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Product market competition and the cost of equity capital

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ABSTRACT

This paper provides empirical evidence that firms in more competitive industries have lower cost of equity capital than those in concentrated industries. The association between product market competition and the cost of equity capital is more pronounced with lower analyst coverage, lower forecast accuracy, higher forecast dispersion, and higher bid-ask spread. Using import tariff rate reductions as a quasi-natural experiment, we find that tariff reductions intensify domestic product market competition, which in turn reduces firms' cost of equity capital. When the tariff rate reduction is larger, the more intensified competition reduces the cost of equity capital to a greater extent. Tariff rate reductions also influence firms' financing policy, cash flow from operations, and growth rate.

1. Introduction

In this paper, we examine the impact of product market competition on the cost of equity capital. The cost of equity capital is important to a firm given that it directly influences the financing cost of the firm and thus the capital structure and financing strategies. Theoretically, it is unclear whether competition at the industry level affects a firm's cost of equity capital. Theoretical work suggests that under certain circumstances, there exists an equilibrium with more disclosures in industries where competitions are more intense (Wagenhofer, 1990; Darrough, 1993; Corona & Nan, 2013; Suijs & Wielhouwer, 2019). Empirical studies echo this finding and document that firms in concentrated industries tend to disclose less (Bamber & Cheon, 1998; Botosan & Stanford, 2005; Ali, Klasa, & Yeung, 2014), suggesting a negative association between industry concentration and corporate disclosure. Theories on disclosure and the cost of capital have not reached a consensus. Some theoretical papers suggest there is no effect of disclosure on the cost of capital (Hughes, Liu, & Liu, 2007; Christensen, de la Rosa, & Feltham, 2010; Bertomeu, 2015; Caskey, Hughes, & Liu, 2015), while others find that information affects the cost of capital (Bertomeu, Beyer, & Dye, 2011; Cheynel, 2013; Bertomeu & Cheynel, 2016; Dye & Hughes, 2018). Given the above, whether product market competition increases or decreases the cost of equity capital remains an empirical question.

We adopt the *ex-ante* implied cost of equity capital, which better approximates the theoretical construct: *ex-ante* required returns. Furthermore, the *ex-ante* implied cost of equity capital measure controls for the cash flow effect and the growth effect and separates both from the cost of equity measure (Hail & Leuz, 2009). We use three different estimation methods to measure the implied (*ex-ante*) cost of equity capital: Gebhardt, Lee, and Swaminathan (2001), Claus and Thomas (2001), and Gode and Mohanram (2003). To alleviate the potential bias and measurement errors in each estimate, we adopt the average of the three estimates as the proxy for the cost of equity capital. In terms of the competition measure (the concentration ratio), we use the text-based network industry classification Herfindahl-Hirschman Index (*TNIC HHI*) to proxy for industry competition (Hoberg & Phillips, 2016). The classification is based on product descriptions from listed firms' annual 10-K filings with the Securities and Exchange Commission (SEC); it classifies firms with similar products into the same industry and makes comparisons reasonable.

We find that *TNIC HHI* is positively associated with the *ex-ante* implied cost of equity capital after we control for year and industry fixed effects. This empirical finding suggests that firms in more competitive industries have lower cost of equity capital than their peers in less competitive industries. *TNIC HHI* is effective in identifying peer firms, which can come from different industries classified under traditional SIC codes. We also examine the potential channels through which product market competition affects the cost of equity capital. Analysts gather information from both public and private sources to evaluate firm performance and firm value, which improves the overall transparency of

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the information environment (Lang, Lins, & Miller, 2004). The more analysts that follow a firm and the more accurate analyst forecasts are, the more information gathered by intermediaries and the more difficult it is for the firm to hide information from the public (Lang, Lins, & Maffett, 2012). Therefore, we expect that analyst coverage and forecast accuracy will attenuate the effect of product market competition on the cost of equity capital. Higher analyst forecast dispersion and a higher bid-ask spread capture the degree of information asymmetry (Venkatesh & Chiang, 1986; Welker, 1995; Armstrong, Core, Taylor, & Verrecchia, 2011; Papakroni, 2013), and we expect information asymmetry to reinforce the effect of product market competition on the cost of equity capital. We find results consistent with our expectations; that is, greater information asymmetry contributes to a more pronounced relationship between product market competition and the cost of equity capital.

We find a negative association between product market competition and the cost of equity capital. An endogeneity issue arises, as it is unclear which is the driving force. To address this concern, we take advantage of the reductions of import tariff rates as exogenous shocks to competitive markets in a quasi-natural experiment. Reductions in tariff rates would intensify domestic market competition by decreasing the entry costs of foreign firms (Tybout, 2003; Bernard, Jensen, & Schott, 2006). The results show that after large tariff rate reductions, the competition in the industry intensifies, which leads to a decrease in the cost of equity capital. When the import tariff rate reduction is larger, the more intensified competition will reduce the cost of equity capital to a greater extent. Changes in product market competition also affect firms' financing policy, cash flow from operations, and the growth rate, with small firms being affected more than large firms.

