Product Market Rivalry and Strategic Disclosure

Christo Karuna

Monash University

Date: Friday April 7 2017
Time: 3:00pm – 4:00pm
Venue: Business School Building Room 216
Product market rivalry and strategic disclosure

Christo Karuna*
Monash Business School
Monash University

January 2017

Keywords: product market competition; strategic disclosure; entry deterrence; proprietary costs; industrial segment information

I thank Phil Berger, James Cannon (discussant at the American Accounting Association Annual Conference), Judson Caskey, Rong Huang (discussant at the American Accounting Association Managerial Accounting Section Mid-year Conference), Clive Lennox, Tong Lu, Tharindra Ranasinghe, Mary Stanford, Robert E. Verrecchia, Feng Tian, Scott Whisenant, Jinyoung Wynn, Calvin Yang, Yuping Zhao, and workshop participants at Texas Christian University and the University of Texas at Arlington for their comments and suggestions. All errors are my own.

* Monash Business School, Monash University, Melbourne, VIC 3800; Phone: (613) 9905-5492; Email: christo.karuna@monash.edu
INTRODUCTION

Firms facing product market competition respond to that competition in several ways, such as deciding whether to strategically disclose information in hopes of gaining a competitive edge. While the level of competition faced by a firm influences its level of disclosure, the nature of this relation is inconclusive. Prior empirical studies provide mixed results, with some finding a positive relation (e.g., Harris, 1998; Clarkson and Toh, 2010) and others finding either no relation (e.g., Botosan and Harris, 2000) or a negative one (e.g., Verrecchia and Weber, 2006, James, Leiblein, and Lu, 2013).

A potential reason for the mixed empirical findings regarding competition and voluntary disclosure (hereafter disclosure) may be the difficulty in precisely measuring this relation (Healy and Palepu, 2001). For example, studies in the literature often treat competition as a unidimensional variable, typically using only industry concentration to proxy for competition (e.g., Verrecchia and Weber, 2006). Prior studies using concentration as a competition measure yield inconclusive evidence on the competition-disclosure relation – for example, while Harris (1998) and Ali et al. (2014) find a positive relation, Verrecchia and Weber (2006) find a negative relation. Recent studies in the industrial organization literature show that using concentration as a sole proxy for competition may be misleading, especially in cross-industry studies, as concentration may signal either greater or less competition depending on the industry (e.g., Sutton, 1991, Raith, 2003). For example, greater product substitutability (reflecting greater competition) could lead to greater concentration in an industry in the long run because weaker firms that cannot lower costs either exit or merge with other firms (Aghion et al., 2001). Greater market size and lower entry costs (both also reflecting greater competition) lead to less concentration via more firms in the industry in the long run due to the greater profitability prospects and lower barriers to entry, respectively. Furthermore, concentration reflects existing market structure and does not accurately capture competitive threat, especially from potential entrants (Ahn, 2002).

The inconclusive empirical evidence on the relation between competition and disclosure extends to the theoretical literature. Some studies predict a positive relation, arguing that firms disclose more to deter rivals (strategic deterrence force) (e.g., Darrough and Stoughton, 1990; Pacheco-De-Almeida and Zemsky,
2012). However, insights in other studies suggest that with greater competition, firms are at a competitive disadvantage if the commercially sensitive information they disclose can be used by their rivals (*proprietary cost force*) (e.g., Verrecchia, 1983; 1990).

My study attempts to shed some light on the mixed findings pertaining to the competition-disclosure relation by using a range of competition and disclosure proxies at the narrowly defined industry level to more completely and precisely examine this relation; these measures have not been previously used to examine this relation. To measure industry competition, I use several determinants of price competition, namely, product substitutability, market size, and entry costs. Controlling for industry concentration, I examine how these different dimensions of competition affect a firm’s disclosure. Note that my competition proxies are derived from product market fundamentals and are considered concurrently in the regressions. This reflects the multidimensional nature of competition, as suggested by recent studies in economics (e.g., Sutton, 1991, Raith, 2003, Vives, 2008). Further, as there could be relations among my competition measures, by considering my proxies concurrently, I am able to capture the incremental effect of each measure relative to the other measures.

To capture discretionary disclosure, I use research and development expenditure, order backlog, and number of employees. These measures afford several advantages for my study. Since these proxies are forward looking, they provide more time for rival firms to react to the disclosure compared to backward-looking information like profits. In addition, they are measured at the industrial segment level, which allows a more precise examination of disclosure choices based on industry-specific competition.1 Although the SEC requires segment-level disclosure of these items, this requirement is subject to materiality and certainty for research and development expenditure and order backlog, respectively. The discretion afforded by the subjective nature of materiality suggests that firms could strategically choose whether to disclose these segment items. Moreover, these disclosure proxies are less directly associated with investor stakes in the firm than are profitability measures, thus enabling a cleaner examination of product market

---

1 Feltham, Gigler, and Hughes (1992) and Arya, Frimor, and Mittendorf (2010) provide theoretical support for the benefits of line-item disclosure relative to aggregate reporting in a product market setting. Other studies that show that firms exercise discretion in providing information at the industrial segment level are Sanders et al. (1999) and Street et al. (2000).
incentives for disclosure. Finally, the information provided by my disclosure proxies could be interpreted either favorably or unfavorably by rival firms from a product market perspective, whereas profitability-based disclosure proxies like earnings do not reflect unfavorable information unless losses are reported. On the one hand, the information in my disclosure proxies could be viewed as favorable in that it reflects future product demand for the disclosing firm. On the other hand, the information could reveal costs such as customer loyalty and expenditures, which would be interpreted unfavorably (Darrough and Stoughton, 1990). Using disclosure measures that enable rival firms to react to both the favorable information (leading to less disclosure by a given firm) and unfavorable information (leading to greater disclosure by a given firm) in the measures allows a more powerful examination of whether there is a positive or negative relation between competition and disclosure.

In generating my study’s hypothesis, I consider the possibility that both a positive and negative competition-disclosure relation could separately exist simultaneously but at different competition levels. From low to moderate levels of competition, to soften price competition and charge higher prices, firms invest in efforts such as advertising or research and development (Caves and Porter, 1977; Shaked and Sutton, 1982). Such activities enable firms to differentiate their products from their rivals’ (Caves and Porter, 1977; Shaked and Sutton, 1982; Deephouse, 1999). A firm in such settings can change its prices without losing all of its business because buyers are attracted to its products and do not see a close substitute to them. Disclosure of these efforts by firms is also necessary to deter their rivals. For example, prospective entrants to the industry could be discouraged by the perceived costs associated with competing in the industry. Disclosure of relevant information could also influence existing rivals by altering their production schedules. Reactions (or lack thereof) by rivals enable incumbent firms to charge higher prices and enhance/maintain their market share in the industry. In such a setting, firms are more concerned with deterring their rivals than revealing commercially sensitive information to their rivals. Hence, the benefits of disclosure exceed its costs and the relation between competition and disclosure is positive. However,

2 I assume that, since firms are concerned about deterring their rivals via disclosing unfavorable information while at the same time ensuring that favorable information is not revealed, controlling for capital market incentives for disclosure, if firms disclose more (less) with greater competition, this indicates that they feel that their rivals would react more to the unfavorable (favorable) information contained in these measures.
once competition exceeds a certain level (e.g., when it becomes cutthroat), prices move considerably closer toward marginal costs and firms are less able to influence prices. Thus, firms have no incentive to spend money to differentiate their products from those of their rivals, as they cannot recover the higher associated costs through higher prices. Given the lack of incentive to differentiate their products and the inability to successfully raise prices, rival firms (both prospective and existing) in such industries are unlikely to alter their investment/production schedules based on the behavior of incumbents, as the associated higher costs would only decrease profitability. In this situation, the rivalrous behavior of a cutthroat nature could result in firms easily losing market share, and possibly their very survival, by divulging commercially sensitive information. Consequently, the costs exceed the benefits of disclosure and firms care more about revealing proprietary information than about strategically deterring their rivals, resulting in a negative competition-disclosure relation.

Supporting my hypothesis, I find evidence that the competition-disclosure relation is positive at low competition levels but negative at high competition levels. Thus, although both economic forces exist and oppose each other at all competition levels, there is some evidence that the strategic deterrence force dominates at low competition levels whereas the proprietary cost force dominates at high levels of competition. This finding complements two recent studies (Ellison and Ellison, 2011; Seamans, 2013) that find some evidence of a non-monotonic relation between the threat of entry into the industry and entry deterrence activity by firms. I also find that industry competition interacts with a firm’s market share and size to influence disclosure. Specifically, when the strategic deterrence force dominates, firms with greater market share are more (less) likely to disclose information that can be regarded as less (more) favorable to rivals so as to protect their market share. However, when the proprietary costs force dominates, firms with greater market share are less willing to disclose any information that could reveal commercially sensitive information to their rivals.

This study makes several contributions to the literature. First, it sheds light on the mixed empirical evidence in the literature on the relation between competition and disclosure by showing that both positive and negative relations could exist concurrently, but at different competition levels. Second, these findings
shed some light on the inconclusive theoretical evidence in the literature by suggesting that the economic force that supports a positive relation between competition and disclosure and the economic force that supports a negative relation not only coexist and act as opposing forces, but separately dominate each other at different competition levels. The theoretical insights and empirical evidence I provide thus suggest the need for researchers to consider non-linear models of discretionary disclosure. They also suggest that insights based on both the strategic deterrence and proprietary cost forces could be combined in disclosure models. For example, the lack of consistent empirical evidence supporting the proprietary cost effect documented in some prior studies, which has plagued researchers for decades (Leuz, 2004), could be attributed to the dominance of the strategic deterrence effect and not just the absence of the proprietary cost effect as asserted in these studies. My study stimulates the debate on this relation further by providing researchers with several avenues to consider, both theoretically and empirically.

Third, my study contributes to the small but growing body of research on industrial segment-level disclosure (e.g., Botosan and Harris, 2000; Berger and Hann, 2003; 2007). These studies show that firms exercise discretion in reporting the number of segments. My study extends these studies by showing that, once firms decide to report a particular segment, they also make use of information pertaining to this segment in their strategic disclosure choices. Finally, my study provides insight for policymakers in the ongoing debate on whether disclosure should be mandatory for firms. Since I show that firms make a strategic choice to disclose or not to disclose to attain and/or sustain a competitive advantage, my findings suggest that mandating such disclosure may be counter-productive to economic prosperity and social welfare, as different disclosure choices could be optimal for different firms.

