

HOSTED BY



ELSEVIER

Contents lists available at ScienceDirect

China Journal of Accounting Research

journal homepage: www.elsevier.com/locate/cjar

Product market competition and the disclosure of supply chain information



Yue Chen^a, Xiaotong Yang^{b,*}, Chun Yuan^a, Bing Zhu^a

^a School of Accounting, Central University of Finance and Economics, China

^b Department of Finance, School of Business, Renmin University of China, Beijing, China

ARTICLE INFO

Article history:

Received 14 June 2020

Accepted 14 February 2022

Available online 9 March 2022

Keywords:

Product market competition

Voluntary disclosure

Supply chain information

ABSTRACT

We investigate how product market competition affects corporate voluntary disclosure decisions, specifically regarding supply-chain information. Our results, based on a sample of manufacturing companies listed in China from 2010 to 2016, show that companies in more competitive industries disclose less customer/supplier information. The main results stand through several robustness tests. Further analyses show that the negative relationship between product market competitiveness and supply-chain information disclosure is stronger when the disclosure contains more incremental information and when competitors are more capable of gaining competitive advantage using the disclosed information. Our study contributes to the understanding of both the relationship between product market competition and voluntary disclosure decisions and the regulation of information disclosure to build a transparent capital market.

© 2022 Sun Yat-sen University. Production and hosting by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

After decades of rapid growth, the capital market in China now plays an increasingly prominent role in China's social and economic development. President Xi Jinping emphasized the goal of building a healthy capital market in the report of the 19th Communist Party of China (CPC) National Congress. The chairman of the China Securities Regulatory Commission (CSRC), Yi Huiman, also pointed out that the foremost duty of the CSRC is to build a "regulated and transparent" capital market to better promote China's high-quality economic development. The disclosure of financial information is an essential ingredient of a well-functioning

* Corresponding author.

E-mail address: 2016101032@ruc.edu.cn (X. Yang).

capital market, (Darrough, 1993; Liu et al., 2013). In recent years, competition between companies has gradually evolved into competition between firms' supply chains (Tang, 2009), and as a result, suppliers and customers have become crucial strategic resources able to significantly influence firms' growth (Fisher, 1997; Christopher and Ryals, 1999). Accordingly, a listed company's customer and supplier information provides valuable information for external investors to assess its firm value.

For this reason, the CSRC has increased its efforts to encourage corporations to disclose supply-chain information. Specifically, the CSRC issued The Standards Concerning the Contents and Formats of Information Disclosure by Companies Offering Securities to the Public No.2 — [Contents and Formats of Annual Reports \(2007 Revision\)](#) and required listed companies to disclose the total amount they purchase from their top five suppliers and sell to their top five customers as well as the ratio of those numbers to their annual aggregated purchases and sales. Moreover, the CSRC encourages listed firms to disclose the identities of their top five suppliers and customers as well as the ratio of the amount they purchase from and sell to each of them to the firms' annual aggregated purchases and sales. In practice, however, companies are often reluctant to disclose such information. For example, in our sample period of 2010 to 2016, only 21% of Chinese listed manufacturing companies disclosed the identities of and proportions of purchases attributable to their top five suppliers, and only 36% disclosed the identities of and proportions of sales attributable to their top five customers. Similarly, Ellis et al. (2012) find that U.S. listed companies often fail to meet the Securities and Exchange Commission's (SEC's) requirements of disclosing detailed information about important customers. To explain this under-disclosure, our paper examines the factors affecting firms' supply-chain information disclosure decisions and determines the possible working mechanisms. Our study not only helps to deepen the understanding of the supply-chain information disclosure practices of Chinese A-share listed companies but also explores the determinants of firms' voluntary disclosure. Moreover, this paper contributes information that is critical to capital market regulators.

Supply chain information is a key issue in both the academic and practical worlds. However, past research mostly focuses on the economic consequences of supplier–customer relationships (proxied by the level of concentration) for companies and their stakeholders, including cash holdings (Itzkowitz, 2013), auditor choice (Zhang et al., 2012), the cost of equity capital (Chen et al., 2015; Dhaliwal et al., 2016) and the cost of debt (Campello and Gao, 2017; Cai and Zhu 2020). Recently, security regulatory authorities around the world have begun to encourage listed firms to disclose detailed information about their major suppliers and customers. Researchers find that the incremental information embodied in the identity of companies' major suppliers and customers and in information regarding transactions between the companies and those suppliers and customers helps companies to adjust their production behavior and thereby mitigate the “long whip effect” (Yang et al., 2020), improve the accuracy of analyst forecasts (Guan et al., 2015; Pandit et al., 2011), reduce the uncertainty of new issuances of shares (Johnson et al., 2010) and help investors to better understand the predictability of returns between economically linked firms (Cohen and Frazzini, 2008; Menzly and Ozbas, 2010). In addition, Cen et al. (2017) show that supply-chain information diffusion speed drives investors' customer momentum strategies, affects the price feedback effect on corporate investment decisions and enhances supply-chain coordination. To summarize, although certain studies investigate how companies choose their level of supply-chain information disclosure (Li and Wang, 2016) and the role played by proprietary cost (Ellis et al., 2012; Li et al., 2018), most of the literature concentrates on the economic consequences of supply-chain information disclosure, and little is known about the causal relationship between market factors and supply-chain information disclosure.

Theoretically, companies have a strong incentive to fully reveal all of their private information to reduce information asymmetry and gain capital-market benefits (Grossman, 1981; Milgrom, 1981). In practice, however, the extent of voluntary disclosure varies greatly across firms. Previous studies show that agency cost, litigation risk and proprietary costs may influence corporations' disclosure decisions and lead them to reduce voluntary disclosures (Healy and Palepu, 2001; Luo and Zhu, 2010; Ellis et al. 2012; Wang and Yu, 2014).

Product market competition may exert a key influence on the disclosure of supply-chain information, which is closely related to companies' operations. Firms facing greater competition may choose to disclose more supply-chain information to improve their information environment and reduce the cost of capital (Yi et al., 2010). Furthermore, intense competition may also encourage firms to announce their high-quality

suppliers and customers to deliver credible threats to potential competitors (Johnson et al., 2010). Thus, intense product market competition may encourage corporations to disclose more supply-chain information.

However, a firm's supply-chain information may be observed and used by current and potential competitors to decrease the firm's competitive advantage, raising proprietary costs (Bhattacharya and Ritter, 1983; Foster, 1986; Darrough, 1993). Therefore, companies in highly competitive industries are more concerned about losing their competitive advantage and more reluctant to release private information than those in less competitive industries (Clinch and Verrecchia, 1997; Huang et al., 2017). In the unique institutional background of China's transforming economy, due to the imperfect protection of property rights (Fang et al., 2017), companies in highly competitive industries generally face the serious risk of being deprived of corporate resources by their competition (Wu et al., 2012). Unlike other voluntarily disclosed information, such as social responsibility information, a company's supply-chain information is closely related to its operations and is therefore likely to be used by competitors to imitate the company's strategies or to steal its corporate resources (Ellis et al., 2012). As a result, firms facing fierce competition tend to limit their disclosure of supply-chain information to avoid high proprietary costs.

Based on these contradicting predictions, the impact of product market competition on companies' supply-chain information disclosure decisions remains an empirical question. Therefore, this paper empirically examines the relationship between product market competition and corporate supply-chain information disclosure decisions, using a sample of Chinese A-share manufacturing company observations from 2010 to 2016. Our results show that companies in highly competitive industries choose to disclose less supply-chain information than those in less competitive industries. These main results are robust to several robustness tests, including a difference-in-differences (DID) regression using large reductions in China import tariff rates as an exogenous shock to the level of competition. Further tests show that the influence of product market competition on supply-chain information disclosure is more pronounced when there is more incremental information contained in the information (i.e., for companies in worse information environments) and when the information is more likely to be used by competitors to obtain a competitive advantage (i.e., for non-state owned companies, companies with cost leadership strategies and lower levels of product differentiation and companies in worse legal environments), which is consistent with the proprietary cost argument.

Our research makes several contributions. First, this study adds new evidence to the long-running debate on the relationship between product market competition and voluntary corporate disclosure (Verrecchia, 1983, 1990; Darrough and Stoughton, 1990; Ren and Wang, 2019). Previous studies in this area mainly focus on the voluntary disclosure of social responsibility reports (Zhang, 2012), management forecasts (Li, 2010; Ma, Lianfu et al., 2013; Huang et al., 2017) and corporate press releases (Burks et al., 2018). As compared to these kinds of information, supply-chain information is more closely linked to firms' operations (Ellis et al., 2012) and is therefore more likely to be exploited by competitors. Therefore, it is intuitive that decisions regarding the disclosure of supply-chain information are more affected by the level of product market competition than decisions to disclose other kinds of information.

Moreover, due to China's stage of economic development, its legal environment and its imperfect protection of property rights, the role of product market competition in shaping a company's supply-chain information disclosure in its capital market likely differs from that in developed markets. For instance, Ellis et al. (2012) find that U.S. firms in less competitive industries are more likely to conceal the identities of their major customers. Ellis et al. (2012) argue that firms in less competitive industries are more likely to enjoy a monopoly; therefore, their detailed supply-chain information is more valuable. In other words, the propriety cost of their supply-chain information is higher. Under these circumstances, product market competition is positively correlated to the disclosure of customer and supplier information. The results in our study, however, show the opposite. Using data on Chinese firms, we find a negative relationship between product market competition and supply-chain information disclosure. The seemingly contradicting results may be explained by the relative lack of property rights in China (Fang et al., 2017). This institutional background, combined with the relatively low industry concentration in China, increases companies' risk of being deprived of valuable corporate resources by their competitors. In this context, intense competition increases the proprietary costs associated with supply-chain information disclosure and thus decreases the level of disclosure. Our study also takes advantage of China's unique ownership and legal environment to examine how product market competition affects firms' disclosure decisions through proprietary cost. In summary, the research perspective and

background of this study provide novel evidence to the long-standing debate concerning the relationship between competition and voluntary disclosure.