This paper contributes to the literature in the following ways. First, the paper adds to the literature that examines the determinants of a firm's cost of equity capital. Prior studies investigate extensively how various risks and firm characteristics are associated with the cost of equity capital (Gebhardt et al., 2001; Lambert, Leuz, & Verrecchia, 2007; Collins & Huang, 2011; Antoniou, Doukas, & Subrahmanyam, 2015; Dhaliwal, Judd, Serfling, & Shaikh, 2016). This paper provides additional evidence that industry-level competition in product markets, identified using a text-based network industry classification, leads to a lower *ex-ante* implied cost of equity capital.[1]

Second, this study sheds some light on whether information plays a role in the relationship between competition and the cost of equity capital. Theories on the relationship between information and the cost of equity capital are mixed (Hughes et al., 2007; Cheynel, 2013; Caskey et al., 2015; Bertomeu & Cheynel, 2016; Dye & Hughes, 2018). Empirical evidence on the association between market competition and disclosure is also inconclusive (Harris, 1998; Botosan & Stanford, 2005; Verrecchia & Weber, 2006; Li, 2010). Ali et al. (2014) show that firms in more concentrated (less competitive) industries disclose less. Our paper is in line with theirs in that the availability of more information in the market attenuates the relationship between market competition and the cost of equity capital.

Third, adopting import tariff rate reductions as a quasi-natural experiment alleviates the potential endogeneity concern. The exogenous shocks of large tariff reductions are not concentrated in a specific year, mitigating the concern that the identification is driven by a time-specific event that happened in a given year (Valta, 2012). Such shocks enable us to establish a causal link between product market competition and the cost of equity capital. The results have relevance for regulators, managers, and investors.

The remainder of the paper is organized as follows. Section 2 reviews the literature and develops the hypotheses. Section 3 describes the empirical design and the sample selection. Section 4 presents descriptive statistics and empirical results and addresses the endogeneity issue. Section 5 concludes the paper.

2. Literature review and hypothesis development

A large body of theoretical work examines the relationship between competition and corporate disclosure policy. Darrough (1993) formulates a two-stage model to analyze a firm's incentive to disclose private information. Given the conflicting incentives for disclosure, users of public information would infer the underlying information that is withheld. In equilibrium, firms are successful in withholding information in limited scenarios. The model shows that the incentive to disclose depends on the type of competition (Cournot or Bertrand) and the type of private information (demand or cost). The author finds that firms in Cournot competition facing cost uncertainty and firms in Bertrand competition facing demand uncertainty commit to voluntary disclosure and to supporting mandated disclosure. Wagenhofer (1990) develops a theoretical setting with an informed firm, an opponent, and an outside market. The firm faces a trade-off in disclosing favorable information because such disclosure will induce a high market price and increased proprietary costs. The author documents that there exists a sequential equilibrium with full disclosure and that there never exists a nondisclosure equilibrium. The introduction of proprietary costs that depend on strategic actions taken by the opponent still leads to a full disclosure equilibrium. Suijs and Wielhouwer (2019) document that a credible threat of regulation can increase voluntary disclosure and that firms may strategically conduct voluntary disclosure to deter a regulation. Corona and Nan (2013) examine how market competition provides incentives for a firm to disclose future strategic decisions and how these preannouncements influence the firm's real actions. The authors find that such preannouncements shall be more likely observed in industries with more intense competition, lower future demand uncertainty, and higher preannouncement credibility.

Many empirical papers also examine the relationship between market competition and disclosure. Most studies adopt industry concentration ratios to proxy for competition. Types of disclosures vary greatly, including managers' earnings forecasts, operating segment disclosure under Statement of Financial Accounting Standards (SFAS) No. 14, disclosure ratings provided by analysts, information environment captured by analyst forecast properties, etc. Earnings forecasts made by firms in more concentrated product markets are more likely to be reactive, and firms in more concentrated industries tend to issue less specific earnings forecasts (Bamber & Cheon, 1998). Managers are less likely to disclose segment information in less competitive industries, supporting the theory in Hayes and Lundholm (1996) that managers hide certain segments to protect profits (Botosan & Stanford, 2005). Ali et al. (2014) document that for firms operating in more concentrated industries, earnings forecasts are less frequent, horizons are shorter, disclosure ratings are lower, and information environments are more opaque. An alternative contention is that greater competition in an industry from potential entrants will result in increased disclosure by incumbent firms (Darrough & Stoughton, 1990). Therefore, from the perspectives of theory and empirical evidence, market competition (industry concentration) is positively (negatively) associated with corporate disclosure.

Agreements and disagreements coexist regarding the insights of the theory on disclosure and the cost of capital. Some theoretical papers suggest no effect of disclosure on the cost of capital (Hughes et al., 2007; Christensen et al., 2010; Bertomeu, 2015; Caskey et al., 2015). Hughes et al. (2007) find that information asymmetry has no cross-sectional

[1] We differ from Hodges, Lin, and Lin (2014) and Chen, Li, and Ma (2014) because Hodges et al. (2014) examine the relationship between corporate governance and the cost of capital in the U.S. setting, use ex-post realized returns to measure the cost of capital, and do not address the endogeneity concern; Chen et al. (2014) examine the relationship between market competition and the cost of equity capital in China and look into the moderating effect of institutional factors, use traditional HHI to measure concentration, and adopt a one-shot event as a shock, which may cause concern that the identification is driven by a time-specific event that happened in a given year.

effects on the cost of capital when controlling for betas. Christensen et al. (2010) document that although disclosure reduces the ex-post cost of capital, this effect is offset by an equal increase in the pre-posterior cost of capital, resulting in an unchanged ex-ante cost of capital. Bertomeu (2015) suggests that information for the purpose of stewardship would not be a determinant of the cost of capital. Caskey et al. (2015) find that sensitivities to systematic risks explain all cross-sectional variations in the cost of capital and that information asymmetry has no effect on the cost of capital after controlling for betas, which echoes the findings of Hughes et al. (2007).