THEORETICAL BACKGROUND

Consistent with the industrial organization literature (e.g., Caves and Porter, 1977; Demsetz, 1982; Raith, 2003), I assume that firms react to competitive pressure by attempting to prevent prospective rival firms from entering the industry and/or forcing existing rival firms to exit the industry. These strategies enable incumbent firms to increase/maintain market share and, consequently, increase/maintain their
profitability and chances of long-term survival in the industry. One method of influencing rival behavior is to disclose or withhold information. In generating my hypothesis, I draw from insights in the theoretical literature that are based on the notions that firms are more likely to disclose information to deter rivals (strategic deterrence force) (e.g., Darrough and Stoughton, 1990; Hughes and Williams, 2008; Pacheco-De-Almeida and Zemsky, 2012) and are less likely to disclose information when they are more concerned with rivals benefiting from the commercially sensitive information disclosed (proprietary cost force) (e.g., Verrecchia, 1983). This paradox of disclosure (Arrow, 1962) should be considered carefully by firms in reacting to the competition they face in the industry. I next discuss these competing forces and then develop my hypothesis on the competition-disclosure relation.

**Strategic deterrence force**

To date, there have been only a handful of studies that use a product market perspective to predict a positive relation between competition and disclosure. Prior studies that predict greater disclosure in more competitive environments typically use a capital markets perspective and are based on the premise that firms disclose more favorable information to increase their investing, financing or other capital markets prospects (e.g., Lang and Lundholm, 1993; 1996). By contrast, those that use a product market perspective typically argue that firms in more competitive industries could benefit from greater disclosure as a means of deterring rivals. For example, Darrough and Stoughton (1990) show that firms in more competitive industries could disclose their research and development expenditures to deter prospective firms from entering the industry. Extending this insight to my study I argue that, to combat this competitive threat, incumbent firms may voluntarily disclose information related to research and development expenditure, order backlog, or number of employees. Such information may deter industry rivals who feel they cannot compete after considering other investments or production requirements (Caves and Porter, 1977; Sutton, 1991; Siegfried and Evans, 1994; Raith, 2003). Specifically, research and development expenditure signals to prospective entrants that they must overcome higher expenditures to enter or survive/thrive in the industry. Order backlog information signals that a firm has strong existing consumer loyalty in the industry.
(Demsetz, 1982). Finally, employment levels convey information pertaining to future activity levels and capacity in a given product market. Note that entry may be deterred even in high profit industries if potential entrants expect a more aggressive response to entry from incumbents who have greater economic profits to protect (Kessides, 1991). An incumbent firm thus gains from greater disclosure when competition is greater.

In addition to deterring prospective rivals from entering the industry, other studies show that firms also deter existing rivals in the industry by disclosing more to influence their rivals’ production and innovation schedules (Baker and Mezzetti, 2005; Hughes and Williams, 2008). According to Hughes and Williams, by disclosing information pertaining to commitments, firms can influence their rivals in the industry to increase production, and thus production costs, so as to reduce profitability. A more recent study by Pacheco-De-Almeida and Zemsky (2012) shows that innovative firms are willing to disclose necessary information to encourage their industry rivals to imitate their innovation rather than to innovate.

**Proprietary cost force**

By contrast, competition could have a negative relation with disclosure if firms in more competitive industries are more reluctant to divulge commercially sensitive information that rival firms could use to sustain a competitive advantage. Verrecchia (1983; 1990) assumes that proprietary costs are exogenous and shows that the threshold for disclosure is positively correlated with proprietary costs. Assuming that proprietary costs are higher with greater competition because firms have more to lose from their rivals securing a competitive advantage by relying on the proprietary information they disclose, firms in more competitive industries are less likely to disclose than firms in less competitive industries.

Clinch and Verrecchia (1997) also argue that competition reduces a firm’s likelihood to disclose information. In their study, they find that firms in mature industries choose not to disclose information that signals either very high or very low product demand, as such information may allow rival firms to adopt their own production schedules.

---

3 According to Nickell (1996), firms use excess capacity to make deterrence credible.
Hypothesis development

Combining the insights in the literature as discussed above, I posit that both a positive and negative competition-disclosure relation could exist simultaneously but separately dominate at different competition levels. The intuition for such an expectation is as follows. In industries with no to intermediate competition, firms can set prices considerably above marginal costs (Caves and Porter, 1977; Shaked and Sutton, 1982). In such industries, products across rival firms are differentiated, thus enabling higher prices to be sustained and incumbent firms to create/maintain local monopolies for themselves (Shaked and Sutton, 1982; Hughes and Kao, 1994). Furthermore, if a firm cuts its price, its rivals in the industry lose only a small portion of market sales. Firms could always adjust the prices for their products by differentiating them from those of their rivals, and the differentiation costs could be recouped. A firm’s differentiation activities could even be regarded as its attempts to deter its rivals and disclosing the proxies I use, especially R&D and order backlog, could be viewed as part of these attempts. Such information may deter industry rivals who feel they cannot compete after considering other investments or production requirements as discussed above (Caves and Porter, 1977; Sutton, 1991; Siegfried and Evans, 1994; Raith, 2003). Thus, from low to moderate competition levels, the benefits of disclosure exceed the costs of disclosure and competition has a positive relation with disclosure.

However, as competition becomes intense and profitability is considerably reduced, survival becomes the number one priority for firms in the industry as firms cannot influence prices as much for their products and thus any differentiation initiatives could drastically reduce profits due to the costs involved. Moreover, drastically reduced profitability and its associated cost-consciousness and short-term horizon makes it less likely that a firm’s rivals would be deterred by its disclosure of forward-looking information related to investments, innovation, or production. In this situation, it becomes less attractive for firms to disclose more information with greater competition as their rivals could more easily steal their market share by using the commercially sensitive information they divulge. For example, when product substitutability is

---

4 Other characteristics associated with such industries are excess capacity and a downward sloping demand curve.
higher, it becomes easier for rival firms to steal market share due to similar production technologies. Consequently, the costs to disclosure outweigh the benefits as market share becomes highly sensitive to rival firm reactions to a given firm’s behavior, resulting in a negative competition-disclosure relation.

The preceding discussion suggests that competition could have a positive relation at low levels of competition but a negative relation at high competition levels. Thus, the strategic deterrence force dominates the proprietary cost force up to a certain level of competition; beyond this level, the proprietary cost force dominates the strategic deterrence force. This leads to this study’s hypothesis (stated in alternate form):

\[ H_0: \text{Firms in more competitive industries are more likely to disclose when competition is low and less likely to disclose when competition is high, compared to firms in less competitive industries, ceteris paribus.} \]

It is important to note that, while the proprietary cost force predicts a negative relation between competition and disclosure, it is unclear whether proprietary costs are higher when competitive threat increases in an industry that faces low to intermediate competition versus a highly competitive industry. For example, a firm in the former type of industry could enjoy less intense competition compared to a firm in the latter type of industry due to its product-related proprietary technology. This firm also faces proprietary costs as, similar to its counterpart in a highly competitive industry, it could also be at a competitive disadvantage from an increase in competition if its rivals benefit from the commercially sensitive information it discloses about this technology. While this may be the case, my prediction is based not just on proprietary costs but on the dominance of the strategic deterrence force relative to the proprietary cost force, and hence disclosure choice, across these two types of competitive setting. Thus, while the strategic deterrence force dominates the proprietary cost force with greater competition, its strength weakens relative to, possibly even being dominated by, the proprietary costs force once a certain level of competition is exceeded.

---

5 I assume that while firms face proprietary costs at all competition levels, such costs are higher when competition is intense because firms have more to lose from a loss in market share like exiting the product market or being liquidated due to drastically reduced profitability.
Additional theoretical support for the prediction of the coexistence of both a positive and negative competition-disclosure relation is provided by Darrough (1993) and Gal-Or and Ghose (2005). Darrough shows that, under cost uncertainty (which firms that compete on price are concerned with), firms disclose under Cournot competition and do not disclose under Bertrand competition. A shift from Cournot to Bertrand competition can be regarded as an increase in the intensity in price competition (Sutton, 1991; Darrough, 1993). Gal-Or and Ghose document a non-monotonic relation between firm price and information disclosure. Arya et al. (2010) show that a multi-segment firm responds to competitive pressure by disclosing more information in one industrial segment and less information in another segment when the two segments entail similar disclosure patterns. In my study, I extend their reasoning to a multi-firm setting. More recently, Ellison and Ellison (2011) and Seamans (2013) find some evidence of a non-monotonic relation between competitive threat and entry deterrence—the benefit of entry deterrence activity (e.g., due to first-mover innovative activity) increases up to a certain competition level but decreases after this level as the likelihood of establishing monopolies render costly entry deterrence activity less attractive.

I next discuss how I generate the sample and measures used to test this study’s hypothesis.

SAMPLE SELECTION AND MEASURES USED

Sample

To study the relation between competition and disclosure, I use data from Compustat and Center for Research in Security Prices (CRSP) from 1984 to 2003. To be included in the sample, a firm must have complete data across the Segments and Annual Industrial databases in Compustat, and CRSP. Note that I use data for only the primary industrial segments. I do this because, in a separate analysis, I find that firms appear to make line item disclosure choices at the firm level. Furthermore, I require firms to have identical

---

6 A formal theoretical analysis is beyond the scope of this study.
7 Compustat defines a firm’s primary industrial segment at the four-digit SIC code level for a given year as the industrial segment that contributes the most toward firm sales in that year.
four-digit Standard Industrial Classification (SIC) codes across all the databases for observations to be included in the final sample. To avoid ambiguity, I delete industries with SIC codes ending in zero.\footnote{Compustat assigns a zero value for the fourth digit in an SIC code when it is not sure which four-digit industry a firm has as its primary industry.}

The Compustat data is extracted from the Wharton Research Data Services (WRDS) database. In March 2003, the WRDS data request page was modified to provide the “best” available SIC code. This modification resulted in two datasets that researchers could choose from: one based on the period from 1984 to 2003 and one based on the period from 1990 to the most recent year.\footnote{See the Wharton Research Data Services Knowledge Base article titled “In the Compustat Segment data, why do the SSIC1/SSIC2 variables only go back to 1990? And why do the SSICB1/SSICB2 variables only cover 1984-2004?” Also see http://wrds-web.wharton.upenn.edu/wrds/ds/documentation/comp/seg/ssic1.cfm.} I selected the dataset based on the 1984 to 2003 period to avoid possible errors, inconsistencies, and discrepancies due to the backfilling of segments data by Compustat.\footnote{This period is also likely not subject to the confounding influences of disclosure regulation that is associated with more recent years.} As this dataset is based on actual items and values reported by firms, it may be more reliable with respect to SIC codes.