Second, our study contributes to the growing attention paid to supply-chain information disclosure decisions. Previous studies in this area mainly focus on the economic consequences of supply-chain information disclosure for companies and their stakeholders (Guan et al., 2015; Cohen and Frazzini, 2008; Johnson et al., 2010; Menzly and Ozbas, 2010; Pandit et al., 2011; Itzkowitz, 2013; Yang et al. 2020). Only two papers discuss the determinants of supply-chain information disclosure decisions from the aspect of proprietary costs (Ellis et al., 2012; Li et al., 2018). However, both papers use product market competition as a proxy for proprietary cost and fail to fully explore the impact of market competition. In fact, market competition may influence supply-chain information disclosure not only through proprietary cost but also through increased financial pressure and market discipline (Chen et al., 2015; Jiang et al., 2017). If the latter impact dominates the former, then companies in markets with higher competition have an incentive to increase their supply-chain information disclosure to ease their financial constraints. Given these two possible outcomes, how product market competition affects corporate supply-chain information disclosure remains an open question. Furthermore, unlike the SEC's mandatory disclosure requirement¹ in the U. S., the CSRC only requires listed firms to disclose their total annual transaction amount and the total proportion attributable to their top five customers and suppliers and encourages listed firms to voluntarily disclose the identity and transaction amount of each major customer and supplier. Under China's non-mandatory disclosure requirements, the level of supply-chain information disclosure better reflects a company's reporting strategy, which helps us to understand the impact of product market competition on corporations' disclosure choices. Against this background, this paper provides an in-depth analysis of the factors influencing supply-chain information disclosure from the perspective of product market competition and explores the underlying mechanism, thus complementing previous research on supply-chain information disclosure.

Third, our study alleviates the problem of measuring the level of product market competition noted by Ali et al. (2008). Previous studies mainly use the data of publicly traded firms to score the degree of product market competition and concentration (Verrecchia and Weber, 2006; Li, 2010; Yi, 2010). This method is problematic in that it excludes private firms, which may account for a nonnegligible percentage of industry sales; thus, this method harms the accuracy of competition measures (Ali et al., 2008; Zhou and Tang, 2015). To this end, we use the data of both publicly traded and privately held firms to construct our industry concentration measures. Moreover, we use the large reductions in China's import tariff rates as an exogenous shock to market competition and adopt a DID analysis to address the endogeneity concern. We also conduct robustness tests with alternative proxies for product market competition.

Finally, our study has practical implications for both investors and capital market authorities. Given that supply-chain information provides valuable information helpful to external investors in assessing firm value (Chen Jun et al., 2015; Dhaliwal et al., 2016), the CSRC increased regulation of the disclosure of supply-chain information, encouraging listed companies to publicize their detailed supply-chain information. However, as pointed out above, the current disclosure quality in China is inadequate. Ellis et al. (2012) also find that the customer information provided by listed companies in the U.S. fails to meet the SEC's requirements. Our paper attempts to explain the phenomenon of under-disclosure from the perspective of product market competition. Our findings could help regulators to perfect regulatory means to improve the quality of supply-chain information disclosure.

The remainder of this paper is organized as follows. Section 2 discusses the theoretical framework and develops testable hypotheses. Section 3 describes the data and the main variables. Section 4 presents the empirical results. Section 5 concludes the paper.

¹ In the U.S., SEC Reg. S-K requires publicly traded firms to report the sales to and identity of any customer that comprises more than 10% of a firm's consolidated revenues, if losing that customer would have a material, adverse effect on the company.

2. Hypothesis development

Determining a firm's level of supply-chain information disclosure is one of the most important voluntary corporate disclosure decisions. On the one hand, detailed customer and supplier information may reduce information asymmetry and bring a series of capital market gains, such as lower capital costs, a higher stock price, more liquidity and more efficient asset pricing (Healy and Palepu, 2001; Balakrishnan et al., 2014). On the other hand, providing detailed supply-chain information has a potential downside arising from the fact that, compared with purely financial information, supply-chain information is more closely related to companies' real operations, especially the characteristics of their customers and suppliers (Ellis et al., 2012). In other words, customer and supplier information is a trade secret. While such disclosure improves the corporate information environment (Li and Wang, 2016), reduces financial costs (Chen et al., 2015; Cai and Zhu, 2020) and large customers could play an identification role for companies (Johnson et al., 2010), detailed supply-chain information may also be observed by current and potential competitors and used against the disclosing companies, leading to considerable proprietary costs (Ellis et al., 2012; Wang and Yu, 2014). Therefore, the decision to disclose supply-chain information is the result of weighing the pros and cons of such disclosure. Based on previous studies, we believe that product market competition plays a critical role in this cost-benefit analysis.

First, companies are exposed to greater capital pressure and threats of bankruptcy in more competitive industries (Schmidt, 1997). In this environment, a firm's customer and supplier information provides valuable information concerning the concentration, quality and stability of the firm's customers and suppliers, helping external investors to assess the present and future value of the firm as well its risk (Gosman et al., 2004; Chen et al., 2015). Therefore, companies facing fierce competition have strong incentives to release higher quality supply-chain information to reduce information asymmetry and decrease capital costs (Yi et al., 2010). Furthermore, companies in more competitive industries are more motivated to act strategically to distinguish themselves from others, such as by disclosing high-quality customers to prove the quality of its revenue (Johnson et al., 2010). For these reasons, product market competition may increase the disclosure of supply-chain information.

Second, competitors in competitive industries are more likely than those in monopoly industries to obtain disclosing companies' private information and adjust their strategies accordingly to gain a competitive advantage. Particularly in the context of China's transitional economy and due to its highly decentralized industrial structure, there is fierce competition among a great number of companies of similar scale and offering similar products (Wu et al., 2012). Furthermore, as property protection in China is relatively underdeveloped (Fang et al., 2017), companies in competitive industries make use of others' private information to mimic their business strategies, to launch price wars and to conduct competition for resources, leading to substantial proprietary costs for the disclosing companies.

Companies' supply-chain information is considered to be "material information" related more closely to their real operations (Ellis et al., 2012), as it includes critical trade secrets such as customer demand, production preference and product-pricing strategies (ASIS International, 2002). Therefore, customer and supplier information is more likely to be imitated and used by market rivals than other information, causing more significant proprietary costs for disclosing firms by three specific mechanisms. First, market rivals may use disclosed supplier and customer information to obtain or infer a company's existing production capacity, operating costs, market demand, gross profit margins and other private information and adjust their own production output and prices accordingly or imitate products to weaken the disclosing firms' competitive advantage (Clinch and Verrecchia, 1997). Second, when the disclosing firm is a participant in a competitive industry rather than a monopoly, its market rivals may use detailed supply-chain information to compete for strategic resources such as valuable suppliers and customers, meaning that disclosing firms face a greater threat of customer and supplier loss (Darrough and Stoughton, 1990; Wagenhofer, 1990). Third, when the market concentration is low and industry competition is intense, supplier and customer bargaining power is greater and transformation costs are lower. Under these conditions, while supply-chain information helps corporate competitors to compete for resources, it also increases bargaining power and decreases transformation costs for both suppliers and customers, thus worsening the hold-up problems caused by suppliers and customers

(Baiman and Rajan, 2002). Given these three mechanisms, product market competition may also decrease the disclosure of supply-chain information.

Therefore, given that product market competition may either promote or inhibit corporate supply-chain information disclosure, we form the following hypotheses:

H1a: Product market competition is positively correlated with supply-chain information disclosure.

H1b: Product market competition is negatively correlated with supply-chain information disclosure.

3. Data and main variables

3.1. Data source and sample selection

Our sample consists of all Chinese listed manufacturing firms from 2000 to 2016. We collect product market competition data from the China Stock Market and Accounting Research (CSMAR) China Industry Business Performance Database. We collect supply chain data from the Chinese Research Data Service (CNRDS) Supply Chain Research Data (SCRD) database. We obtain stock return and financial data from the CSMAR database. Tariff rates data are obtained from the Trade Analysis and Information System (TRAINS).

Following previous studies, we remove financial firms and firms with supply-chain information labeled as “Confidential unit.”² We further exclude firms with missing or incomplete data. The final sample consists of 9,854 firm-year observations. To reduce the influence of outliers, we winsorize all of the continuous variables at the 1st and 99th percentiles.

3.2. Main variable definitions

3.2.1. Product market competition

Our primary measure of product market competition is the Herfindahl–Hirschman Index (HHI). HHI is defined as the sum of squared market shares for all firms in the same industry. The market share of a firm is the ratio of the firm’s sales to the entire industry’s sales. A higher HHI indicates a more concentrated industry and thus lower product market competition. HHI is one of the most commonly used measures for the following reasons. First, HHI gives more weight to larger enterprises; thus, it can meaningfully reflect the size of and dominant power among companies. Second, HHI comprehensively reflects the number and relative size of enterprises, improves the differentiation of research samples and thus better depicts market competition (Liu et al., 2003). To make the measure more intuitive, we calculate $(1 - \text{HHI}) * 100$ (*Competition*) to proxy for competition. A higher *Competition* value reflects a higher level of product market competition.

Previous studies on product competition often use listed firm data from the U.S. Compustat database to construct a measure of industry concentration. However, as pointed out by Ali et al. (2008), an absence of private firms in the computation of HHI makes it a biased estimate of competition. Zhou and Tang (2015) also point out that as private companies often account for a significant proportion of industry sales, industry competition variables based on an industrial enterprise database are superior to those based solely on listed company data. Therefore, following Ali et al. (2014) and Jiang et al. (2015), we use China’s National Bureau of Statistics (NBS) data to estimate our product market competition measure, as this database includes private firms as well as listed firms. Specifically, the NBS database includes all manufacturing firms with sales greater than 5 million RMB (during most of our sample period, 8 RMB equaled about US\$1). A comprehensive list of firms reduces listing bias in measuring product market competition. As these data are only available before 2013, we derive the HHI measure after 2013 based on the change in HHI trend from 2011 to 2013.