However, other papers do find that information affects the cost of capital. Bertomeu and Cheynel (2016) review the theories on disclosure and the cost of capital and conclude that information affects the cost of capital and that this effect is undiversifiable. Bertomeu et al. (2011) develop a theoretical model that accommodates the capital structure, voluntary disclosure, and the cost of capital and find that a firm's capital structure and voluntary disclosure jointly determine the extent of information asymmetry, which in turn determines the cost of capital. The firm's cost of capital is negatively associated with the extent of information disclosed by the firm. Dye and Hughes (2018) document that investors perceive a disclosure firm's systematic risk to be lower than no disclosure, which is true for equilibrium disclosures. Similarly, Cheynel (2013) finds that in equilibrium, disclosing firms have a lower beta and lower cost of capital than non-disclosing firms. In addition to the theoretical papers, empirical papers also find similar evidence that firms disclosing more information have lower cost of capital, and such disclosures include financial and nonfinancial information (Botosan, 1997; Botosan & Plumlee, 2002; Francis, Nanda, & Olsson, 2008; Dhaliwal, Li, Tsang, & Yang, 2011; Berger, Chen, & Li, 2018). Taken together, we conjecture that market competition increases corporate disclosure, which in turn lowers the cost of equity capital. The first hypothesis is displayed as follows.

H1. Firms in more competitive industries have lower cost of equity capital than those in concentrated industries.

To examine whether market competition affects the cost of equity capital through the information channel, we adopt four proxies to measure information asymmetry. The first two proxies, analyst following and analyst forecast accuracy, capture the transparency of a firm's information environment. Analysts gather information from both public and private sources to evaluate firm performance and firm value, which improves overall transparency (Lang et al., 2004). The more analysts that follow a firm (the more accurate analyst forecasts are), the more information gathered by intermediaries, which would make it difficult for the firm to hide information from the public (Lang et al., 2012). The increase in firm information availability, and thus a better information environment, helps reduce the required rate of return by investors. Therefore, firms with greater analyst coverage and more accurate analyst forecasts are expected to have lower cost of equity capital than their peers in the same product market. The remaining two proxies, analyst forecast dispersion and bid-ask spread, capture information asymmetry. The use of analyst forecast dispersion to measure information asymmetry relies on the assumption that the degree to which analysts possess information also reflects the degree of information asymmetry between informed and uninformed investors. Further, if a firm holds back information, analysts have incentives to acquire private information or develop more advanced models to predict firm performance. In this case, there will be a higher disagreement among analysts and thus a higher forecast dispersion (Papakroni, 2013). The bid-ask spread is negatively related to corporate disclosure policy (Welker, 1995) and can be used to test for an increase in information asymmetry (Venkatesh & Chiang, 1986). Prior studies suggest that information asymmetry can have a separate effect on the cost of equity capital (Easley, Hvidkjaer, & O'Hara, 2002; Francis, Khurana, & Pereira, 2005; Armstrong et al., 2011). We expect that greater information asymmetry will contribute to a higher cost of equity capital than peers within the same product market. The second hypothesis is displayed as follows.

H2. The association between product market competition and the cost of equity capital is more pronounced when information asymmetry is higher.

3. Empirical design

3.1. Model specification

To examine the effect of product market competition on the cost of equity capital, we estimate the following regression model:

$$ravg\ i,t - rf,t = \alpha_0 + \alpha_1 TNIC\ HHI_{i,t\text{-}1} + \alpha_2 Size_{i,t\text{-}1} + \alpha_3 BTM_{i,t\text{-}1} + \alpha_4 Leverage_{i,t\text{-}1} + \alpha_5 ROA_{i,t\text{-}1} + \alpha_6 Beta_{i,t\text{-}1} + \alpha_7 Growth_{i,t\text{-}1} + \alpha_8 Dispersion_{i,t\text{-}1} + \alpha_9 CFO_{i,t\text{-}1} + Year\ dummies + Industry\ dummies + \varepsilon_{i,t} \quad (1)$$

where *ravg-rf* is the average implied cost of equity capital minus the risk-free rate. The implied cost of equity capital measures, which are constructed based on the dividend discount model and the residual income model, can better approximate the theoretical construct: *ex-ante* required returns. Therefore, we use the *ex-ante* cost of equity capital to compute the equity premium. The *ex-ante* cost of equity capital estimate relies on three estimation models: Gebhardt et al. (2001), Claus and Thomas (2001), and Gode and Mohanram (2003). To alleviate the potential bias and measurement errors in each estimate, we adopt the average of the three estimates as the proxy for the cost of equity capital (*ravg*). The risk-free rate (*rf*) is measured by the yield on 10-year US treasury bonds.

The primary independent variable is *TNIC HHI*, which is short for the text-based network industry classification Herfindahl-Hirschman Index (HHI). The HHI is also named the concentration ratio. A higher value of *TNIC HHI* indicates a higher level of concentration and thus a lower level of competition. If H1 holds, we expect the coefficient on *TNIC HHI* to be positive.