To further determine my sample, I delete observations where primary segment sales or costs are either zero or negative, as these could reflect erroneous values. I also delete observations where my disclosure variables, research and development expenditure, order backlog, and number of employees, are negative in value. My final sample comprises data for 11,195 firms spanning 349 industries over a 20-year period, resulting in 64,627 firm-year observations. All dollar items are CPI-adjusted to year-2005 dollars to adjust for the effects of inflation.

Next, I describe the procedures used to construct my measures. The definitions and computational details for these measures are provided in the Appendix. In separate analyses, I validate my disclosure measures but do not discuss this for brevity.\footnote{Details can be provided upon request.}

**Measures**

*Dependent variable: disclosure measures*
As mentioned above, I use three industrial segment-level measures to proxy for firm disclosure: research and development expenditure, order backlog, and number of employees. These measures are forward-looking in nature in that they reflect a firm’s capacities for innovation, customer loyalty, and production, respectively (Smiley, 1988; Seamans, 2013). Specifically, research and development expenditure reflects a firm’s expectations of the future of the product market (Siegfried and Evans, 1994). Order backlog indicates sales orders that will be fulfilled subsequent to the end of the reporting period. The level of employment conveys forward-looking information to the extent that the hiring of employees leads activity in a given market and thus provides information on a firm’s allocation of human capital and future capacity.12

**Research and development expenditure** In my study, research and development expenditure at the segment level refers to all costs that relate to the development of new products or services. To capture whether firms disclose segment-level research and development expenditure, I construct an indicator variable equal to one if this variable does not have missing values for the primary segment in my sample, and zero otherwise. I label this variable RDDISC. Panel A of Table 1 shows that 43% of the firms in my sample disclose research and development expenditure at the industrial segment level.

**Order backlog** I define order backlog as the dollar amount of the backlog of orders believed to be set for the industrial segment as of the company’s fiscal year end. To capture whether firms disclose segment-level order backlog information, I construct an indicator variable equal to one if this variable does not have missing values for the primary segment in my sample, and zero otherwise. I label this variable OBKLGDISC. Panel A of Table 1 shows that 31% of the firms in my sample disclose order backlog at the industrial segment level.

12 It is also conceivable that by preventing firms from entering the industry and forcing existing rivals to leave the industry, the industry becomes concentrated in the long run (Demsetz, 1982). This enables incumbent firms to charge higher prices in the long run to increase their profitability (and therefore sustain higher price-cost margins), thus softening price competition. Incumbent firms could charge lower prices in the short run compared to their rivals (undercut rivals’ prices) to win market share with the intention of charging higher prices in the long run. The greater capacity incumbent firms possess allows them greater leeway to reduce prices in the short run, and disclosing such capacities sends a signal to their rivals about their capabilities to drastically reduce prices (Spence, 1977; Dixit, 1979; 1980). In a later section, I control for such effects of industry concentration on price-cost margins to capture the more exogenous aspects of price-cost margins (Deutsch, 1975).
**Number of employees** This variable represents the number of people employed by the firm within the industrial segment, as reported by the company, and includes full-time, part-time, and seasonal personnel. To capture whether firms disclose values for the number of employees, I construct an indicator variable equal to one if this variable does not have missing values for the primary segment in my sample, and zero otherwise. I label this variable EMPDISC. Panel A of Table 1 shows that 72% of the firms in my sample disclose the number of employees at the industrial segment level.

If a firm discloses a zero value for R&D, order backlog, or number of employees, I consider this a disclosure and assign a value of one to the disclosure proxy indicator variable. Therefore, only missing values are assigned a value of zero for the disclosure proxy indicator variable.\footnote{It is possible that some missing values are due to truly missing information rather than firms strategically not disclosing. However, this is unlikely to generate bias across the many firms and industries I examine. Moreover, Koh and Reeb (2014) find that non-reporting R&D firms file 14 times more patents than firms that report zero R&D. This validates my assumption that missing values reflect strategic non-disclosure.} Note that the descriptive statistics in Panel A of Table 1 show that there is considerable variation across firms in the likelihood of disclosure for these proxies.

**Main independent variables: competition measures**

As discussed, prior disclosure studies typically use concentration as a sole proxy for industry competition (e.g., Verrecchia and Weber, 2006). A key assumption in these studies is that concentration is an exogenous variable, following a one-way chain of causation from market structure to conduct to performance (Bain, 1956). However, research in industrial organization suggests that concentration may be endogenous and, consequently, its role in measuring competition may be ambiguous, especially in cross-industry studies (e.g., Demsetz, 1973; Sutton, 1991; Raith, 2003). Further studies suggest a possible reverse link from conduct or performance to structure (e.g., Schmalensee, 1989; Nickell, 1996; Ahn, 2002). For example, higher product substitutability can increase price competition in an industry. This, in turn, will force some firms to exit or merge, resulting in greater industry concentration. By contrast, large market size or low entry costs in an industry may encourage firms to enter, increasing industry competition. In this case, greater competition would be associated with reduced concentration.
In this study, I focus on three dimensions of price competition. Previous research has shown that it is important to examine these dimensions simultaneously, while controlling for concentration, both to capture the incremental and more exogenous effect of each measure relative to the other competition measures as there could be relations among these variables, and to properly reflect the multidimensional nature of competition (e.g., Sutton, 1991; Raith, 2003; Vives, 2008). By showing that industry concentration is endogenous, Sutton (1991) asserts that there is a historically determined lower bound to the level of concentration which must be controlled for in examining the effects of the three determinants of competition I examine. According to Sutton (1991), the effect of product substitutability is best captured by examining not the levels of price-cost margins but how these margins differ between industries given the level of concentration. He also highlights the importance of examining the effect of market size after considering entry costs and given the level of concentration in industries where products are either homogenous or heterogeneous. Vives (2008) specifically asserts that, since measures like the price-cost margin and concentration can be regarded as endogenous and influenced by other more exogenous determinants of competition like market size and entry costs, it is important to control for these other determinants in the same regression to capture the more exogenous nature of the price-cost margin and concentration and to more accurately interpret these measures. By using these determinants, I assess how the economics of an industry that derive from product market fundamentals influence the nature of disclosure in firms. In doing so, I am able to provide a more precise and complete examination of the competition-disclosure relation.

**Product substitutability** I define product substitutability as the extent to which close substitutes exist for a particular product in an industry. Prior studies in the industrial organization literature typically assert that an increase in product substitutability (hereinafter “substitutability”) reflects greater price competition.

---

14 In the tire industry, for example, product substitutability is high (denoting *high* competition) although entry costs are also high (denoting *low* competition), thus illustrating the multidimensional nature of competition. Similarly, in another example, Sutton (1991) shows that in the highly concentrated salt industry, product substitutability and entry costs are both high.

15 Controlling for concentration also rules out the possibility that my findings are not simply picking up what has already been documented on the relation between concentration and disclosure in prior research. In my regressions below, I also control for other observed and unobserved effects that could affect my competition measures.
Consequently, they use the price-cost margin as their measure of price competition (e.g., Martin, 1984; Sutton, 1991; Carlton and Perloff, 1994; Aghion et al., 2001; Nevo, 2001; Baggs and DeBettignies, 2007). The economic intuition for this assumption derives from two approaches to specifying consumer preferences and modeling firm behavior in the context of horizontal product differentiation (Waterson, 1994). The first approach, based on spatial or location models, was developed by Hotelling (1929) and extended by Lancaster (1979) and Salop (1979). The second approach is based on representative consumer models (Chamberlin, 1933; Dixit and Stiglitz, 1977). According to these models, product differentiation naturally arises based on consumer preferences. As these preferences differ based on tastes and incomes, they reflect the exogeneity of product substitutability (Bresnahan, 1981; Waterson, 1989; Berry et al., 1995; Nevo, 2001). In the case of perceived product similarity, firms have fewer ways in which to differentiate their products, and thus must compete on price. This leads to a product price that is closer to the marginal or average variable cost, and thus creates lower price-cost margins, as consumers are unwilling to pay more for one firm’s product than another’s (Shaked and Sutton, 1983)). By contrast, when products are highly differentiated, firms have greater market (pricing) power, as there is a ready market of consumers willing to pay more for the differentiated products at a price considerably above the marginal or average variable cost (Schmalensee, 1978; Perloff and Salop, 1985). Here, price competition is less intense because rival firms face fewer incentives to compete on price, resulting in higher price-cost margins.

The price-cost margin is defined as the negative reciprocal of the elasticity of demand for a product (Salop, 1979; Martin, 1984; Waterson, 1984; Perloff and Salop, 1985; Shapiro, 1987; Carlton and Perloff, 1994). The greater the availability of close substitutes, the larger the magnitude of the substitution effect

---

16 As an example, Coca Cola and Pepsi may be perfect substitutes to some consumers but not to others.
17 Shaked and Sutton (1982) analytically show that product differentiation leads to a relaxing of price competition.
18 Similar to several studies (e.g., Nevo, 2001), my measure of substitutability is related to the own-price and cross-price elasticity of demand. Some researchers show that there is a relation between these two elasticities. For example, according to Carlton and Perloff (1994), since these elasticities necessarily add to zero, the greater the cross-price elasticity of demand, the greater is the own-price elasticity of demand in absolute value.
of a price change, and hence the higher the price elasticity of demand. Thus, low (high) levels of the price-cost margin signify high (low) levels of substitutability.

Based on the Lerner index of monopoly power (Lerner 1934), several studies measure the price-cost margin by comparing price to a measure of cost (e.g., Domowitz, Hubbard, and Peterson, 1986; Nevo, 2001; Aghion et al., 2005; Karuna, 2007). Consistent with Karuna (2007), I calculate the price-cost margin at the industrial segment level as sales divided by operating costs, all at the four-digit SIC code level. I compute industry sales and operating costs by taking the sum of the primary industrial segment sales and the sum of the primary industrial segment operating costs for firms at the four-digit SIC code level, respectively. To obtain a measure that is positively correlated with product substitutability, I multiply the price-cost margin by -1. I label this measure SUB. The larger the value of SUB, the higher the product substitutability, and thus the greater the intensity of price competition in the industry.