3.2.2. Supply chain information disclosure

We adopt the following two measures of supply chain disclosure: supplier information disclosure and customer information disclosure. Supplier-specific disclosure (*DumSupply*) equals 1 if a company discloses

² Confidential units are often mandated not to disclose supply chain information due to industry characteristics (e.g., the arms industry) and thus are excluded.

information specific to at least one supplier, including the identity, transaction amounts and proportion of purchases attributable to that supplier, and 0 otherwise. Similarly, customer-specific disclosure (*DumCustom*) equals 1 if the firm discloses information specific to at least one customer, including the identity, transaction amounts and proportion of sales attributable to that customer, and 0 otherwise.

3.2.3. Control variables

Following the literature (e.g., Ellis et al., 2012; Jiang et al., 2015), we include several control variables, including firm size (*Size*), financial leverage (*Lev*), operating performance (*ROA*), Tobin's Q (*TobinQ*), state-owned enterprise (SOE) indicator (*SOE*), ownership of the largest shareholder (*top1*), CEO-chair duality (*Dual*), board size (*Bsize*), proportion of independent directors (*Indep*), research and development (R&D) disclosure information (*Dum_Rd*) and intangible assets (*Intang*). Industry and year dummies are also included in the analyses. Detailed variable definitions are provided in Table 1.

3.3. Model specification

We examine the relationship between product market competition and corporate supply-chain information disclosure with the following model:

$$Disclosure_{i,t} = \alpha + \beta * Competition_{i,t-1} + \gamma * Control_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

We use supplier-specific information disclosure (*DumSupply*) and customer-specific information disclosure (*DumCustom*) as our two measurements of supply information disclosure (*Disclosure_{i,t}*). *Competition_{i,t-1}* is our key independent variable; its measurement is described above. *Control_{i,t-1}* includes firm-specific control variables, industry dummies and year dummies, as mentioned above. All of the independent variables (except for industry and year dummies) are lagged by 1 year to mitigate endogeneity concerns.

Table 1
Variable definitions.

Variable	Description	Definition
<i>DumSupply</i>	Supplier-specific information disclosure	Indicator that equals 1 if the firm discloses information specific to least one supplier, including identity, transaction amounts and proportion of total purchases attributable to that supplier, and 0 otherwise
<i>DumCustom</i>	Customer-specific information disclosure	Indicator that equals 1 if the firm discloses information specific to at least one customer, including identity, transaction amounts and proportion of total sales attributable to that customer, and 0 otherwise
<i>Competition</i>	Product market competition	(1-HHI)*100, HHI is defined as the sum of squared market shares for all firms in the same industry. The market share of a firm is the ratio of the firm's sales to the sales of the entire industry.
<i>Size</i>	Firm size	Log (firm assets)
<i>Lev</i>	Firm leverage	Ratio of total liabilities to total assets
<i>ROA</i>	Operating performance	Ratio of net operating income to total assets
<i>TobinQ</i>	Tobin's Q	Ratio of the sum of market value of tradable shares and book value of non-tradable shares to the book value of total assets at the beginning of the year
<i>Dum_Rd</i>	R&D information disclosure	Indicator that equals 1 if the firm discloses R&D information, and 0 otherwise
<i>Intang</i>	Intangible assets investment	Ratio of net intangible assets to total assets
<i>SOE</i>	Enterprise property	Indicator that equals 1 if the firm's ultimate controlling shareholders are state entities, and 0 otherwise
<i>Top1</i>	Top1 ownership	Ownership of the largest shareholder
<i>Dual</i>	CEO-Chair duality	Indicator that equals 1 if the CEO is also the board chair, and 0 otherwise
<i>BSize</i>	Board size	Log (total number of directors on the board)
<i>Indep</i>	Proportion of independent directors	Ratio of the number of independent directors to the total number of directors on the board

4. Empirical results

4.1. Summary statistics

Table 2 presents the summary statistics of our main variables. Panel A shows that 20.9% of our sample disclosed supplier-specific information and 36.1% of our sample disclosed customer-specific information, suggesting that the level of supply-chain information disclosure is low in general. The mean (median) value of competition is 0.997 (0.998), indicating that compared with the level of industry competition in the U.S.³, the product market competition is rather intense in China. The values of our control variables are consistent with those reported in previous studies.

Panel B of Table 2 provides preliminary results on the relation between product market competition and supply-chain information disclosure. Specifically, we split the full sample along the median HHI value and compare the mean values of *DumSupply* (*DumCustom*) in the low-HHI group and the high-HHI group. As shown in Panel B, the mean *DumSupply* (*DumCustom*) in the high-HHI subsample is 19.5% (34%) and the mean *DumSupply* (*DumCustom*) in the low-HHI subsample is 23.3% (39.9%). The difference between these two mean values is significant at the 1% level. The results indicate that product market competition is negatively correlated with supply-chain information disclosure.

4.2. Main regression results

We use model 1 to empirically test the relation between product market competition and supply-chain information disclosure. The dependent variables in columns (1) and (3) and columns (2) and (4) are supplier-specific and customer-specific information disclosure, respectively. Columns (3) and (4) include industry dummy variables to control for potential industry fixed effects.

As shown in Table 3, the coefficient on *Competition* is -0.262 and is significant at the 5% level in column (1), whereas the coefficient value is -0.415 and is significant at the 1% level in column (2), suggesting that competition discourages the disclosure of supplier-specific and customer-specific information. These results remain robust after we control for industry fixed effect in columns (3) and (4). Overall, the results in Table 3 show that firms in highly competitive industries tend to disclose less supply-chain information.

4.3. Addressing endogeneity concerns

Next, we address two endogeneity concerns. First, the negative relation between competition and supply-chain information disclosure may be driven by reverse causality or by a latent variable (Arya and Mittendorf, 2007; Ali et al., 2014; Lang and Sul, 2014). To address this concern, we first use an exogenous shock to market competition. Second, our findings may be driven by omitted time-invariant, firm-specific variables. To alleviate this concern, we regress the change in supply-chain information disclosure on the change in competition.

4.3.1. A quasi-natural experiment: Large reductions in industry import tariff rates

Considering the endogenous nature of competition, several studies attempt to use exogenous shocks to the intensity of product market competition to mitigate endogeneity concerns. For example, Bhojraj et al. (2004) take the gradual deregulation of the U.S. electric power industry as a series of exogenous shocks to industry competition; Huang et al. (2017) take the decline of U.S. import tariffs as an exogenous event that increases the product market competition; and Burks et al. (2018) use the implementation of the Interstate Banking and Branch Efficiency Act, which deregulates the interstate branches of the U.S. banking industry, as an exogenous shock to competition in the banking sector. Following previous studies (Fresard, 2010; Valta, 2012; Huang et al., 2017; Jiang et al., 2015), we use large reductions in industry import tariff rates in China as exogenous shocks to competition, and we use a DID model to examine the relationship between product market competition and supply-chain information disclosure. As the unexpected, large reductions in industry import

³ As Zheng et al. (2021) note, the mean (median) level of competition (HHI) is 0.276(0.174) for U.S. firms.

Table 2
Summary statistics.

Variable	N	Mean	Median	Sd	Min	Max
<i>DumSupply</i>	9854	0.209	0	0.406	0	1
<i>DumCustom</i>	9854	0.361	0	0.48	0	1
<i>Competition</i>	9854	99.7	99.8	4	98.2	100
<i>Size</i>	9854	21.85	21.69	1.23	19.24	25.67
<i>Lev</i>	9854	0.441	0.434	0.22	0.049	1.05
<i>ROA</i>	9854	0.048	0.039	0.076	-0.183	0.372
<i>TobinQ</i>	9854	2.706	2.079	2.007	0.882	13.134
<i>Dum_Rd</i>	9854	0.744	1	0.437	0	1
<i>Intang</i>	9854	0.051	0.038	0.048	0	0.282
<i>SOE</i>	9854	0.433	0	0.495	0	1
<i>Top1</i>	9854	0.356	0.338	0.148	0.091	0.749
<i>Dual</i>	9854	0.241	0	0.428	0	1
<i>Bsize</i>	9854	2.272	2.303	0.174	1.792	2.773
<i>Indep</i>	9854	0.37	0.333	0.052	0.308	0.571
Variable	High competition		Low competition		Mean Diff.	
<i>DumSupply</i>	6239	0.195	3615	0.233		-0.038***
<i>DumCustom</i>	6239	0.34	3615	0.399		-0.060**

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

Table 3
Competition and supply-chain information disclosure: Main results.

Variable	(1) DumSupply	(2) DumCustom	(3) DumSupply	(4) DumCustom
<i>Competition</i>	-0.262** (-2.56)	-0.415*** (-4.40)	-0.345*** (-3.05)	-0.289*** (-2.67)
<i>Size</i>	-0.176*** (-3.31)	-0.132*** (-3.00)	-0.171*** (-3.12)	-0.122*** (-2.70)
<i>Lev</i>	0.565** (2.53)	0.579*** (3.08)	0.518** (2.34)	0.581*** (3.08)
<i>ROA</i>	-0.276 (-0.53)	0.168 (0.38)	-0.242 (-0.45)	0.132 (0.29)
<i>TobinQ</i>	-0.044* (-1.90)	-0.046** (-2.19)	-0.014 (-0.61)	-0.034 (-1.54)
<i>Dum_Rd</i>	-0.375*** (-3.04)	-0.376*** (-4.08)	-0.205 (-1.58)	-0.237** (-2.52)
<i>Intang</i>	2.406*** (2.85)	1.844** (2.44)	1.979** (2.11)	1.539* (1.88)
<i>SOE</i>	0.008 (0.07)	0.124 (1.38)	-0.028 (-0.25)	0.092 (1.00)
<i>Top1</i>	0.380 (1.21)	0.311 (1.20)	0.214 (0.66)	0.184 (0.69)
<i>Dual</i>	-0.107 (-1.13)	-0.098 (-1.20)	-0.087 (-0.92)	-0.078 (-0.94)
<i>Bsize</i>	0.197 (0.61)	0.315 (1.21)	0.018 (0.06)	0.240 (0.91)
<i>Indep</i>	-2.438*** (-2.68)	-0.669 (-0.91)	-2.476*** (-2.62)	-0.678 (-0.89)
<i>Intercept</i>	26.983** (2.58)	43.155*** (4.54)	35.670*** (3.12)	31.137*** (2.88)
<i>Year Fixed</i>	Yes	Yes	Yes	Yes
<i>Industry Fixed</i>	No	No	Yes	Yes
<i>N</i>	9854	9854	9854	9854
<i>Pseudo R²</i>	0.060	0.067	0.082	0.082

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

tariff rates lowered the barriers faced by foreign-based firms, they increased competition within the industry (Bernard et al., 2006). Tariff changes are mainly triggered by global economic and political forces and bilateral (or multilateral) trade agreements and are less likely to be affected by corporate supply-chain information disclosure (Huang et al., 2017).

