Corporate transparency and firm value: Does market competition play an external governance role? ☆

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ABSTRACT

We investigate whether market competition affects the relationship between corporate transparency and firm value in the United States using a sample of 12,665 firm-year observations, representing 1,644 individual firms for the period 1996–2018. The results show that stronger transparency enhances firm value, and market competition has a significantly positive effect on that relationship. More importantly, we use hierarchical linear models further to explore the cross-level interaction impact of market competition, and we find evidence suggesting that the industry-level competition has a significant cross-level moderating effect. Additionally, consistent with the substitute perspective, we also find that the disciplinary power of competition on the relationship between transparency and value is more pronounced for firms with weak corporate governance. Overall, our evidence supports the "bright side" of the competition view and highlights the active external governance role that competition plays in the value promotion effect of corporate transparency at both the individual and the industry levels.

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Introduction

The Basle Committee on Banking Supervision (1998) defines transparency as the public disclosure of reliable and timely information that enables users to accurately grasp a bank's financial position and performance, operating activities, risk distribution, and risk management practices. High transparency allows stakeholders to perceive the underlying quality, and accurately understand the financial status and risk of companies, and thus make rational decisions. Although listed companies are required to provide extensive disclosure, they still have some discretion on information dissemination, leading to pervasive differences in corporate opacity (Anderson et al., 2009). The opacity of information disclosure often implies the existence of some problems, for example, low earnings quality. Meanwhile, most previous studies have highlighted the potential benefits of corporate transparency, showing that it has a significant impact on reducing the cost of equity (Bhattacharya et al., 2003) and idiosyncratic return volatility (Rajgopal and Venkatachalam, 2011). In addition, it decreases the mispricing of accruals (Elliott et al., 2010), which stimulates firm value by reducing information asymmetry and broad-

ening the communication channels between firms and stakeholders. According to agency theory, transparency also directly affects the governance mechanism, for example, by deterring opportunistic behaviors of managers and thereby enhancing firm value (Chung et al., 2015).

However, the effect of information varies greatly depending on the intensity of market competition. The competition the company faces is between perfect competition and monopoly. The perfectly competitive market is an ideal condition in economics—information flows smoothly, and corporate information is free and public. However, when competition tends toward oligopoly or monopoly, a few firms occupy the whole market share and control it to a greater extent. At this point, information circulates incompletely, making it more valuable. Thus, the influence of information differs with stronger or weaker market competition. Prior studies typically concentrate on the relationship between transparency and firm value from an internal environment perspective, especially internal governance. Accordingly, research needs to focus on whether and how market competition influences the value promotion effect of corporate transparency. So, central to our analysis is a consideration of the macro environment, namely, market competition.

Market competition provides a way to reduce information asymmetry and market friction by threatening managers with bankruptcy liquidation and placing reputation constraints on them. Managers may take internal advantages to manipulate information to mislead investors or conceal the firm's poor performance. However, market competition imposes discipline on managers by increasing the probability of failure and making a firm a more attractive takeover target (Giroud and Mueller, 2011). The threat causes massive pressure on companies, and managers will consequently work much harder to promote the firm performance (Chhaochharia et al., 2017; Majeed et al., 2018) because it restrains their value deviation behaviors of self-utility maximization. However, of note, prior studies offer competing views on the impact of competition on agency problems and transparency selections. In contrast to the studies mentioned above, another stream of research describes a "dark side" of competition and argues that firms prefer creating an opaque information environment to shield proprietary information to maintain competitive advantages (Cheng et al., 2013; Ali et al., 2014). Furthermore, even competition may cause unethical behaviors such as earnings manipulation (Shleifer, 2004; Markarian and Santalo, 2014). Hence, the competing arguments lead to the primary objective of this study, determining whether market competition plays an external governance role in the relationship between transparency and firm value.

Research into the promotion of firm value by various internal and external mechanisms is building. Information and competitive environments are thought to affect firm value, and frequent reference has been made to the substitutive or complementary effects between corporate governance and competition. However, there has been little exploration of the substitutive or complementary relationship between them with regard to value promotion. It is noteworthy that transparency and competition may have a substitutive or complementary impact on firm value. On the one hand, high information transparency can be better coordinated with the positive effects of market competition. In other words, market competition may act as a complementary governance mechanism for transparency. On the other hand, corporate transparency and competition may conflict, with higher competition leading to a more opaque information environment (Cheng et al., 2013; Ali et al., 2014) and slowing information flow (Stoughton et al., 2017). Thus, increasingly fiercer competition possibly crowds out transparency. This study aims to shed further light on this debate.