3.2. Information asymmetry measures

We adopt four proxies to measure information asymmetry. Analyst coverage (*Coverage*) is the number of analysts covering the firm. Analyst forecast accuracy (*Accuracy*) is the absolute value of the forecast error multiplied by negative one, scaled by the stock price, where the forecast error is the I/B/E/S analysts' mean annual earnings forecast, less the actual earnings. These two proxies capture the transparency of the information environment (Lang et al., 2012). If H2 holds, we expect the coefficients on the interactions between the information environment measures and *TNIC HHI* to be negative. Analyst forecast dispersion (*Dispersion*) is the standard deviation of analysts' one-year-ahead EPS forecasts. Bid-ask spread (*Bid-ask spread*) is the daily bid-ask spread during the year, where the spread is the difference between the ask price and the bid price, deflated by their midpoint. These two proxies capture the information asymmetry of a firm (Venkatesh & Chiang, 1986; Papakroni, 2013). If H2 holds, we expect the coefficients on the interactions between information asymmetry measures and *TNIC HHI* to be positive.

3.3. Control variables

We control for firm-level factors that prior studies identified as influencing a firm's cost of equity capital. We first incorporate Fama-French three factors: firm size (*Size*), B/M ratio (*BTM*), and beta (*Beta*). Fama and French (1992) find that expected returns increase in leverage. Therefore, we control for firm leverage (*Leverage*). Expected returns also depend on firm profitability (Ball, Gerakos, Linnainmaa, & Nikolaev, 2016); thus, we include *ROA* as a proxy for firm profitability. Gebhardt et al. (2001) find that the implied cost of equity capital increases in the long-term growth rate (*Growth*) and analyst forecast dispersion (*Dispersion*). Accordingly, we also control for these two

factors. Finally, we control for cash flow from operations (*CFO*) to measure the abundance of cash (Dhaliwal et al., 2011). We also include year and industry fixed effects and cluster standard errors by firm (Petersen, 2009).

3.4. Sample selection

To estimate the cost of equity capital estimates, we obtain analyst forecasts and stock price information from I/B/E/S, book value and dividend data from Compustat, and stock return from the CRSP. The text-based network industry classification HHI is obtained from the Hoberg-Phillips data library. We gather U.S. annual import data from Peter Schott's website. Other financial data are obtained from Compustat. We merge the cost of equity capital dataset with the Hoberg-Phillips dataset and drop observations with missing financial information. The final sample consists of 11,645 firm-year observations between 2000 and 2017 in 291 three-digit SIC code industries. To control for the potential effects of extreme values, we winsorize observations that fall in the top and bottom one percent of the sample distributions of the continuous dependent and independent variables.

Hoberg and Phillips (2016) provide a text-based network industry classification. The classification is based on product descriptions from listed firms' annual 10-K filings with the SEC. This new industry classification is preferable to traditional ones (e.g., SIC codes, NAICS) in the sense that it can better classify firms with similar products into the same industry and thus make comparisons more reasonable. Suppose firm A and firm B both produce product M and thus compete in the same product market. However, according to the traditional SIC codes, firm A and firm B belong to different industries. In this scenario, *Compustat HHI* fails to capture the competition of the two firms in the product market of M. The text-based network industry classification can identify product similarity between firm A and firm B, and thus, *TNIC HHI* better captures the product market competition between the two firms. Another advantage of the *TNIC HHI* is that this new industry classification is time-varying according to the business description of 10-K filings every year, which leads to more time-series variations.

Table 1
Descriptive Statistics (n = 11,645).

	Mean	Median	SD	Q1	Q3
r_{avg}-r_f	0.062	0.054	0.096	0.003	0.100
TNIC HHI	0.276	0.174	0.269	0.078	0.384
Size	8.271	8.155	1.694	7.076	9.345
BTM	0.499	0.441	0.334	0.266	0.665
Leverage	0.599	0.598	0.203	0.467	0.736
ROA	0.056	0.047	0.057	0.021	0.083
Beta	1.132	1.068	0.544	0.754	1.439
Growth	0.169	0.127	0.212	0.081	0.201
Dispersion	0.085	0.049	0.105	0.020	0.104
CFO	0.097	0.088	0.069	0.053	0.132
Bid-ask spread	0.028	0.025	0.012	0.019	0.033
Coverage	2.175	2.197	0.727	1.609	2.773
Accuracy	−0.026	−0.010	0.372	−0.117	0.104
Δtariff (n = 4568)	−0.050	−0.014	2.816	−0.478	0.317

Note: This table reports summary statistics for the main variables used in the analysis. All variables are defined in the appendix.

4. Results

4.1. Descriptive statistics

Table 1 presents descriptive statistics for the main variables used in the sample. The average equity premium (*ravg-rf*) for the full sample is

Table 3
Product market competition and the cost of equity capital.

VARIABLES	r_{avg}-r_f (1)	r_{avg}-r_f (2)	r_{avg}-r_f (3)
TNIC HHI	0.012***	0.010**	0.006***
	(3.12)	(2.38)	(2.61)
Size	−0.008***	−0.007***	−0.003***
	(−9.29)	(−8.11)	(−6.46)
BTM	0.019***	−0.003	0.017***
	(3.78)	(−0.68)	(5.52)
Leverage	0.130***	0.115***	0.029***
	(14.33)	(12.58)	(7.51)
ROA	−0.077***	−0.031	−0.079***
	(−2.62)	(−1.03)	(−4.57)
Beta	0.022***	0.027***	0.009***
	(10.76)	(13.50)	(7.32)
Growth	0.044***	0.026***	0.058***
	(8.03)	(4.54)	(12.68)
Dispersion	0.055***	0.079***	0.022***
	(4.43)	(6.06)	(2.70)
CFO	0.112***	0.114***	0.004
	(5.50)	(5.36)	(0.34)
Constant	−0.087***	−0.003	−0.033***
	(−9.33)	(−0.36)	(−5.29)
Observations	11,645	11,645	11,645
Year dummies	No	Yes	Yes
Industry dummies	No	No	Yes
Adjusted R-squared	0.40	0.49	0.52

Note: This table reports the estimation results of regressing the cost of equity capital on product market competition. All variables are defined in the appendix. T-statistics are reported in parentheses. *, **, *** Denotes significance at the 0.10, 0.05, and 0.01 levels, respectively.

