from the data. As show in the last four columns of Table IA5, the coefficients of $SC\ Risk_{no\ sentiment}$ and $SC\ Risk_{no\ sentiment}$ are negative in inventory turnover regressions and positive in cash holding regressions, with statistical significance at least at the 5% level.

Table IA4. Fifty most representative "supply chain" and "risk" keywords

This table lists the 50 most representative words for "supply chain" and "risk".

"Supply chain" key words	"Risk" key words
supply_chain	risk
supply	fluctuation
supplier	variability
raw_material	uncertainty
customer	unpredictable
production	volatility
manufacturer	volatile
demand	unpredictability
product	instability
customer_demand	variation
supply_chain	fluctuate
vendor	uncertain
contract_manufacturer	difficult_predict
component_part	market_volatility
manufacturing_process	unstable
manufacture	economic_instability
finished_product	fluctuate_significantly
import	wide_fluctuation
sourcing	market_uncertainty
inventory_level	cyclical_nature
production_process	economic_downturn
feedstock	price_volatility
factory	market_fluctuation
manufacturing	difficult_forecast
steel	turmoil
producer	price_fluctuation
manufacturing_capacity	cyclicality
shipment	downturn
retailer	risk_uncertainty
packaging	deterioration
distributor	extreme_volatility
consumer_demand	factor_beyond_control
oem	currency_fluctuation
fabric	highly_volatile
market_demand	crisis
goods	swing
end_user	uncertainty_surround
oem_customer	lengthy_sale_cycle
shipping	erratic
inventory	economic_crisis
production_capacity	competitive_pressure
sale_volume	economic_weakness
capacity	political_tension
coal	economic_recession
end_product	vary_significantly

fuel	earnings_volatility
customer_order	depressed
manufacturing_cost	inherent_uncertainty
transport	political_unrest
chemical	constraint

Table IA5. Validating the text-based supply chain risk exposure measures

This table validates the supply chain risk exposure measures based on the MD&A section texts of 10-Ks. Columns 1-4 examines whether the text-based measures are related to the volatility of firms' stock returns, the commonly used measure of overall risk. Column 1 and 2 focus on realized volatility while Column 3 and 4 on (options) implied volatility. Columns 5-8 further investigate whether the measures correlate with actions that firms typically undertake in response to supply chain risks: inventory (Columns 5 and 6) and cash holdings (Columns 7 and 8). Numbers in parentheses are robust standard errors clustered at the firm level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dependent variable	*Return Volatility*$_{realized}$		*Return Volatility*$_{implied}$		*Inventory Efficiency*		*Cash Holdings*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SC Risk$_{sentiment}$	0.008***		0.005***		-0.102***		0.062**	
	(0.002)		(0.002)		(0.037)		(0.031)	
SC Risk$_{no\ sentiment}$		0.007***		0.004***		-0.069*		0.091***
		(0.002)		(0.002)		(0.041)		(0.031)
Size	-0.093***	-0.093***	-0.066***	-0.067***	-0.043	-0.039	-1.011***	-0.999***
	(0.007)	(0.007)	(0.006)	(0.006)	(0.144)	(0.144)	(0.114)	(0.114)
Leverage	0.180***	0.180***	0.123***	0.122***	0.392	0.392	-2.619***	-2.605***
	(0.028)	(0.028)	(0.018)	(0.018)	(0.264)	(0.265)	(0.311)	(0.311)
Gross Margin	-0.019*	-0.019*	-0.019**	-0.019**	1.402***	1.400***	-0.132	-0.134
	(0.011)	(0.011)	(0.007)	(0.007)	(0.228)	(0.229)	(0.231)	(0.232)
Sales Growth	-0.032***	-0.032***	-0.004	-0.004	2.163***	2.152***	1.213***	1.210***
	(0.008)	(0.008)	(0.005)	(0.006)	(0.178)	(0.178)	(0.169)	(0.170)
Lead Time	0.014**	0.014**	0.003	0.003	-1.178***	-1.178***	0.241**	0.242**
	(0.006)	(0.006)	(0.005)	(0.005)	(0.143)	(0.143)	(0.116)	(0.117)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,916	12,916	6,569	6,569	17,051	17,051	16,301	16,301
R-squared	0.697	0.698	0.817	0.817	0.775	0.774	0.377	0.377

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