Following Huang et al. (2017), for each industry-year, we define a significantly large import tariff rate cut as an exogenous shock to competition. Specifically, we first obtain the HS-2002 hex quantile product-level AD valorem import tariff rates from UNCTAD's TRAINS system.⁴ Second, we merge the HS-2002 hex quantile product into the four-digit industry code of the international standard industry classification (ISIC) (Revision 3) according to the comparison table released by the United Nations Statistics Division, then we calculate the average tariff rate of the industry. Third, we match this average tariff rate with the CIC two-digit industry code to obtain the double-digit, national economy, industry-level import tariff rate. Finally, we define a significantly large, unexpected import tariff rate cut ($Post_Reduction_{i,t}$) as a reduction that is at least three times the average import tariff rate reduction for the industry over our sample period.

Next, we use a DID regression to establish the causal relation between competition and supply-chain information disclosure with the following model:

$$Disclosure_{i,t} = \alpha + \beta Post_Reduction_{i,t} + \gamma * Control_{i,t-1} + \varepsilon_{i,t} \quad (2)$$

We use supplier-specific information disclosure ($DumSupply$) and customer-specific information disclosure ($DumCustom$) as our measures for supply information disclosure ($Disclosure_{i,t}$). $Post_Reduction_{i,t}$ is an indicator variable that equals 1 if a firm is in an industry that experienced a large, unexpected tariff reduction by year t , and 0 otherwise. Control $i, t-1$ includes firm-specific control variables, industry dummies and year dummies in line with model (1).

The results are reported in Table 4. In columns (1) and (3), we control for industry fixed effects and year fixed effects. In columns (2) and (4), we control for firm fixed and year fixed effects. The coefficients of $Post_Reduction$ are all negative and significant at the 5% level, indicating that a large reduction in import tariff rates may lead companies in affected industries to disclose less information about their supply chains. The DID models alleviate concerns of potential reverse causality and help to establish the causality between industry competition and corporate disclosure.

4.3.2. Change model

To ensure that our results are not driven by omitted variable bias, we follow previous studies (Jiang et al., 2015; Jiang et al., 2017) by regressing the year-to-year change in supplier-specific information disclosure ($\Delta DumSupply$) and customer-specific information disclosure ($\Delta DumCustom$) on the year-to-year change of the measure of product market competition ($\Delta Competition$). Table 5 presents the results of this change model.

Table 5, columns (1) and (2) show that the coefficients of $\Delta Competition$ are all negative, suggesting that companies disclose less supply-chain information after large declines in industry concentration. These findings are consistent with our main results.

4.4. Additional tests

The results presented above suggest that companies in highly competitive industries disclose less supply-chain information. In this section, we test the role played by proprietary cost. Ali et al. (2014) point out that proprietary cost is determined by the following two factors: whether information disclosed by a company may provide incremental information to competitors and whether competitors may take advantage of this information at the expense of the disclosing firms. To explore the effect of proprietary costs, we test these two pathways separately. First, we use information asymmetry to proxy for incremental information contained in supply-chain information. Then, we use ownership, operation strategy, and legal environment to proxy for rivals' ability to use supply-chain information for competitive advantage.

⁴ As the import tariff rate data are only available before 2014, we replace the import tariff data after 2014 with the data from 2014. We also remove the sample after 2014 and find that the results are robust.

Table 4
Competition and supply-chain information disclosure: DID model.

Variable	(1) DumSupply	(2) DumSupply	(3) DumCustom	(4) DumCustom
<i>Post_Reduction</i>	-0.522** (-2.00)	-0.737** (-2.34)	-0.178** (-1.99)	-0.315** (-2.18)
<i>Size</i>	-0.180*** (-2.92)	-0.177 (-1.29)	-0.121** (-2.32)	-0.166 (-1.45)
<i>Lev</i>	0.581** (2.30)	0.725 (1.64)	0.556** (2.53)	0.193 (0.50)
<i>ROA</i>	0.241 (0.34)	0.691 (0.68)	0.108 (0.17)	1.295 (1.64)
<i>TobinQ</i>	-0.015 (-0.52)	-0.012 (-0.28)	-0.010 (-0.39)	0.018 (0.49)
<i>Dum_Rd</i>	-0.091 (-0.80)	-0.099 (-0.68)	-0.084 (-0.89)	-0.014 (-0.12)
<i>InTang</i>	1.536** (2.23)	0.310 (0.28)	1.467* (1.93)	-0.208 (-0.20)
<i>SOE</i>	0.017 (0.13)	0.364 (1.07)	0.086 (0.79)	0.473* (1.67)
<i>Top1</i>	0.296 (0.85)	1.680** (2.18)	0.213 (0.74)	0.292 (0.40)
<i>Dual</i>	-0.009 (-0.09)	0.022 (0.13)	-0.078 (-0.81)	0.066 (0.47)
<i>BSize</i>	0.064 (0.18)	-0.643 (-1.01)	0.227 (0.78)	0.365 (0.71)
<i>Indep</i>	-3.027*** (-2.96)	-3.665** (-2.42)	-1.326 (-1.61)	0.321 (0.26)
<i>Intercept</i>	1.882 (1.23)		2.302* (1.81)	
<i>Firm Fixed</i>	No	Yes	No	Yes
<i>Year Fixed</i>	Yes	Yes	Yes	Yes
<i>Industry Fixed</i>	Yes	No	Yes	No
<i>N</i>	7244	3419	7244	4608
<i>Pseudo R²</i>	0.064	0.192	0.069	0.183

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

4.4.1. Incremental information of supply-chain information: Information environment

We first examine the influence of incremental information. As stated by [Berger and Hann \(2007\)](#), incremental information in private information is determined by the public market information available to competitors. When the information environment of a company is relatively transparent, meaning that outsiders may obtain private information through open market channels, then supply-chain information disclosure releases little incremental information and proprietary cost is low. Conversely, in less transparent information environments, supply-chain information disclosure conveys more incremental information and proprietary cost is higher. Therefore, we expect that a more transparent information environment weakens the negative correlation between competition and supply-chain information disclosure.

Previous studies document that the media are an important source of information in the public market. For example, press releases on firms' business operation help to reduce information asymmetry. Competitors therefore rely on the media to obtain companies' supply-chain information ([Mullainathan and Shleifer, 2005](#); [Graham et al., 2005](#)). Securities analysts have alternate sources of firms' private information, namely, personal contact with executives, on-site investigations, telephone interviews and other personal channels. Analysts are thus in a position to improve the efficiency of information analysis and pass information to the market through analyst reports, thereby reducing information asymmetry ([Amiram et al., 2016](#); [Son et al., 2016](#)). We therefore use variables representing companies' news coverage (*Media*) and analyst following

Table 5
 Competition and supply-chain information disclosure: Change model.

Variable	(1) ΔDumSupply	(2) ΔDumCustom
<i>ΔCompetition</i>	-0.258* (-1.66)	-0.325** (-2.28)
<i>ΔSize</i>	0.570*** (5.70)	0.338*** (3.87)
<i>ΔLev</i>	-0.283 (-0.79)	0.147 (0.49)
<i>ΔROA</i>	-0.539 (-0.90)	0.279 (0.60)
<i>ΔTobinQ</i>	0.114*** (4.57)	0.006 (0.24)
<i>ΔDum_Rd</i>	-0.109 (-1.20)	0.098 (1.17)
<i>ΔIntang</i>	-1.557 (-1.20)	-0.242 (-0.22)
<i>ΔSOE</i>	-0.135 (-0.56)	0.016 (0.07)
<i>ΔTop1</i>	0.871 (1.49)	0.986* (1.80)
<i>ΔDual</i>	-0.311*** (-2.83)	0.000 (0.00)
<i>ABSize</i>	-0.271 (-0.70)	-0.027 (-0.08)
<i>ΔIndep</i>	-2.018** (-2.23)	-1.297 (-1.61)
<i>Intercept</i>	-2.536*** (-21.05)	-1.521*** (-9.86)
<i>Year Fixed</i>	Yes	Yes
<i>Industry Fixed</i>	Yes	Yes
<i>N</i>	9773	9773
<i>Pseudo R²</i>	0.071	0.035

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

(*Analyst*) to measure the relevant information environments to examine how incremental information provided in supply-chain information affects the relationship between competition and disclosure.

For empirical testing purposes, we include the interaction term between the variables *Competition* and *Media* (*Competition*Media*) and between the variables *Competition* and *Analyst* (*Competition*Analyst*) and use them as key explanatory independent variables in regression models. Shown in columns (1) and (3) of Table 6, the coefficients of *Competition*Media* are significantly positive, and in columns (2) and (4), the coefficients of *Competition*Analyst* are also shown to be significantly positive. All of these results show that a more transparent information environment is associated with lower proprietary costs and a weaker relationship between competition and supply-chain information disclosure.