To test how market competition affects the relation between transparency and firm value, we collect data on a panel of U. S. listed companies for the period 1996–2018. Drawing on Anderson et al. (2009), we use the opacity index as a proxy for transparency and Tobin's Q to measure firm value. In addition, the Herfindahl-Hirschman Index is used as a proxy of market competition for empirical analysis. The main findings are summarized below. First, consistent with prior studies, our empirical results indicate that corporate transparency is positively associated with firm value. This positive correlation corroborates the prediction that greater transparency of the information environment is conducive to firm value maximization. Second, market competition positively moderates the association between transparency and firm value, implying that the managers of firms facing higher market competition disclose information more voluntarily to improve transparency and thus enhance firm value. This relationship continues to hold after considering endogenous issues and after employing alternative measures of transparency and competition. In particular, we employ hierarchical linear models and find that market competition also has a cross-level impact. In brief, our study provides robust evidence that competition plays an external governance role in the value promotion effect of transparency at both the individual and the industry levels, which strongly supports the "bright side" of market competition. Finally, as an extension of our research, we explore the substitutive and complementary effects between transparency, governance, and market competition on firm value. We find that market competition contributes to the value enhancement effect of a transparent information environment. Moreover, we separately run benchmark regressions in strong corporate governance and weak corporate governance subsamples. We determine that the moderating effect of market competition is only significant in firms with weak corporate governance. These results confirm that market competition acts as an alternate mechanism for internal governance, while complementing corporate transparency to improve firm value.

Our study makes several contributions to the extant literature. First, it provides evidence on the positive impact of transparency by emphasizing the interactive effect of the micro information environment and the macro market environment. Existing papers also document an interactive effect between transparency and macro factors such as property rights protection (Durnev et al., 2009) and investor protection (Hansen et al., 2015). However, the impact of transparency on firm value varies according to the level of competitive intensity. Our findings show that increased transparency results in value increases that are more significant when firms operate in a more competitive market. Apart from confirming that companies

benefit from corporate transparency directly, the current study effectively introduces market competition as an external governance mechanism into a logical framework.

Second, this study belongs to the stream of literature investigating the role of market competition in corporate research. Two competing viewpoints on market competition exist: the bright side and the dark side. The bright side supports the existence of positive outcomes such as providing managerial incentives and overcoming slack (Ammann et al., 2013; Chang et al., 2015; Majeed et al., 2018), while the dark side offers evidence on negative effects such as earnings manipulation (Shleifer, 2004; Markarian and Santalo, 2014). Our results confirm that market competition positively affects the association between corporate transparency and firm value, which provides strong evidence for the bright side. In particular, we consider the relationship between market competition and firms as a cross-level nested construction. We effectively address econometric issues related to endogeneity and a cross-level interaction effect by using the hierarchical linear models procedure. These analyses broaden the understanding of the positive role of market competition at both the individual and the industry levels.

Finally, this study complements previous research examining the relationship between transparency, market competition, and governance. First of all, corporate governance structure and information environment have an endogenous relation (Armstrong et al., 2012); that is, corporate transparency reflects both corporate governance and corporate information. The debate on a substitute or a complementary relationship between market competition and governance has been extensively considered in prior studies. One strand of literature focuses on the external governance mechanism, that is, the market for corporate control. For instance, Giroud and Mueller (2010, 2011) show that strong governance, as represented by antitakeover provisions, and firm value show a positive relation only in noncompetitive industries. Another stream of studies focuses on internal corporate governance. For example, Ammann et al. (2013) demonstrate that competitive pressure acts as a substitute for corporate governance. In sum, the impact of market competition is more pronounced for firms with weak external and internal governance mechanisms. After removing the internal governance component from the opacity index, we argue that transparency and market competition work complementarily. In comparison with prior findings, the evidence from subsample tests also suggests that, compared with firms with strong governance, firms with weak governance qualities react in a more pronounced manner to the effect of market competition in terms of the relationship between transparency and value. Overall, our findings further support that market competition acts as a substitute for corporate governance and as a complement of transparency and thus serves as a disciplinary mechanism.

The remainder of the paper is organized as follows. Section 2 provides a survey of the related literature. Section 3 deduces theories and leads to our research hypotheses. Section 4 describes the sample selection process and research methodology. Section 5 reports empirical results. Section 6 provides the conclusions.