Table 2
Pearson correlation (n = 11,645).

	r_{avg}-r_f	TNIC HHI	Size	BTM	Leverage	ROA	Beta	Growth	Dispersion	CFO	Bid-ask spread	Coverage	Accuracy
r_{avg}-r_f	1.000												
TNIC HHI	0.027*	1.000											
Size	−0.031*	−0.230*	1.000										
BTM	−0.041*	−0.159*	0.091*	1.000									
Leverage	0.171*	−0.115*	0.439*	−0.066*	1.000								
ROA	−0.032*	0.128*	−0.189*	−0.422*	−0.275*	1.000							
Beta	0.177*	−0.008	−0.038*	0.088*	−0.013	−0.059*	1.000						
Growth	0.080*	0.052*	−0.159*	0.037*	−0.079*	−0.204*	0.155*	1.000					
Dispersion	0.089*	−0.127*	0.240*	0.147*	0.055*	−0.055*	0.156*	0.017	1.000				
CFO	0.031*	0.116*	−0.239*	−0.428*	−0.260*	0.590*	−0.030*	−0.092*	−0.041*	1.000			
Bid-ask spread	0.103*	0.024*	−0.321*	0.221*	−0.092*	−0.096*	0.403*	0.216*	0.064*	0.051*	1.000		
Coverage	0.011	−0.127*	0.614*	−0.167*	0.148*	0.092*	0.025*	−0.073*	0.146*	0.139*	−0.199*	1.000	
Accuracy	−0.001	0.021*	−0.017	0.113*	−0.007	−0.097*	−0.003	0.011	0.078*	−0.045*	0.047*	0.004	1.000

Note: This table reports Pearson correlation among the variables used in the analysis. All variables are defined in the appendix. * Denotes significance at the 0.05 level or better.

Table 4
Information environment, product market competition, and the cost of equity capital.

VARIABLES	r_{avg}-r_f (1)	r_{avg}-r_f (2)
TNIC HHI	0.015**	0.012***
	(2.24)	(3.03)
Size	−0.005***	−0.008***
	(−7.04)	(−9.23)
BTM	0.019***	0.018***
	(5.90)	(3.66)
Leverage	0.031***	0.130***
	(8.06)	(14.33)
ROA	−0.080***	−0.081***
	(−4.60)	(−2.76)
Beta	0.008***	0.022***
	(6.85)	(10.75)
Growth	0.057***	0.044***
	(12.45)	(8.06)
Dispersion	0.022***	0.053***
	(2.73)	(4.28)
CFO	−0.008	0.111***
	(−0.58)	(5.43)
Coverage	−0.006***	
	(−3.63)	
TNIC HHI*Coverage	−0.008**	
	(−2.01)	
Accuracy		−0.007**
		(−2.01)
TNIC HHI*Accuracy		−0.006**
		(−2.12)
Constant	−0.034***	−0.088***
	(−5.32)	(−9.39)
Observations	11,645	11,645
Year dummies	Yes	Yes
Industry dummies	Yes	Yes
Adjusted R-squared	0.52	0.40

Note: This table reports the estimation results of whether information environment moderates the relation between product market competition and the cost of equity capital. All variables are defined in the appendix. T-statistics are reported in parentheses. *, **, *** Denotes significance at the 0.10, 0.05, and 0.01 levels, respectively.

Table 5
Information asymmetry, product market competition, and the cost of equity capital.

VARIABLES	r_{avg}-r_f (1)	r_{avg}-r_f (2)
TNIC HHI	0.013**	0.012**
	(2.55)	(2.16)
Size	−0.008***	−0.002***
	(−9.30)	(−4.37)
BTM	0.019***	0.016***
	(3.77)	(5.08)
Leverage	0.130***	0.028***
	(14.32)	(7.22)
ROA	−0.077***	−0.073***
	(−2.62)	(−4.28)
Beta	0.022***	0.006***
	(10.79)	(4.15)
Growth	0.044***	0.056***
	(8.04)	(12.01)
CFO	0.112***	−0.001
	(5.49)	(−0.04)
Dispersion	0.057***	0.020**
	(3.52)	(2.47)
TNIC HHI*Dispersion	0.016**	
	(2.17)	
Bid-ask spread		0.402***
		(3.22)
TNIC HHI*Bid-ask spread		0.214***
		(2.99)
Constant	−0.087***	−0.049***
	(−9.36)	(−5.97)
Observations	11,645	11,645
Year dummies	Yes	Yes
Industry dummies	Yes	Yes
Adjusted R-squared	0.41	0.53

Note: This table reports the estimation results of whether information asymmetry moderates the relation between product market competition and the cost of equity capital. All variables are defined in the appendix. T-statistics are reported in parentheses. *, **, *** Denotes significance at the 0.10, 0.05, and 0.01 levels, respectively.