4.4.2. Ability of competitors to obtain a competitive advantage using disclosed supply-chain information

We use ownership, operation strategy and legal environment to capture competitors' ability to obtain a competitive advantage using disclosed supply-chain information.

First, we study how ownership affects companies' supply chain information disclosure decisions. Compared with private enterprises, SOEs receive more financial and political government support; enjoy more conveniences in terms of obtaining sales channels, operating licenses and product pricing; and have closer natural ties with the government. These competitive advantages are difficult for non-SOE competitors to imitate (Shleifer and Vishny, 1994; Kong et al., 2013). This means that even if an SOE's competitors have access to the firm's supply-chain information, they have little ability to challenge the firm's competitive advantage.

Table 6
Competition and supply-chain information disclosure: Information environment.

Variable	(1)	(2)	(3)	(4)
	Media attention		Analyst attention	
	DumSupply	DumCustom	DumSupply	DumCustom
<i>Competition*Media</i>	0.168** (2.43)	0.115* (1.68)		
<i>Competition*Analyst</i>			0.113* (1.94)	0.172*** (3.36)
<i>Competition</i>	-0.560*** (-3.59)	-0.318** (-2.11)	-0.344** (-2.27)	-0.540*** (-4.02)
<i>Media</i>	-16.717** (-2.43)	-11.482* (-1.68)		
<i>Analyst</i>			-11.375* (-1.96)	-17.260*** (-3.38)
<i>Size</i>	-0.075 (-1.39)	-0.128*** (-2.74)	-0.101* (-1.76)	-0.074 (-1.52)
<i>Lev</i>	0.412* (1.86)	0.539*** (2.86)	0.459** (2.08)	0.476** (2.51)
<i>ROA</i>	-0.996* (-1.95)	-0.042 (-0.10)	0.217 (0.43)	0.361 (0.82)
<i>TobinQ</i>	-0.000 (-0.01)	-0.040* (-1.87)	-0.023 (-1.00)	-0.029 (-1.35)
<i>Dum_Rd</i>	0.111 (0.96)	-0.223** (-2.39)	-0.178 (-1.38)	-0.193** (-2.08)
<i>Intang</i>	1.714** (1.98)	1.476* (1.83)	1.849** (2.12)	1.564* (1.95)
<i>SOE</i>	-0.080 (-0.73)	0.086 (0.93)	-0.075 (-0.68)	0.066 (0.72)
<i>Top1</i>	0.103 (0.33)	0.261 (1.00)	0.337 (1.07)	0.270 (1.04)
<i>Dual</i>	-0.098 (-1.03)	-0.089 (-1.08)	-0.077 (-0.80)	-0.073 (-0.88)
<i>BSize</i>	-0.070 (-0.23)	0.192 (0.74)	0.127 (0.40)	0.199 (0.76)
<i>Indep</i>	-2.488*** (-2.72)	-0.838 (-1.11)	-2.601*** (-2.80)	-0.869 (-1.15)
<i>Intercept</i>	50.316*** (4.80)	34.221*** (3.44)	34.508** (2.27)	55.300*** (4.11)
<i>Year Fixed</i>	Yes	Yes	Yes	Yes
<i>Industry Fixed</i>	Yes	Yes	Yes	Yes
<i>N</i>	9854	9854	9854	9854
<i>Pseudo R²</i>	0.053	0.077	0.071	0.079

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

Therefore, we expect SOEs in highly competitive industries to experience lower proprietary costs associated with information disclosure and thus to disclose more supply-chain information than their private enterprise counterparts. Based on this assumption, we include the interaction term between *Competition* and *SOE* (an indicator that takes the value of 1 if the firm's ultimate controlling shareholders are state entities, and 0 otherwise). The coefficients of *Competition*SOE*, presented in Table 7, are all significantly positive, indicating that SOEs are more likely to disclose supply-chain information in highly competitive industries than their non-SOE counterparts.

Second, we study how operation strategy affects companies' supply chain information disclosure decisions. According to previous studies, corporate operation strategies may be categorized as either product-differentiation strategies or cost-leadership strategies. Companies that adopt a product differentiation strategy are less substitutable and more difficult for competitors to imitate and therefore encounter low proprietary

Table 7
 Competition and supply-chain information disclosure: Ownership.

Variable	(1) DumSupply	(2) DumCustom
<i>Competition*SOE</i>	0.394** (2.51)	0.166* (1.65)
<i>Competition</i>	-0.337** (-2.50)	-0.233*** (-2.61)
<i>Size</i>	-0.184*** (-3.27)	-0.133*** (-4.73)
<i>Lev</i>	0.502** (2.12)	0.539*** (4.01)
<i>ROA</i>	-0.331 (-0.50)	0.116 (0.25)
<i>TobinQ</i>	-0.041 (-1.48)	-0.044** (-2.46)
<i>Dum_Rd</i>	-0.223* (-1.73)	-0.217*** (-3.22)
<i>Intang</i>	1.116 (1.63)	1.260*** (2.90)
<i>SOE</i>	-39.359** (-2.51)	-16.474 (-1.64)
<i>Top1</i>	0.336 (1.07)	0.237 (1.49)
<i>Dual</i>	-0.092 (-0.96)	-0.089 (-1.61)
<i>BSize</i>	0.128 (0.41)	0.207 (1.35)
<i>Indep</i>	-2.524*** (-2.83)	-0.729 (-1.51)
<i>Intercept</i>	35.248*** (2.61)	25.642*** (2.86)
<i>Year Fixed</i>	Yes	Yes
<i>Industry Fixed</i>	Yes	Yes
<i>N</i>	9854	9854
<i>Pseudo R²</i>	0.068	0.076

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

costs resulting from information disclosure (Bhojraj et al., 2004). For companies adopting a cost-leadership strategy, however, supply-chain information contains business secrets, such as pricing strategies and gross profit margins, that represent cost-leading advantages. As a result, these companies' supply-chain information is easily imitated or exploited by competitors and the proprietary costs resulting from supply-chain information disclosure is high. Therefore, it is expected that companies with product-differentiation strategies (cost-leadership strategies) are less (more) likely to be affected by product market competition due to lower (higher) proprietary costs.

Following Duanmu et al. (2018), we first use each firm's ratio of 'total sales minus production costs' to total sales to measure its *cost-leadership* variable. We then use the industry median *cost-leadership* to adjust firm level *cost-leadership* measure and obtain an *adjusted cost-leadership value*. Next, we standardize each firm's *adjusted cost-leadership value* with the extreme value of industry *adjusted cost-leadership value* to obtain *Clcc*. A higher *Clcc* value indicates a stronger cost-leadership strategy.⁵ We use each firm's ratio of advertising expense to total sales to measure its *product-differentiation*. We then use the industry median *product-differentiation* to adjust firm level *product-differentiation* measure and obtain an *adjusted product-differentiation value*. Next, we standardize each firm's *adjusted product-differentiation value* with the extreme value of industry *adjusted*

⁵ $Clcc = \frac{CL - \text{median}(CL)}{\text{range}(CL - \text{median}(CL))}$

Table 8
 Competition and supply-chain information disclosure: Operation strategy.

Variable	(1)	(2)	(3)	(4)
	Product-differentiation strategy		Cost-leadership strategy	
	DumSupply	DumCustom	DumSupply	DumCustom
<i>Competition*Dfcc</i>	0.416*** (3.18)	0.324** (2.18)		
<i>Competition*Clcc</i>			-0.026* (-1.81)	-0.042*** (-3.01)
<i>Competition</i>	-0.412*** (-3.72)	-0.311** (-2.49)	-0.132 (-1.50)	-0.273*** (-4.63)
<i>Dfcc</i>	-41.571*** (-3.19)	-32.448** (-2.19)		
<i>Clcc</i>			2.647* (1.82)	4.155*** (3.01)
<i>Size</i>	-0.132*** (-2.92)	-0.193*** (-3.51)	-0.137*** (-3.00)	-0.107*** (-3.45)
<i>Lev</i>	0.504*** (2.63)	0.523** (2.34)	0.532*** (2.83)	0.406*** (2.89)
<i>ROA</i>	0.123 (0.23)	-0.282 (-0.45)	-0.078 (-0.17)	-0.934** (-2.27)
<i>TobinQ</i>	-0.041* (-1.84)	-0.045* (-1.78)	-0.041* (-1.79)	0.001 (0.04)
<i>Dum_Rd</i>	-0.208** (-2.24)	-0.197 (-1.52)	-0.232** (-2.49)	0.144* (1.80)
<i>Intang</i>	1.275* (1.75)	1.132* (1.66)	1.280* (1.77)	1.175*** (2.76)
<i>SOE</i>	0.095 (1.03)	-0.023 (-0.21)	0.095 (1.03)	-0.063 (-1.01)
<i>Top1</i>	0.235 (0.91)	0.323 (1.03)	0.223 (0.86)	0.054 (0.29)
<i>Dual</i>	-0.083 (-1.00)	-0.090 (-0.93)	-0.095 (-1.15)	-0.098 (-1.52)
<i>BSize</i>	0.225 (0.88)	0.145 (0.46)	0.228 (0.89)	-0.062 (-0.34)
<i>Indep</i>	-0.717 (-0.98)	-2.536*** (-2.82)	-0.768 (-1.05)	-2.559*** (-4.44)
<i>Intercept</i>	43.398*** (3.90)	32.893*** (2.60)	15.631* (1.78)	29.111*** (4.84)
<i>Year Fixed</i>	Yes	Yes	Yes	Yes
<i>Industry Fixed</i>	Yes	Yes	Yes	Yes
<i>N</i>	9854	9854	9854	9854
<i>Pseudo R²</i>	0.077	0.068	0.075	0.047

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

product-differentiation value to obtain *Dfcc*. A higher *Dfcc* value indicates a stronger product-difference strategy.⁶ Next, we interact *Competition* with *Clcc* and *Competition* with *Dfcc*. The results, presented in column (1) of Table 8, show that the coefficient of *Competition*Dfcc* is significantly positive, indicating that the higher the degree of product differentiation, the weaker the negative relationship between industry competition and supply-chain information disclosure. The results, presented in column (2) of Table 8, show that the coefficient of *Competition*Clcc* is significantly negative, suggesting that the stronger the competitive advantage gained by a company through its cost-leadership strategy, the more pronounced the negative relationship between industry competition and supply-chain information disclosure.