**Market size** I define market size as the level of demand for a particular product in a given industry. This demand depends on both the product’s inherent attributes and consumers’ preferences. Hence, market size can be regarded as an exogenous variable (Sutton, 1986; 1991; Waterson, 1989; Nevo, 2001). In my study, market size reflects the density of consumers in a market or industry and is measured using the primary industrial segment sales at the four-digit SIC code level (Sutton, 1991; Ellison and Ellison, 2011). According to Sutton (1991), Bresnahan and Reiss (1991), and Raith (2003), when market demand for a product increases at a given price, sales of that product also increase. Attracted by the prospects of greater profitability, more firms enter the market (industry), after taking into account barriers to entry like exogenous sunk costs, and thus price competition increases. This negative market size-concentration relation is a consistently robust result in game theoretic analyses in the industrial organization literature (e.g., Schmalensee, 1989; Bresnahan and Reiss, 1991; Sutton, 1991; Berry and Reiss, 2007; Berry and Waldfogel, 1999; 2010).

---

19 The greater the extent of product substitutability among rival firms, the greater the demand for a firm’s product if the price of its rival’s product increases.
Note that, although market size is highly skewed to the right, its natural log transformation brings the mean and median values closer together (see panel A of Table 1). Hence, I use the log-transformed variable (labeled MKTSIZE) in subsequent statistical analyses. In sum, the greater the value of MKTSIZE, the greater the market size, and thus the greater the price competition in the industry.

**Entry costs** I define entry costs as costs that firms incur to enter an industry. As such, these costs reflect potential barriers to entry.\(^\text{20}\) Lower entry costs attract more entrants and thus increase industry competition (Spence, 1977; 1979; Dixit, 1979; 1980; Demsetz, 1982). Similar to Sutton (1991), I measure entry costs as the minimal level of investment (exogenous sunk cost) that must be incurred by each entrant firm prior to commencing production in the industry. This minimal level of investment varies across industries in proportion to the cost of constructing a single plant of minimum efficient scale. Thus, it is an exogenous determinant of competition (Sutton, 1991).\(^\text{21}\) According to Sutton (1991), this minimum efficient scale is “an element of sunk cost that must be incurred by all entrants, and whose level is determined exogenously by the nature of the underlying technology.” To capture this minimal level of investment, I compute the weighted average gross value of the cost of property, plant and equipment for firms for which this is the primary industry at the four-digit SIC code level, weighted by each firm’s market share in this industry.\(^\text{22}\) I compute market share by dividing the segment sales figure for the primary industrial segment of a firm by the sum of the segment sales of all firms for which this is the primary industry.

As the entry costs measure is highly skewed, I use the log-transformed entry costs measure and multiply it by \(-1\) to obtain a measure that is positively correlated with competition. I label this measure ENTRY. The larger the value of ENTRY, the lower the entry costs, and thus the greater the price competition in the industry.

Finally, it is worth noting that, in a survey of seventy empirical studies that examine entry and exit patterns covering eleven different countries, Siegfried and Evans (1994) conclude that these studies

\(^\text{20}\) Barriers to entry are defined as conditions that allow incumbent firms in an industry to earn abnormal profits without attracting entry (Bain, 1956)).

\(^\text{21}\) The minimum efficient scale of a plant is defined as the lowest level of output the plant can produce such that its long-run average costs are minimized (Cabral, 2000).

\(^\text{22}\) I compute a weighted average measure to aggregate property, plant, and equipment (PPE) to the industry level from the firm level. Data pertaining to PPE are not available in the Segments database.
generally find evidence that greater market size (higher entry costs) is associated with more (less) entry into the industry by firms and, consequently, more (less) intense price competition. Collectively, these findings support my use of market size and entry costs as competition measures.

**Control variables**

To measure industry concentration, I use the four-firm concentration ratio (CONC). CONC reflects the proportion of sales in the primary industry accounted for by the four largest firms (by sales). I obtain the data to compute CONC from the Segments database.

In my regressions, I also include several firm-level control variables documented in prior research as affecting disclosure (e.g., Berger and Hann, 2003; 2007). Specifically, SALE, VOLAT, MTB, and RD denote the natural log of sales, the volatility of monthly stock returns, the market-to-book ratio, and research and development intensity, respectively. In this study, SALE proxies for firm size, whereas VOLAT proxies for firm risk. Both MTB and RD proxy for growth/investment opportunities. In addition to these variables, I include a lagged variable for my disclosure proxy in my regressions (LAGDISC). Including this variable controls for the possibility that the previous year’s disclosure may impact the current year’s disclosure. Finally, I include year indicator variables to control for trends in disclosure that may vary over time.

**Univariate analysis**

In this section, I compare a sample of firms in industries that disclose values for my disclosure proxies (disclosure subsample) with a sample of firms in industries that do not disclose values (non-disclosure subsample). Panel B of Table 1 provides the average values for the descriptive statistics for my three disclosure proxies, RDDISC, EMPDISC, and OBKLGDISC. These statistics show that the average values for my competition variables are significantly larger for the disclosure subsample relative to the non-disclosure subsample. This suggests that firms in more competitive industries may have a higher likelihood of disclosing information compared to firms in less competitive industries, providing preliminary support

---

23 The results in this study are similar when I use the Herfindahl-Hirschman index as the measure of concentration.
24 In a separate analysis, I find that disclosure choices are generally sticky over time for a given firm.
for the strategic deterrence force. Furthermore, the results show that firms in the disclosure subsample tend to be smaller and riskier, but with greater growth or investment opportunities, than those in the non-disclosure subsample. Another interesting observation is that when the likelihood of firms disclosing one variable is higher, those firms are also more likely to disclose the other two variables. For example, the values for RDDISC, OBKLGDISC, and EMPDISC are higher for the disclosure subsamples of the other two variables. This suggests that firms do not make tradeoffs among my disclosure proxies, but that these variables complement each other in firms’ strategic disclosure choices.

To summarize, the descriptive statistics in Table 1 indicate that firms in more competitive industries are more likely to disclose values for these three variables than those in less competitive industries.

[Insert Table 1 here]

Correlation matrix

Table 2 presents the Pearson correlation matrix for the independent variables in the study. No high correlations emerge among the independent variables. The correlations that do emerge suggest that all my disclosure variables are positively correlated with each other. This suggests that these three variables may capture different dimensions of strategic forward-looking disclosure choices. The correlations also confirm the observations mentioned above, that larger firms generally disclose less whereas riskier firms disclose more. Finally, the correlations indicate that firms with greater growth opportunities are more likely to disclose research and development expenditure and number of employees but less likely to disclose order backlog. Since it is important to account for the effects of the other competition variables, all the competition variables need to be considered together to obtain a more complete and accurate measure of competition as indicated above. Consequently, I do not report the correlations related to the competition variables to avoid misleading inferences. I next conduct multivariate analyses to more accurately capture the effect of a given competition variable on disclosure.

[Insert Table 2 here]

RESEARCH METHOD
Before I test my study’s hypothesis, I first examine whether the strategic deterrence force or the proprietary cost force is empirically supported overall. To do this, I run the following logistic regression model at the firm-year level:\textsuperscript{25}

\[
\text{DISCLOSURE PROXY} = \beta_0 + \beta_1 \text{SUB} + \beta_2 \text{MKTSIZE} + \beta_3 \text{ENTRY} + \beta_4 \text{CONC} + \beta_5 \text{SALE} + \beta_6 \text{VOLAT} + \beta_7 \text{MTB} + \beta_8 \text{RD} + \beta_9 \text{LAGDISC} + \text{YEAR INDICATOR} + \varepsilon. \tag{equation 1}
\]

Specific definitions for the above variables are given in the Appendix. Equation 1 allows me to test the likelihood of a firm disclosing research and development expenditure (RDDISC), order backlog (OBKLGDISC), or the number of employees (EMPDISC), based on the intensity of competition it faces in its industry. DISCLOSURE PROXY represents the range for each disclosure variable and equals one when a firm discloses an item, and zero otherwise. The coefficient \(\beta_1\) measures how the disclosure proxy varies with SUB. The coefficients \(\beta_2\) and \(\beta_3\) measure how the disclosure proxy varies with MKTSIZE and ENTRY, respectively. The strategic deterrence force predicts that \(\beta_1, \beta_2,\) and \(\beta_3 > 0\). By contrast, the proprietary cost force predicts that \(\beta_1, \beta_2,\) and \(\beta_3 < 0\). As concentration may have an ambiguous relation with competition, I offer no prediction for the coefficient \(\beta_4\). The variables are winsorized at the 1\% and 99\% levels to minimize the influence of outliers. Year indicator variables are included in the regressions, but are not reported for brevity. The next section presents and discusses the results of the tests I conduct in this section.

**RESULTS**

Table 3 provides the results for my logistic regression model based on equation 1. The regressions show a good model fit with Pseudo R squares ranging from 56\% to 81.5\%. In column I, I provide the results for the regression where the research and development expenditure disclosure indicator, RDDISC, is the dependent variable (Swamy, 1970). These results show that SUB has a coefficient of 0.563, with a p value of 0.00 and 95\% confidence interval (CI) of [0.18, 0.95]. This indicates that higher product substitutability is associated with greater likelihood of research and development expenditure disclosure overall. The results in Table 3 also show that MKTSIZE has a coefficient of 0.344 (p value = 0.00, 95\% CI [0.23, 0.44]).

\textsuperscript{25} Conducting the analysis at the firm year level incorporates inter-firm differences; it also controls for differences in the industry mix of sample firms over time (Bushman, Engel, and Smith, 2006).
This indicates that firms in larger markets are more likely to disclose their research and development expenditure overall. ENTRY has a coefficient of 0.269 (p value = 0.00, 95% CI [0.18, 0.36]). This indicates that lower entry costs also prompt firms to disclose their research and development expenditure overall. Collectively, these results indicate that competition has an overall positive relation with the likelihood of firms disclosing research and development expenditure at the primary industrial segment level.

Column II provides the results for a logistic regression based on equation 1 where the order backlog disclosure indicator, OBKLGD, is the dependent variable. Here, the results indicate that the coefficients for my competition variables are as follows: SUB (0.460, p=0.00, 95% CI [0.14, 0.78]); MKTSIZE (0.111, p=0.10, 95% CI [-0.03, 0.25]); and ENTRY (0.084, p=0.15, 95% CI [-0.03, 0.20]). These results indicate that competition has an overall positive relation with the likelihood of firms disclosing order backlog at the primary industrial segment level. Column III provides the results for a logistic regression based on equation 1 where the number of employees disclosure indicator, EMPD, is the dependent variable. The results show that SUB has a coefficient of 0.312 (p=0.00, 95% CI [0.14, 0.48]); MKTSIZE has a coefficient of 0.135 (p=0.00, 95% CI [0.07, 0.20]); and ENTRY has a coefficient of 0.061 (p=0.00, 95% CI [0.02, 0.10]). Collectively, these coefficients suggest that competition has an overall positive relation with the likelihood of firms disclosing the number of employees at the primary industrial segment level.