0.062, which is close to the median value (0.054). The means of other variables are not significantly different from their medians. *TNIC HHI* is inversely correlated with the industry competition level. In other words, the higher the *TNIC HHI* is, the less competitive the industry is. *TNIC HHI* is scaled down to [0, 1], with 1 representing the most concentrated industry. The average *TNIC HHI* is 0.276, suggesting that the majority of firms in the sample come from relatively more competitive industries.

Table 2 provides the Pearson correlation matrix for the variables. *TNIC HHI* is positively correlated with the equity premium, providing initial support for H1. Firms in more competitive industries tend to be larger, less profitable, and have higher B/M ratios and higher levels of leverage. The negative relationship between competition and profitability also suggests that investors would require a lower rate of return for investments in firms operating in more competitive industries.

4.2. Regression results

Table 3 presents the regression results for H1. In column (1), we run a pooled regression without controlling for year or industry fixed effects. The coefficient on *TNIC HHI* is positive and significant at the 0.01 level, supporting H1: firms in more (less) competitive industries have lower (higher) cost of equity capital. The signs of the estimated coefficients on most of the control variables are as predicted. As expected, large, lower levered, and more profitable firms have lower cost of equity capital. Moreover, firms with a lower B/M ratio and smaller beta also have lower cost of equity capital. Firms with higher growth expectations and higher analyst dispersion are associated with higher cost of equity capital. Column (2) reports the results of tests that incorporate year fixed effects into the regression. The coefficient on *TNIC HHI* remains positive and significant. Column (3) presents the results of tests where the 3-digit SIC industry fixed effects are included. The results remain qualitatively similar. This evidence shows that *TNIC HHI* is effective in identifying peer firms in the same product market, which may come from different industries under SIC codes. Overall, H1 is well supported in all three models.

Tables 4 and 5 present the regression results for H2. In Table 4, Column (1) shows a negative and significant coefficient on the interaction term (*TNIC HHI*Coverage*) at the 0.05 level, and Column (2) shows a similar result for the interaction term (*TNIC HHI*Accuracy*), lending support to H2. The results suggest that a greater analyst following and more accurate analyst forecasts, and thus reduced information asymmetry, weaken the association between product market competition and the cost of equity capital. Therefore, a better information environment helps mitigate the effect of competition on the cost of equity capital. In Table 5, Column (1) shows a positive and significant coefficient on the interaction term (*TNIC HHI*Dispersion*) at the 0.05 level, and Column (2) shows a similar result for the interaction term (*TNIC HHI*Bid-ask spread*), which further supports H2. The results indicate that greater analyst forecast dispersion and a greater bid-ask spread enhance the effect of product market competition on the cost of equity capital. In summary, greater information asymmetry contributes to a more pronounced association between product market competition and the cost of equity capital.

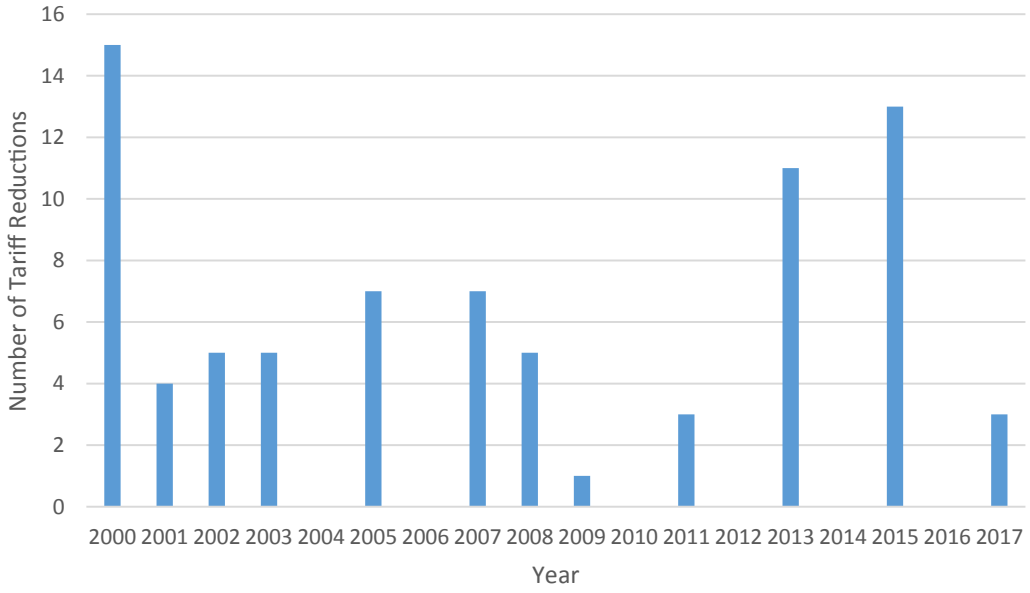

Fig. 1. Distribution of tariff rate reductions.

4.3. Endogeneity of product market competition

The results so far have shown a negative relationship between product market competition and the cost of equity capital. It remains unclear which factor is the driving force, so an endogeneity issue arises. To address this concern, we adopt the reductions of import tariff rates as exogenous shocks to the competition of the product markets. Reductions in import tariff rates would decrease the costs for foreign firms to enter the domestic markets and intensify domestic market competition. Prior literature also suggests that lower trade barriers will induce an increase in competition from foreign firms (Tybout, 2003; Bernard et al., 2006; Valta, 2012).