⁶ $Dfcc = \frac{DF - \text{median}(DF)}{\text{range}(DF - \text{median}(DF))}$

Table 9
 Competition and supply-chain information disclosure: Legal environment.

Variable	(1) DumSupply	(2) DumCustom
<i>Competition*Law</i>	0.034** (2.02)	0.042** (2.49)
<i>Law</i>	-3.404** (-2.05)	-4.223** (-2.52)
<i>Competition</i>	-0.865*** (-3.63)	-0.674*** (-3.30)
<i>Size</i>	-0.090 (-1.58)	-0.117* (-1.88)
<i>Lev</i>	0.353* (1.77)	0.488*** (3.21)
<i>ROA</i>	-1.256** (-2.24)	0.061 (0.12)
<i>TobinQ</i>	0.001 (0.03)	-0.038* (-1.76)
<i>Dum_Rd</i>	0.244 (1.43)	-0.189 (-1.45)
<i>Intang</i>	1.628* (1.71)	1.439* (1.91)
<i>SOE</i>	-0.181* (-1.78)	0.018 (0.30)
<i>Top1</i>	0.144 (0.43)	0.326 (1.13)
<i>Dual</i>	-0.082 (-0.98)	-0.077 (-1.26)
<i>BSize</i>	-0.095 (-0.35)	0.200 (0.78)
<i>Indep</i>	-2.686*** (-3.80)	-0.986* (-1.94)
<i>Intercept</i>	87.849*** (3.72)	69.493*** (3.41)
<i>Year Fixed</i>	Yes	Yes
<i>Industry Fixed</i>	Yes	Yes
<i>N</i>	9854	9854
<i>Pseudo R²</i>	0.058	0.081

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

Third, we study how legal environment affects companies' supply chain information disclosure decisions. In a poorer legal environment, as characterized by relatively weak property rights protection, the supply-chain information disclosed by a company facing intense competition is more likely to be used by improper means by its competitors, who then infringe on the disclosing firm's interests (Guo et al., 2004). Therefore, in such a legal environment, we expect companies in highly competitive industries to disclose less supply-chain information. The legal environment measurement index (*Law*) adopted in this study is taken from Wang et al. (2017).⁷ The higher the index score, the better the legal environment. We include the interaction term of *Competition* and *Law* in our main model and report the results in Table 9. As shown, the coefficient of *Competition*Law* is significantly positive, suggesting that when the legal environment is poor, companies are less likely to disclose supply-chain information.

⁷ Please note that, as the law index data is only available before 2014, following Long and Li (2016) and Wang and Jiang (2020), we first derive the law index measure after 2014 (i.e., 2015 and 2016) based on the law index change trend in the three years from 2012 to 2014. To test robustness, we also follow Wang et al. (2015) and delete the sample and replace the law index data after 2014 with the average law index data from 2012 to 2014. The results remain unchanged.

Table 10
Robustness tests: Alternative proxies for product market competition.

Variable	(1) DumSupply	(2) DumCustom	(3) DumSupply	(4) DumCustom	(5) DumSupply	(6) DumCustom	(7) DumSupply	(8) DumCustom
<i>MCR4</i>	-3.026*** (-3.45)	-2.234*** (-2.64)						
<i>Lerner_Index</i>			0.037* (1.68)	0.031** (2.28)				
<i>Abprofit_Persistence</i>					0.153*** (2.64)	0.101** (2.03)		
<i>Similarity</i>							-0.569** (-2.00)	-0.461* (-1.92)
<i>Size</i>	-0.171*** (-3.12)	-0.122*** (-2.69)	-0.250*** (-9.65)	-0.146*** (-4.01)	-0.217*** (-8.72)	-0.117*** (-5.64)	-0.240*** (-5.47)	-0.135*** (-3.71)
<i>Lev</i>	0.518** (2.34)	0.581*** (3.07)	0.470*** (4.01)	0.271* (1.73)	0.557*** (4.99)	0.276*** (2.80)	0.551*** (3.00)	0.23 (1.43)
<i>ROA</i>	-0.240 (-0.45)	0.133 (0.29)	0.02 (-1.31)	0.01 (-0.56)	-0.028* (-1.95)	0.01 (-0.61)	0.19 (-0.46)	0.14 (-0.39)
<i>TobinQ</i>	-0.014 (-0.58)	-0.033 (-1.52)	0.14 (-0.35)	0.35 (-0.78)	0.08 (-0.21)	0.35 (-1.05)	0.03 (-1.60)	0.02 (-1.00)
<i>Dum_Rd</i>	-0.205 (-1.58)	-0.239** (-2.54)	0.07 (-1.01)	-0.134* (-1.74)	-0.131** (-2.43)	-0.133*** (-2.95)	0.03 (-0.33)	0.12 (-1.56)
<i>InTang</i>	1.986** (2.12)	1.546* (1.89)	0.890** (2.23)	0.74 (1.24)	1.317*** (3.60)	0.933*** (2.84)	0.80 (1.28)	0.63 (1.13)
<i>SOE</i>	-0.029 (-0.25)	0.092 (1.00)	0.07 (1.32)	0.154** (2.07)	0.08 (1.64)	0.191*** (4.60)	0.04 (0.40)	0.176** (2.37)
<i>Top1</i>	0.213 (0.66)	0.184 (0.69)	0.00 (-0.01)	0.08 (-0.36)	0.14 (0.92)	0.02 (0.14)	0.07 (0.27)	0.05 (-0.22)
<i>Dual</i>	-0.087 (-0.91)	-0.078 (-0.94)	0.05 (-0.83)	0.07 (-1.00)	0.06 (-1.21)	-0.080* (-1.75)	0.07 (-0.85)	0.10 (-1.36)
<i>BSize</i>	0.021 (0.06)	0.240 (0.91)	0.21 (1.37)	0.14 (0.67)	0.272* (1.84)	0.261** (2.13)	0.14 (0.55)	0.14 (0.66)
<i>Indep</i>	-2.465*** (-2.61)	-0.677 (-0.89)	-2.089*** (-4.37)	0.74 (-1.23)	-1.981*** (-4.27)	0.48 (-1.24)	-2.410*** (-3.08)	0.98 (-1.54)
<i>Intercept</i>	4.236*** (2.58)	4.441*** (3.36)	1.597** (2.43)	2.239** (2.56)	1.268** (2.09)	1.443*** (2.94)	2.183* (1.95)	2.447*** (2.70)
<i>Year Fixed</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Industry Fixed</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	9854	9854	14531.00	14531.00	14538.00	14538.00	14212.00	14212.00
<i>Pseudo R²</i>	0.082	0.082	0.07	0.07	0.06	0.05	0.07	0.06

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

4.5. Robustness test

4.5.1. Alternative proxies for product market competition

We use alternative proxies for product market competition, including the concentration ratio of the four largest firms in the industry (*CR4*), the Lerner index, abnormal earnings persistence and a text index of product market competition. Specifically, (1) the higher the market share of the four largest firms (*CR4*), the lower the competition. To construct a measure of intuitive acceptance, we use (1 - *CR4*) (*MCR4*) instead of *CR4*. The higher the *MCR4* value, the higher the product market competition. (2) The Lerner index represents a company's pricing power in the industry. The lower the Lerner index, the weaker the company's pricing power in the industry and the higher the product market competition.⁸ (3) The higher the abnormal earnings persistence in an industry, the more difficult it is for the industry to retain abnormal earnings and the higher the

⁸ Following Peress (2010), we define the Lerner index as the ratio of total sales minus operating costs, selling expenses and administrative expenses to total sales.

Table 11
Robustness tests: Fixed effect model.

Variable	(1) DumSupply	(2) DumCustom
<i>Competition</i>	-0.593*** (-3.95)	-0.400*** (-3.20)
<i>Size</i>	-0.226* (-1.78)	-0.215** (-2.09)
<i>Lev</i>	0.923** (2.38)	0.367 (1.08)
<i>ROA</i>	0.096 (0.14)	1.509*** (2.71)
<i>TobinQ</i>	-0.011 (-0.32)	-0.013 (-0.46)
<i>Dum_Rd</i>	0.121 (0.76)	0.080 (0.67)
<i>InTang</i>	1.741 (1.24)	0.798 (0.67)
<i>SOE</i>	0.069 (0.23)	0.174 (0.71)
<i>Top1</i>	1.695** (2.28)	0.244 (0.38)
<i>Dual</i>	0.079 (0.51)	-0.001 (-0.01)
<i>BSize</i>	0.028 (0.05)	0.716 (1.57)
<i>Indep</i>	-3.966*** (-2.77)	0.485 (0.42)
<i>Year Fixed</i>	Yes	Yes
<i>Firm Fixed</i>	Yes	Yes
<i>N</i>	4232	5822
<i>Pseudo R²</i>	0.208	0.192

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

product market competition.⁹ (4) We also measure competition by measuring the similarity of product description text in the annual reports of companies in the same industry (Ren and Wang, 2019). The more similar a company's product description is to that of other companies, the higher the product market competition.¹⁰

The results, presented in Table 10, show that firms with higher competition (i.e., higher *MCR4*, lower Lermer index, lower abnormal earnings persistence, higher similarity of product description text) are less likely to disclose supply-chain information. Both robustness results are consistent with our hypothesis.

4.5.2. Fixed effect model

We run regressions with a fixed effect model. The inclusion of firm fixed effects in regression models helps to control for time-invariant, firm-specific characteristics. As is shown in Table 11, our results are robust to the inclusion of firm fixed effects.