These coefficients are also economically significant. For example, in terms of the marginal effect at the means of the covariates (Pampel, 2000), in column I, a one standard deviation increase in the extent of product substitutability increases the probability of disclosing research and development expenditure by approximately 26%, while a 10% increase (decrease) in market size (entry costs) increases the probability of disclosing research and development expenditure by approximately 8% (6%).

In Table 3, the results for CONC generally indicate positive relations between industry concentration and RDDISC, OBKLGD, and EMPD. If concentration reflects competition, then these results suggest that greater competition leads to less disclosure, consistent with some prior studies (e.g.,
Verrecchia and Weber, 2006). However, given the ambiguous nature of concentration as a reflection of industry competition, I interpret these results with caution, but suggest that they may require further examination beyond the scope of this study.

The results for the other control variables show that larger firms disclose less. This is in contrast to prior disclosure studies that find evidence of a positive relation between firm size and disclosure (e.g., Lang and Lundholm, 1993; Ali et al., 2010). Furthermore, I find that firms with greater growth and investment opportunities generally have a greater tendency to disclose research and development expenditure and the number of employees, but are less likely to disclose order backlog. Finally, I find that the likelihood of firms disclosing my three disclosure variables is higher in the current year when they had disclosed these variables the previous year, suggesting a pattern of stickiness in disclosure behavior.

Overall, my preliminary tests of the relation between competition and disclosure reveal an overall positive relation, thus providing evidence that the strategic deterrence force is supported empirically on average.

[Insert Table 3 about here]

Test of hypothesis - Coexistence of positive and negative competition-disclosure relation

This study’s hypothesis is based on the reasoning that both positive and negative competition-disclosure relations exist but separately at different competition levels. To test this hypothesis, I rerun the logistic regression in equation 1 including quadratic (squared) terms for my competition variables in addition to the other independent variables (Ellison and Ellison, 2011; Seamans, 2013). Since preliminary diagnostic checks indicate multicollinearity concerns, I center the competition variables first by subtracting their means from their original values before taking their squared values (Aiken and West, 1991). This procedure resolves the multicollinearity problem and I proceed with my analysis using these transformed variables. Specifically, I test the following regression model where I cluster observations by industry:

\[
\text{DISCLOSURE PROXY} = \beta_0 + \beta_1 \text{CENTERED SUB} + \beta_2 (\text{CENTERED SUB})^{\alpha_2} + \beta_3 \text{CENTERED MKTSIZE} + \beta_4 (\text{CENTERED MKTSIZE})^{\alpha_4} + \beta_5 \text{CENTERED ENTRY} + \beta_6 (\text{CENTERED ENTRY})^{\alpha_6} + \beta_7 \text{CENTERED CONC} + \beta_8 (\text{CENTERED CONC})^{\alpha_8} + \beta_9 \text{SALE} + \beta_{10} \text{VOLAT} + \beta_{11} \text{MTB} + \beta_{12} \text{RD} + \beta_{13} \text{LAGDISC} + \text{YEAR INDICATOR} + \varepsilon
\]  
(equation 2)
In the above regression, if competition has a positive but diminishing relation with disclosure, then the coefficients on the competition variables should have these following signs: $\beta_1, \beta_3$, and $\beta_5 < 0$ and $\beta_2, \beta_4$, and $\beta_6 > 0$. The results of this test (not reported for brevity) indicate a possible non-monotonic relation between competition and disclosure. While the coefficients for my competition proxies retain the same signs as their counterparts in Table 3, their squared terms generally have signs in the opposite direction. Thus, I find preliminary evidence supporting a non-monotonic relation, specifically, a positive but diminishing relation.

While these results suggest a possible non-monotonic relation, they are not sufficient. To explore the non-monotonic relation I document even further, I next conduct piecewise linear continuous regressions based on equation 1, including break points (knots) at the 33rd and 67th percentiles of my respective competition variables. Doing so more precisely determines the non-monotonic relation, if any, between competition and disclosure. The results are presented in Table 4 and constitute the main test of my hypothesis. For brevity, I report only those coefficients for the competition variables. I am especially interested in examining the results for SUB as this measure is a direct measure of the intensity of price competition in my study, and the most appropriate among my competition proxies to use to test my conjecture of a non-monotonic competition-disclosure relation (Sutton, 1991; Raith, 2003). The results of this test confirm the existence of a non-monotonic relation. Interestingly, in column I, the results for SUB show a flip in sign from the lowest to highest tercile of this measure across all three disclosure variables.

For RDDISC, the coefficient for SUB is 0.445 (p=0.01, 95% CI [0.12, 0.77]) for the lowest tercile of SUB whereas it is -4.923 (p=0.01, 95% CI [-8.69, -1.16]) for the highest tercile of SUB. For OBKLGDISC, the coefficient for SUB is 6.014 (p=0.00, 95% CI [2.28, 9.74]) for the second tercile of SUB whereas it is -5.569 (p=0.00, 95% CI [-8.90, -2.24]) for the highest tercile of SUB. Finally, the coefficient for SUB is 0.164 (p=0.06, 95% CI [-0.01, 0.34]) for the lowest tercile of SUB and -1.116 (p=0.27, 95% CI [-3.08, 0.85]). Thus, there is evidence that the competition-disclosure relation is positive from low to intermediate levels of competition and negative at high competition levels, providing support for my hypothesis.

Although not as direct a measure of the intensity of price competition as SUB, MKTSIZE and ENTRY
show a positive but diminishing competition-disclosure relation and some evidence, albeit weak, of a positive relation at low competition levels and a negative relation at high levels. Thus, overall, there appears to be some support for this study’s hypothesis.

[Insert Table 4 about here]

**Interactive effect of competition and firm market share/size on disclosure likelihood**

Although my analysis is conducted at the firm level, it is based on an industry-level theoretical model where I examine the average disclosure likelihood by all firms in an industry in reaction to the competitive threat they face in that industry. I next examine whether a firm’s position in the industry, for example, its market share or size, could influence how the firm reacts to the nature of competition in the industry in making its disclosure choice. For example, a firm’s relative dominance in pricing power compared to its rivals could influence how it reacts to competitive threat in the industry. To examine this possibility, I rerun the above analysis allowing for interactions between my competition variables and both a firm’s market share (labeled MKTSHARE) and its size (labeled SALE).\(^{26}\) I conduct the following logistic spline regression by terciles of MKTSIZE where I cluster observations by industry:

\[
\text{DISCLOSURE PROXY} = \beta_0 + \beta_1 \text{SUB} + \beta_2 \text{MKTSIZE} + \beta_3 \text{ENTRY} + \beta_4 \text{CONC} + \beta_5 \text{MKTSHARE} + \beta_6 \text{SALE} + \beta_7 \text{VOLAT} + \beta_8 \text{MTB} + \beta_9 \text{RD} + \beta_{10} \text{LAGDISC} + \text{YEAR INDICATOR} + \epsilon. \quad (\text{equation 3})
\]

Table 5 provides the coefficients on MKTSHARE and SALE for the different terciles of MKTSIZE. The results generally provide some evidence that firms with greater market share are more (less) likely to disclose research and development expenditure and the number of employees at the lowest (highest) tercile of MKTSIZE. However, such firms are less likely to disclose order backlog across terciles. These results collectively suggest that, when the strategic deterrence force dominates, firms with greater market share are more (less) likely to disclose information that can be regarded as less (more) favorable to deter rivals. However, when the proprietary cost force dominates, firms with greater market share are less willing to disclose any information that could reveal commercially sensitive information to their rivals. These findings provide corroborating evidence for my main finding pertaining to a positive competition-

\(^{26}\) I measure a firm’s market share and size as above.
disclosure relation that becomes negative at intense competition levels. Such evidence is not obvious for SALE. These findings collectively suggest that a firm’s strategic disclosure choices are influences by its market share in the industry than by its size.

[Insert Table 5 about here]

**Endogeneity considerations**

Finally, I consider whether my analysis may suffer from endogeneity, as firms disclosing at the industrial segment level could have an impact on competition at the industry level. Problems due to endogeneity could arise due to unobserved correlated omitted industry factors that be related to both competition and disclosure and drive the relation between the two variables, or due to a possible reciprocal relation between these two variables, say when disclosure of commercially sensitive information affects how intensely firms compete in the industry.

However, I rule out this concern for several reasons. First, the different signs of the competition-disclosure relation I document at different competition levels suggests that reverse causality is not an issue as it is unlikely that disclosure results in both greater and less competition. Second, it is unlikely that a single disclosure at the firm level has a major impact on competition at the industry level. Third, industry variables like competition typically change over a longer period of time, whereas disclosure at the firm level is relatively more frequent. Finally, since disclosure is a choice variable whereas competition is not, I conclude that endogeneity concerns do not impact my results.

Notwithstanding my preceding conceptual discussion ruling out endogeneity concerns in my study, in the next section I more systematically examine the causal nature of the overall relation between competition and disclosure. I do this in two different ways. First, I identify a natural experiment where there is an external exogenous shock to competition and determine how this shock affects disclosure. Second, I use another exogenous measure of competition, specifically industry tariffs, to examine the competition-disclosure relation.

**Evidence from natural experiment: deregulation in the Telecommunications industrial sector**
The Telecommunications Act of 1996 was approved by the 104th Congress on January 3, 1996, and signed into law on February 8, 1996, by President Bill Clinton. The purpose of this Act was to open up markets to competition by removing regulatory barriers to entry. The Conference Report for this Act by the House of Representatives, 104th Congress, refers to the bill “to provide for a pro-competitive, de-regulatory national policy framework designed to accelerate rapidly private sector deployment of advanced information technologies and services to all Americans by opening all telecommunications markets to competition...”. Congress attempted to create a regulatory framework for the transition from primarily monopoly to competitive provision of telecommunications services. The 1996 Act was also a response by the U.S. Congress to calls to undo the regional bell operating companies’ (RBOCs) monopoly over local telephone service in the midst of new technologies including cable television, cellular (or wireless) service, the internet etc. that offered alternatives to the services provided by local telephone companies. Because the deregulation of the Telecommunications industrial sector was a regulatory shock to competition, it is relatively exogenous to the competition-disclosure relation. Therefore, it can be used as an ideal setting to examine the effect of increased competition on disclosure without being concerned about endogeneity.