Large reductions in import tariff rates are used as the setting to empirically examine the *causal* relationship between product market competition and the cost of equity capital (Fresard, 2010; Schott, 2010). We gather U.S. annual import data from Peter Schott's website for our sample period. The tariff rate is calculated as the duties collected at U.S. Customs deflated by the free-on-board (FOB) custom value of imports. Following Valta (2012), competitive shocks are defined as large variations in the tariff rate on a yearly basis. First, we calculate the median or mean tariff rate change and the largest tariff rate change for each 3-digit SIC industry. Then, if the largest tariff rate change is greater than two or three times the median or mean tariff rate change, the observation is classified as a competitive shock. Based on the above procedures, we define an indicator variable, *Post-reduction*, with the value of one indicating a large tariff rate reduction in the industry.

Fig. 1 presents the distribution of tariff rate reductions for our sample period. Tariff rate reductions are not concentrated in a specific year, indicating that the identification is not driven by a time-specific event in a given year. We find relatively more reductions in 2000, consistent with Valta (2012) finding that there are some large reductions in the later nineties. 2005, 2007, 2013, and 2015 also witness slightly more tariff reductions, probably due to some free trade agreements reached by the U.S. and other countries.[2] Although many agreements were signed during this period, few were as influential as the North American Free Trade Agreement (NAFTA) in 1994. This may explain why the magnitude of the mean value of changes in tariffs (−0.05) in our study is lower than that in Valta (2012) (−0.13).

The following regression specification is estimated:

$$ravg\ i,t - rf,t = \alpha_0 + \alpha_1\ Post\text{-}reduction_{i,t\text{-}1} + \alpha_2 Size_{i,t\text{-}1} + \alpha_3 BTM_{i,t\text{-}1} + \alpha_4 Leverage_{i,t\text{-}1} + \alpha_5 ROA_{i,t\text{-}1} + \alpha_6 Beta_{i,t\text{-}1} + \alpha_7 Growth_{i,t\text{-}1} + \alpha_8 Dispersion_{i,t\text{-}1} + \alpha_9 CFO_{i,t\text{-}1} + Year\ dummies + Industry\ dummies + \varepsilon_{i,t} \quad (2)$$

where variables are defined in the appendix.

Table 6 reports the results for reductions of import tariff rates and the cost of equity capital. In column (1), *Post-reduction* is an indicator equal to one if the largest tariff rate reduction is more than two times the median tariff rate change. The coefficient on *Post-reduction* is negative and significant, indicating that after large tariff rate reductions, the competition in the industry intensifies, and the cost of equity capital decreases. The exogenous shock test provides evidence that increased industry competition results in a decrease in the cost of equity capital. In column (2), *Post-reduction* is an indicator equal to one if the largest tariff rate reduction is more than two times the mean tariff rate change. Replacing the median value with the mean does not alter the results qualitatively. The coefficient on *Post-reduction* remains negative and significant at the conventional level. In column (3), *Post-reduction* is defined as an indicator equal to one if the largest tariff rate reduction is more than three times the median tariff rate change. As expected, *Post-reduction* produces a negative coefficient, which is larger in both the magnitude and the significance level than that in column (1). This suggests that if import tariff rate reduction is larger, more intensified competition will reduce the cost of equity capital to a greater extent. Column (4) yields consistent results with column (3). In sum, the quasi-natural experiment of reductions in import tariff rates provides direct evidence that a higher level of product market competition causally reduces the cost of equity capital.

Table 7 presents firm characteristics before and after a large reduction in import tariff rates. The table shows equity premium, leverage, cash flow from operations, and growth rate before and after a competitive shock for small and large firms. Firms having total assets below the sample median are classified as small firms; otherwise, they are classified as large firms. In Panel A, the equity premium decreases by 0.005 after the competitive shock, consistent with prior findings. Large firms also undergo a significant decrease in the equity premium, but the

[2] These free trade agreements include, for example, Australia–United States Free Trade Agreement (2004), Singapore–United States Free Trade Agreement (2004), Bahrain–United States Free Trade Agreement (2006), Morocco–United States Free Trade Agreement (2006), United States–South Korea Free Trade Agreement (2010), United States–Colombia Free Trade Agreement (2012), and Panama–United States Trade Promotion Agreement (2012).

Table 6
Reductions in import tariff rates and the cost of equity capital.

VARIABLES	2 × median (1)	2 × mean (2)	3 × median (3)	3 × mean (4)
Post-reduction	−0.005*	−0.007*	−0.021**	−0.026**
	(−1.82)	(−1.89)	(−2.03)	(−2.37)
Size	−0.003***	−0.003***	−0.008***	−0.008***
	(−3.15)	(−3.04)	(−7.29)	(−7.16)
BTM	−0.007	0.001	0.025***	0.023***
	(−1.46)	(0.18)	(3.83)	(3.47)
Leverage	0.013*	0.028***	0.143***	0.150***
	(1.81)	(3.24)	(15.60)	(15.63)
ROA	−0.269***	−0.279***	−0.170***	−0.175***
	(−10.51)	(−9.05)	(−5.30)	(−5.20)
Beta	0.014***	0.014***	0.026***	0.026***
	(6.24)	(5.17)	(9.33)	(9.02)
Growth	0.041***	0.058***	0.026***	0.029***
	(7.25)	(8.38)	(3.69)	(3.91)
Dispersion	0.033***	0.027*	0.072***	0.070***
	(2.64)	(1.75)	(4.52)	(4.19)
CFO	0.037	0.048*	0.124***	0.125***
	(1.57)	(1.68)	(4.20)	(4.05)
Constant	0.063***	0.053***	0.021*	0.018
	(6.69)	(4.69)	(1.74)	(1.46)
Observations	4568	4568	4568	4568
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Adjusted R-squared	0.08	0.08	0.12	0.11

Note: This table reports the estimation results of the effect of reductions in import tariff rates on the cost of equity capital. All variables are defined in the appendix. T-statistics are reported in parentheses. *, **, *** Denotes significance at the 0.10, 0.05, and 0.01 levels, respectively.