⁹ Following Ellis (2012), we define abnormal earnings as a company's return on assets minus the industry's average return on assets. We use the correlation between the industry's current abnormal surplus and the industry's abnormal surplus from the previous year to measure the persistence of the industry's abnormal surplus.

¹⁰ Following Ren and Wang (2019), we define *Similarity* as the average similarity of product and business vocabulary among companies in the same industry. The results remain unchanged. The textual data of this article are obtained from the WinGo (text structure) text database (www.wingodata.cn).

Table 12

Robust tests: Alternative methods of addressing missing *Competition* values.

Variable	Using the Competition value in 2013		Using the average Competition value from 2011 to 2013		Deleting the sample after 2013	
	(1) DumSupply	(2) DumCustom	(3) DumSupply	(4) DumCustom	(5) DumSupply	(6) DumCustom
<i>Competition</i>	-0.521*** (-3.55)	-0.422*** (-3.00)	-0.481*** (-3.88)	-0.326** (-2.22)	-0.508*** (-3.56)	-0.493*** (-3.45)
<i>Size</i>	-0.172*** (-3.14)	-0.123*** (-2.72)	-0.174*** (-3.15)	-0.131*** (-2.87)	-0.165*** (-2.83)	-0.120** (-2.48)
<i>Lev</i>	0.520** (2.35)	0.582*** (3.08)	0.524** (2.37)	0.576*** (3.06)	0.834*** (3.31)	0.850*** (4.02)
<i>ROA</i>	-0.241 (-0.45)	0.133 (0.29)	-0.260 (-0.48)	0.125 (0.28)	0.539 (0.72)	0.837 (1.32)
<i>TobinQ</i>	-0.015 (-0.65)	-0.034 (-1.56)	-0.016 (-0.69)	-0.033 (-1.52)	-0.021 (-0.64)	-0.048* (-1.80)
<i>Dum_Rd</i>	-0.202 (-1.55)	-0.234** (-2.48)	-0.193 (-1.48)	-0.200** (-2.10)	-0.167 (-1.12)	-0.167* (-1.67)
<i>Intang</i>	1.975** (2.11)	1.538* (1.88)	1.996** (2.13)	1.634** (2.00)	1.688* (1.65)	1.192 (1.39)
<i>SOE</i>	-0.029 (-0.26)	0.091 (0.98)	-0.030 (-0.27)	0.074 (0.80)	-0.023 (-0.19)	0.075 (0.76)
<i>Top1</i>	0.213 (0.66)	0.184 (0.69)	0.205 (0.64)	0.176 (0.66)	0.400 (1.14)	0.332 (1.16)
<i>Dual</i>	-0.087 (-0.91)	-0.078 (-0.94)	-0.085 (-0.89)	-0.080 (-0.97)	-0.074 (-0.65)	-0.031 (-0.34)
<i>BSize</i>	0.015 (0.05)	0.237 (0.90)	-0.008 (-0.02)	0.195 (0.74)	-0.221 (-0.62)	0.123 (0.44)
<i>Indep</i>	-2.474*** (-2.62)	-0.675 (-0.89)	-2.503*** (-2.65)	-0.671 (-0.88)	-3.141*** (-2.95)	-0.787 (-0.96)
<i>Intercept</i>	53.342*** (3.61)	44.454*** (3.17)	49.291*** (3.93)	34.637** (2.35)	52.251*** (3.63)	51.511*** (3.61)
<i>Year Fixed</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Industry Fixed</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	9854	9854	9854	9854	6596	6596
<i>Pseudo R²</i>	0.082	0.083	0.082	0.084	0.105	0.063

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

4.5.3. Alternative methods of addressing missing competition values

In the results reported above, we derive the competition measure after 2013 based on the competition trend during the three years from 2011 to 2013. As *Competition* is our key variable, we use other methods to supplement the missing data as a robustness check and present the results in Table 12. First, we replace the value for the *Competition* variable after 2013 with the value for the *Competition* variable in 2013 and present the results in columns (1) and (2). Second, we replace the *Competition* value after 2013 with the average competition value from 2011 to 2013, presenting the results in columns (3) and (4). Third, we delete the samples after 2013, showing the results in columns (5) and (6). These results show that the coefficient of *Competition* are all positively significant, suggesting that the previous results are not affected by the methods used to address missing *Competition* values.

5. Conclusion

The importance of supply-chain information to corporations and to the capital market information environment is well recognized by both practitioners and academic scholars, yet empirical study of the determinants of corporate supply-chain information disclosure decisions is very limited. This study aims to fill the

gap by investigating the impact of product market competition, an important external environmental factor, on the level of supply-chain information disclosure by listed companies. Our results show that intense market competition significantly reduces the level of supply-chain information disclosure. These findings are robust to a battery of robustness tests, including a DID regression using large reductions in China import tariff rates as exogenous shocks to the level of competition and change model analysis. We also provide evidence that the proprietary cost channels drive the negative relation between product market competition and supply-chain information disclosure. We find that that when supply-chain information disclosure reveals more incremental information (firms in an opaque information environment) and when competitors are more capable of using supply-chain information disclosure to gain a competitive advantage (for disclosing firms that are not state owned, that gain a strong competitive advantage through product cost leadership strategies, that gain a weak competitive advantage through a product-differentiation strategy and that are located in an underdeveloped legal environment), the proprietary cost of supply-chain information disclosure is higher, making the effect of market competition in curbing the supply-chain information disclosure more pronounced. Our findings not only expand the theoretical framework underlying supply-chain information research but also enrich the literature on competition and voluntary disclosure.

This study has important practical implications. In recent years, China's regulators have endeavored to strengthen the supply-chain information disclosure requirements for listed companies, encouraging them to disclose the identities of their top five suppliers and customers along with the ratio of their purchases from each supplier and sales to each customer to their aggregated annual purchases and sales. In practice, however, companies are often reluctant to disclose such information. Against this background and given our results, we suggest that regulators must not only strengthen disclosure requirements but also create a favorable environment for disclosure. The improvement of property rights protection, promotion of a contractual culture and guidance toward healthy competition in industry can mitigate the negative impact of proprietary costs on information disclosure, thus leading to positive interactions between the product market and the capital market.

Declaration of Competing Interest

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

Acknowledgements

We acknowledge financial support from the China National Natural Science Foundation (Grant numbers: 71502185, 71802207, 71872199, 71972193), the Ministry of Education of the People's Republic of China Humanities and Social Sciences Youth Foundation (Grant numbers: 18YJC630271) and Young Talents Development Support Scheme of Central University of Finance and Economics (QYP2004).

References

- Ali, A., Klasa, S., Yeung, E., 2008. The limitations of industry concentration measures constructed with Compustat data: Implications for finance research. *Rev. Financial Stud.* 22 (10), 3839–3871.
- Ali, A., Klasa, S., Yeung, E., 2014. Industry concentration and corporate disclosure policy. *J. Account. Econ.* 58 (2–3), 240–264.
- Amiram, D., Owens, E., Rozenbaum, O., 2016. Do information releases increase or decrease information asymmetry? New evidence from analyst forecast announcements. *J. Account. Econ.* 62 (1), 121–138.
- Arya, A., Mittendorf, B., 2007. The interaction among disclosure, competition between firms, and analyst following. *J. Account. Econ.* 43 (2–3), 321–339.
- ASIS International, 2002. Trends in proprietary information loss survey report. <http://www.asisonline.org/newsroom/surveys/spi2.pdf>.
- Baiman, S., Rajan, M.V., 2002. The role of information and opportunism in the choice of buyer-supplier relationships. *J. Account. Res.* 40 (2), 247–278.
- Balakrishnan, K., Billings, M.B., Kelly, B., Ljungqvist, A., 2014. Shaping liquidity: On the causal effects of voluntary disclosure. *J. Financ.* 69 (5), 2237–2278.
- Berger, P.G., Hann, R.N., 2007. Segment Profitability and the Proprietary and Agency Costs of Disclosure. *The Accounting Review* 82 (4), 869–906.