Since finding empirical evidence via this test to corroborate my main finding of a positive (negative) competition-disclosure relation a low (high) competition levels is non-trivial, I focus on the overall competition-disclosure relation due to the reduced power. Panel A of Table 6 provides the results for regressions I conduct to ascertain whether the deregulation that occurred in the Telecommunications industrial sector in 1996 led to a significant increase in disclosure in this sector compared to other industrial sectors from the three-year period before (from 1993 to 1995) to the three-year period after (from 1997 to 1999) the deregulation event. I find some evidence that the values of my disclosure proxies are greater in the three-year period post deregulation (DEREG = 1) than in the three-year period pre-deregulation (DEREG = 0) for firms in the Telecommunications industrial sector (TELECOM = 1) compared to other industrial sectors (TELECOM = 0). Specifically, the coefficient on the interaction

27 Provisions of the Telecommunications Act of 1996 are provided by the Federal Communications Commission (FCC) at the following url: http://transition.fcc.gov/telecom.html
28 I define industries with the following four-digit SIC codes as comprising the Telecommunications industrial sector: 4810, 4811, 4812, 4813, 4820, 4830, 4832, 4833, 4840, 4841, 4880, 4890, and 4899.
between TELECOM and DEREG is positive in columns I to III. The likelihood of disclosing in the Telecommunications industrial sector compared to other sectors post- versus pre-deregulation is most likely for order backlog.

**Use of industry trade barriers (tariffs) as competition proxy**

As another exogenous measure of competition, I use industry trade barriers, specifically tariffs. My sample period, 1984 to 2003, witnessed two free trade agreements that the U.S. entered into that substantially reduced tariffs for goods imported into the US from Canada and Mexico. The North American Free Trade Agreement (NAFTA) is an act that increased competition for a broad cross-section of US manufacturing industries and superseded the Canadian-United States Free Trade Agreement (CUSFTA). If lobbying groups did not influence tariff changes, using tariffs during the period where trade agreements were signed yields an exogenous measure of competition.29

Using the industry data on US tariffs obtained from Schott (2010), I calculate tariffs as (the share of US imports from Canada in industry i × Tariff against Canada + the share of US imports from Mexico in industry i× Tariff against Mexico). I then take lagged values of this measure and multiply by -1 to generate a variable that is positively correlated with the competition construct. I label this variable NEGLAGTARIFF. Higher values of NEGLAGTARIFF denote more intense competition.

I then run a regression similar to equation one based on terciles of SUB but including NEGLAGTARIFF in place of SUB, MKTSIZE, ENTRY, and CONC. I present the results in panel B of Table 6. For brevity, I only report the coefficients for NEGLAGTARIFF. The coefficients are positive for the second tercile of SUB but either decrease in magnitude and retain the positive sign or flip sign. Hence, supporting my main findings in Table 4, I find some evidence supporting this study’s hypothesis.

Overall, I provide evidence of the causal nature of the relation between competition and disclosure. I also find that some evidence supporting my study’s main finding.

[Insert Table 6 about here]

**SENSITIVITY TESTS**

29 According to Krugman et al. (2012), lobbying groups are less likely to influence tariff changes that result from multilateral trade agreements such as NAFTA.
Restricted sample

It is conceivable that several observations may have contributed to noise in the sample used in the main analysis above. For example, observations where data for the disclosure variables are missing or zero at both the firm and segment level, and where the data for the disclosure variables are missing at the firm level and equal to zero at the segment level and vice versa may affect the results. Consequently, I delete such observations and rerun my tests; my findings remain.\textsuperscript{30}

Other control variables

As additional sensitivity checks, I rerun the regressions above including alternative proxies for firm size like the log market value of equity and log total assets. I also include firm-level profitability as a control variable. After rerunning these tests, I find that my results remain.

While, as argued above, it is less likely that capital market incentives could confound my analysis, I rerun the above regressions including the level of debt at the firm level. Doing so does not alter my findings. Interestingly, however, I find that, while there is generally a negative relation between the level of either short-term or long-term debt and the likelihood of disclosure (as in Verrecchia and Weber, 2006; and Dedman and Lennox, 2009), there is a positive relation between the level of secured debt and the likelihood of disclosure. These findings suggest that more research could be conducted on how different types of financing mechanisms affect disclosure.

Overall, the comprehensive robustness checks I conduct yield results that generally support this study’s main findings. In the next section, I conclude this study and provide suggestions for future research.

CONCLUSION

I find evidence of a positive relation between competition and disclosure at low competition levels and a negative relation at high competition levels. This finding sheds light on the inconclusive empirical evidence on the relation between competition and voluntary disclosure in the literature. Specifically, my finding suggests that firms are more likely to disclose with greater competition when competition is low to

\textsuperscript{30} The findings are also robust to deleting observations with missing or zero values at the firm-level for my disclosure variables even if such observations are positive at the segment level.
intermediate as a means to deter rivals. However, they are less likely to disclose with greater competition after competition exceeds a certain level, as such disclosure could provide rivals with potential proprietary information. This finding also contributes to the theoretical literature by suggesting that the strategic deterrence force dominates at low to intermediate competition levels, but that the proprietary cost force dominates once competition is intense.

While this study provides detailed insights on the relation between competition and disclosure, there are several possible limitations. First, I assume that firms voluntarily disclose based on competition in the primary industry in which these firms operate, as defined by the four-digit SIC code. In the Compustat database, Standard and Poor’s assigns a primary SIC code to a company based on the primary business activity the company engages in (as determined by revenue). It is arguable that these firms may not identify their primary industry based on SIC codes. However, Berger and Hann (2007) show that, although companies identified segments primarily based on their lines of business under the SFAS 14 regime, there was no difference in their results across both SFAS 14 and SFAS 131 regimes based on how Compustat assigned their primary SIC codes. Thus, they conclude that it is equally appropriate to use the SIC code classification of segments under both reporting regimes.

Second, I rely on Standard and Poor’s primary industrial segment classification to assign firms to industries. However, there are several cases where this may not fully reflect a firm’s competitive industry context. For example, the primary industry for a firm could have changed during the sample period in this study. Furthermore, it is not clear whether conglomerates make their disclosure choices based mainly on the primary segment I identify. This possibility may add noise to the analysis. Another limitation of this study is that some firms may compete with firms in industries with different four-digit SIC codes. In addition, some firms may not compete with other firms in the same industry (at the four-digit SIC code level). For example, the use of the price-cost margin variable assumes a one-to-one correspondence between four-digit SIC codes and product markets. However, this correspondence is not perfect, as some industries may include several products that are not close substitutes for each other. Such an aggregation tends to overstate the true substitutability for a firm’s product. Further, some products may be in different
four-digit SIC codes and yet may be close substitutes of each other. Such a disaggregation tends to understate the true substitutability for a firm’s product. Nonetheless, in the above cases, any mismeasurement due to aggregation or disaggregation is unlikely to be systematically different across industries and is therefore unlikely to bias the empirical results in this study.

A third limitation to this study is the possibility that firms may not fully allocate costs to the segments. In this situation, my price-cost margin measure may be overestimated. However, I argue that this is not a major limitation in this study as any measurement error associated with the price-cost margin measure is unlikely to cause a bias across the many firms and industries in my sample. Moreover, any limitation pertaining to the price-cost margin measure is offset by the robust evidence I find for the other two competition measures.

A final limitation is that this study uses disclosure proxies obtained from industrial segment data, which is reported in publicly-available financial statements. Therefore, a possible criticism is that this study ignores information pertaining to these proxies that may be disclosed by the firms via conference calls, analyst meetings, and other private mechanisms. However, the information provided in these alternative mechanisms is more likely to relate to earnings rather than the price competition measures I use in my study. Consequently, such alternative sources of information disclosure should not impact my results.

One of the key contributions of this study is the consideration of how industry-level factors may impact a firm’s decision to disclose information at the industrial segment level. It would be fruitful if additional research were conducted on other industry-level determinants of voluntary disclosure. In addition, future research could also provide a more in-depth examination of the non-monotonic relation between competition and disclosure proposed in this study. Such research would yield further insights into cross-sectional differences and trends over time in voluntary disclosure in firms. Finally, more detailed studies could be conducted using long time series data within specific industries to obtain a closer look at how disclosure mechanisms work.
## Appendix - Definitions and Computations of Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Definitions</th>
<th>Method of computation</th>
</tr>
</thead>
<tbody>
<tr>
<td>RDDISC</td>
<td>Disclosure proxy for research and development expenditure for industrial segment at four-digit SIC code level</td>
<td>An indicator variable that is equal to one if the firm discloses research and development expenditure, and zero otherwise</td>
</tr>
<tr>
<td>OBKLGDISC</td>
<td>Disclosure proxy for order backlog for industrial segment at four-digit SIC code level</td>
<td>An indicator variable that is equal to one if the firm discloses order backlog, and zero otherwise</td>
</tr>
<tr>
<td>EMPDISC</td>
<td>Disclosure proxy for the number of employees for industrial segment at four-digit SIC code level</td>
<td>An indicator variable that is equal to one if the firm discloses the number of employees, and zero otherwise</td>
</tr>
<tr>
<td>SUB</td>
<td>Extent of product substitutability in industry (at four-digit SIC code level)</td>
<td>(-1) * [\frac{\text{sales}}{\text{operating costs}}], for each industrial segment; operating costs include cost of goods sold, selling, general, and administrative expense, and depreciation, depletion, and amortization.</td>
</tr>
<tr>
<td>MKTSIZE</td>
<td>Level of market size in industry (at four-digit SIC code level)</td>
<td>Natural log of industry sales (for measure constructed from Compustat data, industry sales is computed as the sum of segment sales for firms operating in the industry).</td>
</tr>
<tr>
<td>ENTRY</td>
<td>Ease of entry into the industry (at four-digit SIC code level)</td>
<td>(-1) * [\text{natural log of weighted average of gross value of cost of property, plant and equipment for firms in industry, weighted by each firm’s market share in industry}].</td>
</tr>
<tr>
<td>CONC</td>
<td>Four-firm concentration ratio in industry (at four-digit SIC code level)</td>
<td>Proportion of sales in the industry accounted for by the four largest firms (by sales) in the industry (for measure constructed from Compustat data, industry sales is as computed in MKTSIZE above).</td>
</tr>
<tr>
<td>SALE</td>
<td>Log sales at firm level</td>
<td>Natural log of sales</td>
</tr>
<tr>
<td>VOLAT</td>
<td>Stock return volatility at firm level</td>
<td>Standard deviation of monthly company stock returns</td>
</tr>
<tr>
<td>MTB</td>
<td>Log market-to-book ratio at firm level</td>
<td>Natural log of [\frac{\text{(number of outstanding shares*market price at end of fiscal year) / (total assets – total liabilities)}}]</td>
</tr>
<tr>
<td>RD</td>
<td>Log research and development intensity at firm level</td>
<td>Natural log of (\frac{\text{(R&amp;D expenditure / sales)}}); R&amp;D/sales set to zero for missing values</td>
</tr>
<tr>
<td>LAGDISC</td>
<td>Previous year’s disclosure proxy value at industrial segment level</td>
<td>Lagged values of RDDISC, OBKLGDISC, or EMPDISC</td>
</tr>
</tbody>
</table>