Table 7
Firm characteristics before and after a reduction of import tariff rates.

Panel A: Small firms			
	Before	After	Difference
r_{avg}-r_f	0.074	0.069	−0.005**
Leverage	0.540	0.505	−0.035**
CFO	0.127	0.111	−0.016***
Growth	0.221	0.203	−0.018*
Panel B: Large firms			
	Before	After	Difference
r_{avg}-r_f	0.055	0.052	−0.003*
Leverage	0.612	0.610	−0.002
CFO	0.082	0.075	−0.007*
Growth	0.158	0.149	−0.009

Note: This table reports equity premia and firm characteristics before and after a reduction of import tariff rates for small and large firms. The tariff rate reduction is large if it is larger than three times the median tariff rate reduction. Panel A presents descriptive statistics for firm size below the sample median, and Panel B presents descriptive statistics for firm size above the sample median. *, **, *** Denotes significance at the 0.10, 0.05, and 0.01 levels, respectively.

magnitude is 0.003, lower than that for small firms. Therefore, the reductions of import tariff rates affect small firms' cost of equity capital to a greater extent compared with large firms. Small firms' leverage ratio also decreases significantly by 0.035, while large firms' leverage does not seem to be affected significantly. From this perspective, changes in product market competition can affect firms' financing policy, at least for small firms. Both small and large firms witness a significant decrease in their cash flow from operations, probably due to fiercer competition reducing sales revenue. Finally, the growth rate of small firms decreases by a significant level of 0.018, while large firms' growth rate does not change significantly. The reason could be domestic market share being taken up by foreign rivals, thus hurting the future growth perspective of small firms.

4.4. Robustness tests

We also use *Compustat HHI* and *C4-Index* to proxy for industry competition. *Compustat HHI* is the HHI measure calculated based on the traditional Compustat industry classification. *C4-Index* is the sum of market shares of the four largest firms in an industry. The results, albeit weaker, are consistent with the main findings above.

5. Conclusions

In this paper, we examine the effect of product market competition on the cost of equity capital. Product market competition is measured by a text-based network industry classification HHI, and the cost of equity capital is measured using an ex-ante implied cost of equity capital. We find that firms in more competitive industries have lower cost of equity capital than their peers in less competitive industries. Greater analyst coverage and higher forecast accuracy mitigate the effect of product market competition on the cost of equity capital through a more transparent information environment. Greater forecast dispersion and higher bid-ask spread reinforce the effect of product market competition on the cost of equity capital. Therefore, the association between product market competition and the cost of equity capital is more pronounced if information asymmetry is higher.

Using tariff rate reductions as exogenous shocks in a quasi-natural experiment, we find that tariff reductions intensify domestic product market competition, which in turn reduces firms' cost of equity capital. The exogenous shocks enable us to establish a causal link from product market competition to the cost of equity capital. When the import tariff rate reduction is larger, the more intensified competition reduces the cost of equity capital to a greater extent. Moreover, changes in product market competition also influence firms' financing policy, cash flow from operations, and the growth rate, with small firms being affected more than large firms. In sum, competition in the product market reduces a firm's cost of equity capital, and the reduced financing cost, in turn, influences the firm's capital structure, financing strategies, and long-term growth perspective.

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.

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Appendix. Variable definitions

Variable	Definition
ravg-rf	The average implied cost of equity capital minus the yield on 10-year US treasury bonds; ravg = avg (rgls, rct, rgm).
TNIC HHI	Text-based network industry classification HHI.
Compustat HHI	Herfindahl-Hirschman Index computed using Compustat firms. It is defined as the sum of squared market shares. Market shares are computed using firms' sales.
C4-Index	The sum of the market shares of the four largest firms in an industry.
Size	Log of total assets at the fiscal year-end.
BTM	Book-to-market ratio, measured as the book value of equity divided by the market value of equity.
Leverage	Total debts divided by total assets at the fiscal year-end.
ROA	Net income deflated by total assets.
Beta	Market model beta, estimated from CRSP daily data during the year.
Growth	Log of long-term growth rate, where growth rate is estimated as the ratio of the mean two-year-ahead analyst consensus EPS forecast and the mean one-year-ahead analyst consensus EPS forecast.
Dispersion	Log of analyst forecast dispersion estimated as the standard deviation of analysts' one-year-ahead EPS forecasts.
CFO	Cash flows from operations deflated by total assets.
Bid-ask spread	Natural log of daily bid-ask spread during the year. The spread is the difference between the ask price and the bid price, deflated by their midpoint.
Coverage	Log of the number of analysts covering the firm.
Accuracy	The absolute value of the forecast error multiplied by −1, scaled by the stock price, where the forecast error is the I/B/E/S analysts' mean annual earnings forecast less the actual earnings.
Δtariff	The change of ad valorem tariff rate, defined as the duties collected at U.S. Customs divided by the Free-On-Board custom value of imports.
Post-reduction	An indicator that equals one if an industry has experienced a tariff rate reduction that is larger than two/three times the median/mean tariff rate reduction in that industry, and zero otherwise.

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