- Bernard, A.B., Jensen, J.B., Schott, P.K., 2006. Trade costs, firms and productivity. *J. Monetary Econ.* 53 (5), 917–937.
- Bhattacharya, S., Ritter, J.R., 1983. Innovation and communication: Signalling with partial disclosure. *Rev. Econ. Stud.* 50 (2), 331–346.
- Bhojraj, S., Blacconiere, W.G., D'Souza, J.D., 2004. Voluntary disclosure in a multi-audience setting: An empirical investigation. *Account. Rev.* 79 (4), 921–947.
- Burks, J.J., Cuny, C., Gerakos, J., Granja, J., 2018. Competition and voluntary disclosure: Evidence from deregulation in the banking industry. *Rev. Acc. Stud.* 23 (4), 1471–1511.
- Cai, K., Zhu, H., 2020. Customer–supplier relationships and the cost of debt. *J. Bank. Financ.* 110 105686.
- Campello, M., Gao, J., 2017. Customer concentration and loan contract terms. *J. Financ. Econ.* 123 (1), 108–136.
- Cen, L., Hertz, M.G., Schiller, C., 2017. Speed matters: Limited attention and supply-chain information diffusion. Working paper. <https://ssrn.com/abstract=2925460>.
- Chen, J., Wang, X.Y., Peng, X., 2015. Environment uncertainty, customer concentration and cost of equity capital. *Account. Res.* 11, 76–82, in Chinese.
- Christopher, M., Ryals, L., 1999. Supply chain strategy: Its impact on shareholder value. *Int. J. Logistics Manage.* 10 (1), 1–10.
- Clinch, G., Verrecchia, R.E., 1997. Competitive disadvantage and discretionary disclosure in industries. *Aust. J. Manage.* 22 (2), 125–137.
- Cohen, L., Frazzini, A., 2008. Economic links and predictable returns. *J. Finance* 63 (4), 1977–2011.
- CSRC, the Standards Concerning the Contents and Formats of Information Disclosure by Companies Offering Securities to the Public No 2-contents and Formats of Annual Reports (Revised in 2007), *ZJF 2007* [No212(in Chinese)].
- Darrrough, M.N., 1993. Disclosure policy and competition: Cournot vs. Bertrand. *Account. Rev.* 68 (3), 534–561.
- Darrrough, M.N., Stoughton, N.M., 1990. Financial disclosure policy in an entry game. *J. Account. Econ.* 12 (1), 219–243.
- Dhaliwal, D., Judd, J.S., Serfling, M., Shaikh, S., 2016. Customer concentration risk and the cost of equity capital. *J. Account. Econ.* 61 (1), 23–48.
- Duanmu, J.L., Bu, M., Pittman, R., 2018. Does market competition dampen environmental performance? Evidence from China. *Strategic Manage. J.* 39 (11), 3006–3030.
- Ellis, J.A., Fee, C.E., Thomas, S.E., 2012. Proprietary costs and the disclosure of information about customers. *J. Account. Res.* 50 (3), 685–727.
- Fang, L.H., Lerner, J., Wu, C., 2017. Intellectual property rights protection, ownership, and innovation: Evidence from China. *Rev. Financ. Stud.* 30 (7), 2446–2477.
- Fisher, M.L., 1997. What is the right supply chain for your product? *Harvard Business Rev.* 75, 105–117.
- Foster, G., 1986. *Financial statement analysis*. Prentice Hall, Englewood Cliffs, NJ.
- Fresard, L., 2010. Financial strength and product market behavior: the real effects of corporate cash holdings. *J. Financ.* 65 (3), 1097–1122.
- Gosman, M., Kelly, T., Olsson, P., Warfield, T., 2004. The profitability and pricing of major customers. *Rev. Acc. Stud.* 9 (1), 117–139.
- Graham, J.R., Harvey, C.R., Rajgopal, S., 2005. The economic implications of corporate financial reporting. *J. Account. Econ.* 40 (1), 3–73.
- Grossman, S.J., 1981. The Informational role of warranties and private disclosure about product quality. *J. Law Econ.* 24 (3), 461–483.
- Guan, Y., Wong, M.F., Zhang, Y., 2015. Analyst following along the supply chain. *Rev. Acc. Stud.* 20 (1), 210–241.
- Guo, R.J., Lev, B., Zhou, N., 2004. Competitive costs of disclosure by biotech IPOs. *J. Account. Res.* 42 (2), 319–355.
- Healy, P.M., Palepu, K.G., 2001. Information asymmetry, corporate disclosure, and the capital markets: A review of the empirical disclosure literature. *J. Account. Econ.* 31 (1–3), 405–440.
- Huang, Y., Jennings, R., Yu, Y., 2017. Product market competition and managerial disclosure of earnings forecasts: Evidence from import tariff rate reductions. *Account. Rev.* 92 (3), 185–207.
- Izkowitz, J., 2013. Customers and Cash: How relationships affect suppliers' cash holdings. *J. Corporate Financ.* 19 (1), 159–180.
- Jiang, F., Kim, K.A., Nofsinger, J.R., Zhu, B., 2015. Product market competition and corporate investment: Evidence from China. *J. Corporate Financ.* 35, 196–210.
- Jiang, W., Di, L., Peng, C., 2017. Does customer concentration affect long-term bank lending? Empirical evidence from Chinese listed companies. *Nankai Business Rev.* 20 (2), 71–80, in Chinese.
- Johnson, W.C., Kang, J.K., Yi, S., 2010. The certification role of large customers in the new issues market. *Financ. Manage.* 39 (4), 1425–1474.
- Kong, D.M., Liu, S.S., Wang, Y.N., 2013. Market competition, ownership and government subsidy. *Econ. Res. J.* 2, 55–67, in Chinese.
- Lang, M., Sul, E., 2014. Linking industry concentration to proprietary costs and disclosure: Challenges and opportunities. *J. Account. Econ.* 58 (2–3), 265–274.
- Li, D., Wang, D., 2016. The impact of supply chain customer information on firms' information environment. *J. Financ. Res.* 12, 191–206, in Chinese.
- Li, X., 2010. The impacts of product market competition on the quantity and quality of voluntary disclosures. *Rev. Acc. Stud.* 15 (3), 663–711.
- Li, Y., Lin, Y., Zhang, L., 2018. Trade secrets law and corporate disclosure: Causal evidence on the proprietary cost hypothesis. *J. Account. Res.* 56 (1), 265–308.
- Liu, K.G., Wang, Y., Li, M.B., 2013. Deepening reforms and building a capital market with equal emphasis on investment and financing. *Manage. World* 8, 1–5, in Chinese.
- Liu, Z.B., Jiang, F.X., Lu, E.P., 2003. Capital structure and competition in product market. *Econ. Res. J.* 7, 60–67, in Chinese.
- Long, Y., Li, Y., 2016. Should venture capitalists seek far? A comparative study of regional exit rates of venture capital investments in China. *Financ. Trade Econ.* 6, 129–145, in Chinese.

- Luo, W., Zhu, C.Y., 2010. Agency costs and corporate voluntary disclosure. *Econ. Res. J.* 10, 110–123, in Chinese.
- Ma, L.F., Shen, X.X., Wang, Y.F., 2013. Market competition, executive shareholding and management earnings forecasts. *Res. Econ. Manage.* 5, 18–27, in Chinese.
- Menzly, L., Ozbas, O., 2010. Market segmentation and cross-predictability of returns. *J. Financ.* 65 (4), 1555–1580.
- Milgrom, P.R., 1981. Good news and bad news: Representation theorems and applications. *Bell J. Econ.*, 380–391
- Mullainathan, S., Shleifer, A., 2005. The market for news. *Am. Econ. Rev.* 95 (4), 1031–1053.
- Pandit, S., Wasley, C.E., Zach, T., 2011. Information externalities along the supply chain: The economic determinants of suppliers' stock price reaction to their customers' earnings announcements. *Contemporary Account. Res.* 28 (4), 1304–1343.
- Peress, J., 2010. Product market competition, insider trading, and stock market efficiency. *J. Financ.* 1, 1–43.
- Ren, H., Wang, K., 2019. Relationship between product market competition and disclosure quality of listed firms: Evidence from a textual perspective. *Account. Res.* 3, 32–39, in Chinese.
- Schmidt, K.M., 1997. Managerial incentives and product market competition. *Rev. Econ. Stud.* 64 (2), 191–213.
- Shleifer, A., Vishny, R.W., 1994. Politicians and firms. *Quart. J. Econ.* 109 (4), 995–1025.
- Son, B., Sodhi, M., Kocabasoglu-Hillmer, C., Lee, T., 2016. Supply chain information in analyst reports on publicly traded companies. *Int. J. Prod. Econ.* 171, 350–360.
- Tang, Y.J., 2009. Bargaining power of suppliers and buyers and corporate performance: Evidence from listed Chinese manufacturing companies from 2005 to 2007. *China Ind. Econ.* 10, 67–76, in Chinese.
- Valta, P., 2012. Competition and the cost of debt. *J. Financ. Econ.* 105 (3), 661–682.
- Verrecchia, R.E., 1983. Discretionary disclosure. *J. Account. Econ.* 5, 179–194.
- Verrecchia, R.E., 1990. Endogenous proprietary costs through firm interdependence. *J. Account. Econ.* 12 (1–3), 245–250.
- Verrecchia, R.E., Weber, J., 2006. Redacted disclosure. *J. Account. Res.* 44 (4), 791–814.
- Wagenhofer, A., 1990. Voluntary disclosure with a strategic opponent. *J. Account. Econ.* 12 (4), 341–363.
- Wang, H.J., Li, Q.Y., Liu, F., 2015. Government subsidies as emergency relief or relief for the poor: Empirical evidence from loss-making firms. *Nankai Business Rev.* 5, 42–53, in Chinese.
- Wang, X.Y., Yu, C.Q., 2014. Proprietary costs and voluntary information disclosure: Analysis based on customer information disclosure. *J. Financ. Econ.* 40 (12), 27–38, in Chinese.
- Wang, X., Fan, G., Yu, J., 2017. Marketization index of China's provinces: NERI report 2016. Social Sciences Academic Press, Beijing, China (in Chinese).
- Wang, Y.C., Jiang, Y.H., 2020. Competition Policy and Corporate Investment: Quasi-Natural Experiments Based on the Implementation of the Anti-monopoly Law. *Econ. Res. J.* 55 (08), 137–152, in Chinese.
- Wu, H.M., Yang, X.Q., Wei, H., 2012. Product market competition and firm stock idiosyncratic risk: Based on empirical evidence of Chinese listed companies. *Econ. Res. J.* 6, 101–115, in Chinese.
- Yang, Z.Q., Tang, S., Li, Z.Q., 2020. Information disclosure in the capital market, relational contracts and the bullwhip effect in the supply chain: Empirical research based on the information spillover effect. *Manage. World* 7, 89–105, in Chinese.
- Yi, Z.H., Jiang, F.X., Qin, Y.H., 2010. Market competition in products, corporate governance, and quality of information disclosure. *Manage. World* 1, 133–141, in Chinese.
- Zhang, M., Ma, L.J., Zhang, S., 2012. The supplier–customer relationship and auditor choice. *Account. Res.* 12, 81–86, in Chinese.
- Zhang, Z.Y., 2012. Market competition in products, corporate governance, and social responsibility for information disclosure: Empirical evidence from the social responsibility bulletins of Chinese listed companies. *J. Shanxi Financ. Econ. Univ.* 4, 67–76, in Chinese.
- Zheng, Z., Lin, Y., Yu, X., Liu, X., 2021. Product market competition and the cost of equity capital. *J. Business Res.* 132, 1–9.
- Zhou, H., Tang, L.R., 2015. Can market competition force companies to treat their employees well? Micro evidence from manufacturing companies. *Manage. World* 11, 135–144, in Chinese.