Table 1
Panel A: Descriptive statistics for overall sample

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Median</th>
<th>25th percentile</th>
<th>75th percentile</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>R&amp;D disclosure (RDDISC)</td>
<td>0.43</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
<td>0.50</td>
</tr>
<tr>
<td>Order backlog disclosure (OBKLGDISC)</td>
<td>0.31</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
<td>0.46</td>
</tr>
<tr>
<td>Employees disclosure (EMPDISC)</td>
<td>0.72</td>
<td>1.00</td>
<td>0.00</td>
<td>1.00</td>
<td>0.45</td>
</tr>
<tr>
<td>Product substitutability (SUB)</td>
<td>-1.37</td>
<td>-1.12</td>
<td>-1.26</td>
<td>-1.06</td>
<td>9.94</td>
</tr>
<tr>
<td>Log market size (MKTSIZE)</td>
<td>9.71</td>
<td>9.77</td>
<td>8.37</td>
<td>11.10</td>
<td>2.03</td>
</tr>
<tr>
<td>Log entry costs (ENTRY)</td>
<td>-6.86</td>
<td>-7.03</td>
<td>-8.71</td>
<td>-5.54</td>
<td>2.64</td>
</tr>
<tr>
<td>Concentration ratio (CONC)</td>
<td>0.64</td>
<td>0.64</td>
<td>0.45</td>
<td>0.83</td>
<td>0.22</td>
</tr>
<tr>
<td>Log sales (SALE)</td>
<td>4.92</td>
<td>4.93</td>
<td>3.26</td>
<td>6.63</td>
<td>2.50</td>
</tr>
<tr>
<td>Stock return volatility (VOLAT)</td>
<td>0.15</td>
<td>0.13</td>
<td>0.08</td>
<td>0.19</td>
<td>0.12</td>
</tr>
<tr>
<td>Log market-to-book ratio (MTB)</td>
<td>0.97</td>
<td>0.84</td>
<td>0.71</td>
<td>1.09</td>
<td>0.43</td>
</tr>
<tr>
<td>Log R&amp;D intensity (RD)</td>
<td>0.09</td>
<td>0.00</td>
<td>0.00</td>
<td>0.03</td>
<td>0.38</td>
</tr>
</tbody>
</table>

Panel B: Average values for several variables for disclosure versus non-disclosure industries

<table>
<thead>
<tr>
<th></th>
<th>RDDISC subsample</th>
<th></th>
<th></th>
<th>EMPDISC subsample</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Disclosure</td>
<td>Non-disclosure</td>
<td>t-test</td>
<td>Disclosure</td>
<td>Non-disclosure</td>
<td>t-test</td>
</tr>
<tr>
<td>RDDISC</td>
<td>1</td>
<td>0</td>
<td>(p=0.00)</td>
<td>0.67</td>
<td>0.33</td>
<td>(p=0.00)</td>
</tr>
<tr>
<td>OBKLGDISC</td>
<td>0.48</td>
<td>0.18</td>
<td>(p=0.00)</td>
<td>1</td>
<td>0</td>
<td>(p=0.00)</td>
</tr>
<tr>
<td>EMPDISC</td>
<td>0.86</td>
<td>0.61</td>
<td>(p=0.00)</td>
<td>0.81</td>
<td>0.67</td>
<td>(p=0.00)</td>
</tr>
<tr>
<td>SUB</td>
<td>-1.26</td>
<td>-1.25</td>
<td>(p=0.00)</td>
<td>-1.28</td>
<td>-1.19</td>
<td>(p=0.00)</td>
</tr>
<tr>
<td>MKTSIZE</td>
<td>9.67</td>
<td>9.75</td>
<td>(p=0.00)</td>
<td>9.28</td>
<td>9.91</td>
<td>(p=0.00)</td>
</tr>
<tr>
<td>ENTRY</td>
<td>-7.30</td>
<td>-6.33</td>
<td>(p=0.00)</td>
<td>-7.02</td>
<td>-6.57</td>
<td>(p=0.00)</td>
</tr>
<tr>
<td>CONC</td>
<td>0.63</td>
<td>0.65</td>
<td>(p=0.00)</td>
<td>0.70</td>
<td>0.61</td>
<td>(p=0.00)</td>
</tr>
<tr>
<td>SALE</td>
<td>4.29</td>
<td>5.42</td>
<td>(p=0.00)</td>
<td>4.94</td>
<td>4.93</td>
<td>(p=0.00)</td>
</tr>
<tr>
<td>VOLAT</td>
<td>0.17</td>
<td>0.14</td>
<td>(p=0.00)</td>
<td>0.15</td>
<td>0.15</td>
<td>(p=0.00)</td>
</tr>
<tr>
<td>MTB</td>
<td>1.06</td>
<td>0.89</td>
<td>(p=0.00)</td>
<td>0.92</td>
<td>0.98</td>
<td>(p=0.00)</td>
</tr>
<tr>
<td>RD</td>
<td>0.17</td>
<td>0.01</td>
<td>(p=0.00)</td>
<td>0.04</td>
<td>0.10</td>
<td>(p=0.00)</td>
</tr>
<tr>
<td></td>
<td>RDDISC</td>
<td>OBKLGDISC</td>
<td>EMPDISC</td>
<td>SALE</td>
<td>VOLAT</td>
<td>MTB</td>
</tr>
<tr>
<td>-------</td>
<td>--------</td>
<td>-----------</td>
<td>---------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>RDDISC</td>
<td>1.00</td>
<td>0.32</td>
<td>0.28</td>
<td>-0.23</td>
<td>0.13</td>
<td>0.20</td>
</tr>
<tr>
<td></td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
</tr>
<tr>
<td>OBKLGDISC</td>
<td>1.00</td>
<td>0.14</td>
<td>0.00</td>
<td>0.02</td>
<td>-0.08</td>
<td>-0.09</td>
</tr>
<tr>
<td></td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
<td>(p=0.37)</td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
</tr>
<tr>
<td>EMPDISC</td>
<td>1.00</td>
<td>-0.14</td>
<td>0.08</td>
<td>0.08</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
</tr>
<tr>
<td>SALE</td>
<td>1.00</td>
<td>-0.35</td>
<td>-0.28</td>
<td>-0.36</td>
<td>-0.36</td>
<td>-0.36</td>
</tr>
<tr>
<td></td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
</tr>
<tr>
<td>VOLAT</td>
<td>1.00</td>
<td>0.20</td>
<td>0.17</td>
<td>0.17</td>
<td>0.17</td>
<td>0.17</td>
</tr>
<tr>
<td></td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
</tr>
<tr>
<td>MTB</td>
<td>1.00</td>
<td>0.32</td>
<td>0.32</td>
<td>0.32</td>
<td>0.32</td>
<td>0.32</td>
</tr>
<tr>
<td></td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
<td>(p=0.00)</td>
</tr>
<tr>
<td>RD</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(p=0.00)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 3 – Tests of the relation between competition and disclosure
This table provides results for logistic regressions on several disclosure proxies where observations are clustered by industry and robust standard errors computed. Columns I, II, and III provide results for regressions on the likelihood of firms disclosing research and development expenditure, order backlog, and the number of employees, respectively. The sample comprises data for the period from 1984 to 2003. Data to construct the disclosure and competition proxies are obtained from the Industrial Segments database in Compustat; other firm data are obtained from the Annual Industrial database in Compustat and from CRSP. All dollar items (before transformation) are CPI-adjusted to year-2005 dollar amounts. Year indicators are included in the regressions but not reported for brevity. I run the following regression (for definitions of variables, see the Appendix):

\[ \text{DISCLOSURE PROXY} = \beta_0 + \beta_1 \text{SUB} + \beta_2 \text{MKTSIZE} + \beta_3 \text{ENTRY} + \beta_4 \text{CONC} + \beta_5 \text{SALE} + \beta_6 \text{VOLAT} + \beta_7 \text{MTB} + \beta_8 \text{RD} + \beta_9 \text{LAGDISC} + \text{YEAR INDICATOR} + \epsilon \]

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RDDISC</td>
<td>OBKLGDISC</td>
<td>EMPDISC</td>
</tr>
<tr>
<td>Intercept</td>
<td>-4.676 (p=0.00)</td>
<td>-4.110 (p=0.00)</td>
<td>-1.579 (p=0.00)</td>
</tr>
<tr>
<td>SUB</td>
<td>0.563 (p=0.00)</td>
<td>0.460 (p=0.00)</td>
<td>0.312 (p=0.00)</td>
</tr>
<tr>
<td>MKTSIZE</td>
<td>0.344 (p=0.00)</td>
<td>0.111 (p=0.10)</td>
<td>0.135 (p=0.00)</td>
</tr>
<tr>
<td>ENTRY</td>
<td>0.269 (p=0.00)</td>
<td>0.084 (p=0.15)</td>
<td>0.061 (p=0.00)</td>
</tr>
<tr>
<td>CONC</td>
<td>1.207 (p=0.00)</td>
<td>1.400 (p=0.00)</td>
<td>0.113 (p=0.57)</td>
</tr>
<tr>
<td>SALE</td>
<td>-0.077 (p=0.00)</td>
<td>-0.040 (p=0.10)</td>
<td>-0.205 (p=0.00)</td>
</tr>
<tr>
<td>VOLAT</td>
<td>-0.527 (p=0.26)</td>
<td>0.488 (p=0.30)</td>
<td>0.224 (p=0.49)</td>
</tr>
<tr>
<td>MTB</td>
<td>0.267 (p=0.03)</td>
<td>-0.100 (p=0.31)</td>
<td>0.574 (p=0.00)</td>
</tr>
<tr>
<td>RD</td>
<td>4.273 (p=0.00)</td>
<td>-0.698 (p=0.05)</td>
<td>0.625 (p=0.00)</td>
</tr>
<tr>
<td>LAGDISC</td>
<td>6.778 (p=0.00)</td>
<td>6.590 (p=0.00)</td>
<td>4.630 (p=0.00)</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Observations</td>
<td>37,895</td>
</tr>
<tr>
<td>Used (firm-years)</td>
<td>37,895</td>
</tr>
</tbody>
</table>

Pseudo R^2 81.5 %    77.4 %    56.0 %
Table 4 – Spline regressions on the relation between competition and disclosure

This table provides the coefficients for the competition variables for logistic piecewise linear continuous regressions on the relation between competition and disclosure sorted by terciles of the respective competition variables with break points at the 33rd and 67th percentiles where observations are clustered by industry and robust standard errors computed. Data to construct the disclosure and competition proxies are obtained from the Industrial Segments database in Compustat; other firm data are obtained from the Annual Industrial database in Compustat and from CRSP. All dollar items (before transformation) are CPI-adjusted to year-2005 dollar amounts. I run the following regressions (for definitions of variables, see the Appendix):

\[
\text{DISCLOSURE PROXY} = \beta_0 + \beta_1 \text{SUB} + \beta_2 \text{MKTSIZE} + \beta_3 \text{ENTRY} + \beta_4 \text{CONC} + \beta_5 \text{SALE} + \beta_6 \text{VOLAT} + \beta_7 \text{MTB} + \beta_8 \text{RD} + \beta_9 \text{LAGDISC} + \text{YEAR INDICATOR} + \varepsilon
\]

<table>
<thead>
<tr>
<th></th>
<th>I SUB</th>
<th>II MKTSIZE</th>
<th>III ENTRY</th>
</tr>
</thead>
<tbody>
<tr>
<td>RDDISC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;= 33rd percentile</td>
<td>0.445 (p=0.01)</td>
<td>0.437 (p=0.00)</td>
<td>0.683 (p=0.00)</td>
</tr>
<tr>
<td>33rd percentile &lt; = 67th percentile</td>
<td>1.445 (p=0.56)</td>
<td>0.335 (p=0.05)</td>
<td>0.053 (p=0.75)</td>
</tr>
<tr>
<td>&gt; 67th percentile</td>
<td>-4.923 (p=0.01)</td>
<td>0.146 (p=0.33)</td>
<td>0.164 (p=0.00)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>I SUB</th>
<th>II MKTSIZE</th>
<th>III ENTRY</th>
</tr>
</thead>
<tbody>
<tr>
<td>OBKLGDISC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;= 33rd percentile</td>
<td>0.008 (p=0.96)</td>
<td>0.108 (p=0.36)</td>
<td>0.765 (p=0.00)</td>
</tr>
<tr>
<td>33rd percentile &lt; = 67th percentile</td>
<td>6.014 (p=0.00)</td>
<td>0.345 (p=0.04)</td>
<td>0.060 (p=0.63)</td>
</tr>
<tr>
<td>&gt; 67th percentile</td>
<td>-5.569 (p=0.00)</td>
<td>-0.085 (p=0.63)</td>
<td>-0.192 (p=0.00)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>I SUB</th>
<th>II MKTSIZE</th>
<th>III ENTRY</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMPDISC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;= 33rd percentile</td>
<td>0.164 (p=0.06)</td>
<td>0.107 (p=0.10)</td>
<td>0.104 (p=0.28)</td>
</tr>
<tr>
<td>33rd percentile &lt; = 67th percentile</td>
<td>0.057 (p=0.97)</td>
<td>0.108 (p=0.31)</td>
<td>0.198 (p=0.02)</td>
</tr>
<tr>
<td>&gt; 67th percentile</td>
<td>-1.116 (p=0.27)</td>
<td>0.044 (p=0.64)</td>
<td>0.077 (p=0.00)</td>
</tr>
</tbody>
</table>
This table provides the coefficients for firm market share (MKTSHARE) and firm size (SALE) for logistic piecewise linear continuous regressions sorted by terciles of MKTSIZE with break points at the 33rd and 67th percentiles of MKTSIZE where observations are clustered by industry and robust standard errors computed. The sample comprises data for the period from 1984 to 2003. Data to construct the disclosure and competition proxies are obtained from the Industrial Segments database in Compustat; other firm data are obtained from the Annual Industrial database in Compustat and from CRSP. All dollar items (before transformation) are CPI-adjusted to year-2005 dollar amounts. Year indicators are included in the regressions but not reported for brevity. I run the following regressions (for definitions of variables, see the Appendix):

\[
\text{DISCLOSURE PROXY} = \beta_0 + \beta_1 \text{SUB} + \beta_2 \text{MKTSIZE} + \beta_3 \text{ENTRY} + \beta_4 \text{CONC} + \beta_5 \text{MKTSHARE} + \beta_6 \text{SALE} + \beta_7 \text{VOLAT} + \beta_8 \text{MTB} + \beta_9 \text{RD} + \beta_{10} \text{LAGDISC} + \text{YEAR INDICATOR} + \epsilon
\]

<table>
<thead>
<tr>
<th></th>
<th>MKTSHARE</th>
<th>SALE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RDDISC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;= 33rd percentile</td>
<td>1.062 (p=0.04)</td>
<td>-0.148 (p=0.00)</td>
</tr>
<tr>
<td>33rd percentile &lt; &gt;= 67th percentile</td>
<td>-0.010 (p=0.99)</td>
<td>-0.074 (p=0.22)</td>
</tr>
<tr>
<td>&gt; 67th percentile</td>
<td>-0.281 (p=0.69)</td>
<td>-0.066 (p=0.08)</td>
</tr>
<tr>
<td>OBKLGDISC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;= 33rd percentile</td>
<td>-0.825 (p=0.09)</td>
<td>0.048 (p=0.36)</td>
</tr>
<tr>
<td>33rd percentile &lt; &gt;= 67th percentile</td>
<td>-0.041 (p=0.94)</td>
<td>-0.032 (p=0.48)</td>
</tr>
<tr>
<td>&gt; 67th percentile</td>
<td>-1.198 (p=0.09)</td>
<td>-0.020 (p=0.55)</td>
</tr>
<tr>
<td>EMPDISC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;= 33rd percentile</td>
<td>0.817 (p=0.03)</td>
<td>-0.227 (p=0.00)</td>
</tr>
<tr>
<td>33rd percentile &lt; &gt;= 67th percentile</td>
<td>-0.199 (p=0.63)</td>
<td>-0.253 (p=0.00)</td>
</tr>
<tr>
<td>&gt; 67th percentile</td>
<td>-0.125 (p=0.80)</td>
<td>-0.172 (p=0.00)</td>
</tr>
</tbody>
</table>
Table 6 – Competition and disclosure: Evidence from quasi-natural experiments

Panel A: Evidence from the 1996 deregulation event in the Telecommunications industrial sector

This table provides results for logistic regressions on several disclosure proxies where observations are clustered by industry and robust standard errors computed. The difference-in-differences analysis compares firms in the Telecommunications industrial sector with those from other industrial sectors before and after the 1996 deregulation event in the Telecommunications industrial sector. TELECOM = 1 for firms in the Telecommunications industrial sector; = 0 for firms in other industrial sectors. DEREQ equals one for the three-year period before (i.e., from 1993 to 1995) and equals zero for the three-year period after (i.e., from 1997 to 1999) the 1996 deregulation event in the Telecommunications industrial sector.

I run the following regression (coefficient estimates for other control variables are not reported for brevity):

\[
\text{DISCLOSURE PROXY} = \text{INTERCEPT} + \text{TELECOM} + \text{DEREG} + \text{TELECOM*DEREG} + \text{SALE} + \text{VOLAT} + \text{MTB} + \text{RD} + \text{LAGDISC} + \varepsilon
\]

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>RDDISC</td>
<td>-3.429 (p=0.00)</td>
<td>-3.625 (p=0.00)</td>
<td>-1.929 (p=0.00)</td>
</tr>
<tr>
<td>OBKLGDISC</td>
<td>-0.894 (p=0.03)</td>
<td>-2.146 (p=0.00)</td>
<td>-0.297 (p=0.32)</td>
</tr>
<tr>
<td>EMPDISC</td>
<td>-0.980 (p=0.00)</td>
<td>-0.859 (p=0.00)</td>
<td>-0.877 (p=0.00)</td>
</tr>
<tr>
<td>0.130 (p=0.55)</td>
<td>1.597 (p=0.02)</td>
<td>0.127 (p=0.24)</td>
<td></td>
</tr>
</tbody>
</table>

Number of Observations Used

| RDDISC | 14,752 |
| OBKLGDISC | 14,752 |
| EMPDISC | 14,752 |

Pseudo R^2

| RDDISC | 0.88 |
| OBKLGDISC | 0.87 |
| EMPDISC | 0.59 |

Panel B: Evidence from the NAFTA setting

This table provides the coefficients for the negative of lagged tariffs (NEGLAGTARIFF) for logistic piecewise linear continuous regressions on the relation between competition and disclosure sorted by terciles of SUB with break points at the 33rd and 67th percentiles. Data to construct NEGLAGTARIFF are obtained for the manufacturing industrial sector from Schott (2010) and based on NAFTA. Observations are clustered by industry and robust standard errors computed. Larger values of NEGLAGTARIFF reflect more intense competition. Data to construct the disclosure and competition proxies are obtained from the Industrial Segments database in Compustat; other firm data are obtained from the Annual Industrial database in Compustat and from CRSP. All dollar items (before transformation) are CPI-adjusted to year-2005 dollar amounts.

I run the following regressions (coefficient estimates for other control variables are not reported for brevity):

\[
\text{DISCLOSURE PROXY} = \beta_0 + \beta_1\text{NEGLAGTARIFF} + \beta_2\text{SALE} + \beta_3\text{VOLAT} + \beta_4\text{MTB} + \beta_5\text{RD} + \beta_6\text{LAGDISC} + \text{YEAR INDICATOR} + \varepsilon
\]

<table>
<thead>
<tr>
<th></th>
<th>&lt;= 33rd percentile of SUB</th>
<th>33rd percentile &lt; &gt;= 67th percentile of SUB</th>
<th>&gt; 67th percentile of SUB</th>
</tr>
</thead>
<tbody>
<tr>
<td>RDDISC</td>
<td>141.096 (p=0.10)</td>
<td>340.560 (p=0.00)</td>
<td>54.500 (p=0.36)</td>
</tr>
<tr>
<td>OBKLGDISC</td>
<td>-18.775 (p=0.84)</td>
<td>140.790 (p=0.04)</td>
<td>-99.902 (p=0.19)</td>
</tr>
<tr>
<td>EMPDISC</td>
<td>4.548 (p=0.94)</td>
<td>213.176 (p=0.00)</td>
<td>-42.023 (p=0.45)</td>
</tr>
</tbody>
</table>