Literature review

Corporate transparency is "the widespread availability of sufficient, relevant, and reliable information about the periodic performance, financial position, investment opportunities, governance, value, and risk" of firms (Bushman and Smith, 2003, pp. 66). A high degree of transparency means that information provided by a firm enables users to understand the activities and risk accurately. Although transparency has multi-faceted properties in financial research, prior studies have not clearly defined various types of transparency and made distinctions between them. We classify transparency into broad and narrow senses. The broad sense captures corporate transparency, as used in our study, while narrow transparency includes accounting transparency (Elliott et al., 2010), financial transparency (Hansen et al., 2015), and governance transparency (Hidalgo-Cabrillana, 2013; Yu et al., 2018), based on definitions proposed by various scholars. Anderson et al. (2009) argue that corporate transparency can be divided into financial transparency and governance transparency. Hence, the corporate transparency in the broad sense used in the current study includes the concepts in a narrow sense.

Previous studies have verified the positive economic consequences of transparency, especially in a narrow sense. They have also shown that transparency is associated with better information disclosure and information quality, suggesting that it has a significant impact on improving corporate performance. The transparent accounting information reduces the cost of equity (Bhattacharya et al., 2003), which activates the capital market and consequently affects the success of companies. It also enables stakeholders to make more accurate investment decisions (Bushman and Smith, 2003), contributing to higher corporate valuations. In addition, Chung et al. (2015) show that increased transparency is often achieved by disclosure because they are closely linked. Better disclosure can also reduce information asymmetry (Leuz and Verrecchia, 2000; Huang and Zhang, 2012) and mispricing of accruals (Elliott et al., 2010). Similarly, the capital market rewards firms with more voluntary nonfinancial disclosure; for example, more carbon disclosure is related to better firm value (Jiang et al., 2021). Patel and Dallas (2002) prove that companies with more voluntary disclosure in annual reports have higher price-to-book ratios. In contrast, firms with poor disclosure or a lack of transparency experience increased costs associated with collecting firm-specific information (Chan and Hameed, 2006), as well as severe empire-building problems (Hope and Thomas, 2008).

In a broader sense, corporate transparency is critical not only in reducing information asymmetries and agency problems (e.g., Huang and Zhang, 2012) but also in enhancing external supervision. Corporate transparency is beneficial to reduce uncertainty surrounding the firm (Durnev et al., 2009), which consequently decreases litigation costs, lowers the cost of capital, and alleviates the effects of investor sentiment on stock prices (Firth et al., 2015). Moreover, Baek et al. (2004) find that firms with greater disclosure quality have better stock price performance during a crisis. Anderson et al. (2009) show that

worse corporate transparency intensifies agency conflict between dominant shareholders and minority investors, resulting in poor firm performance. In contrast, extensive disclosure can prevent insiders from encroaching on corporate resources in a self-serving manner, which increases shareholder value (Bushman and Smith, 2003; Huang and Zhang, 2012). Using cross-country data, Francis et al. (2009) confirm that corporate transparency promotes resource allocation across industry sectors. In brief, corporate transparency prevents good firms from being undervalued and serves a vital role in improving firm value.

Market competition is considered to be "probably the most powerful force towards economic efficiency in the world" (Shleifer and Vishny, 1997, pp.738). Specifically, firms seize market resources for their long-term development and profit maximization as a means of carving up the market and achieving survival of the fittest. To avoid being eliminated, firms with more intense competition have to constantly improve their management standard and production efficiency to reduce costs and maximize firm value. However, there are two opposing theoretical viewpoints on the implications of market competition.

First, market competition has been examined as an external disciplinary device in some papers, which could be summarized as the bright side of the competition viewpoint. The basic logic is that competitive threats decrease information asymmetry and put pressure on managers. On the one hand, competition has a direct influence, such as improving market efficiency for corporate control in an emerging economy (Lee et al., 2019) and leading firms to rely less on bank debt financing (Boubaker et al., 2018). The fiercer market competition impels firms to promote governance transparency and financial report quality by driving them to compete for funding (Hidalgo-Cabrillana, 2013). On the other hand, competition is perceived as a disciplining power that alleviates the principal-agent agency conflicts, provides managerial incentives, and overcomes slack (Hart, 1983; Giroud and Mueller, 2011; Ammann et al., 2013; Chhaochharia et al., 2017; Majeed et al., 2018). Since firms compete with rivals, fierce competition increases the likelihood of failure, especially for firms with high costs (Schmidt, 1997; Boubaker et al., 2018). It also motivates managers to exert effort and make value-increasing decisions rather than pursue their private goals because they face the threats of bankruptcy risk, firm liquidation, and dismissal and takeover risks (Schmidt, 1997; Giroud and Mueller, 2011).

Second, some theoretical studies argue that market competition exacerbates managerial slack and opportunism. This stream of research advocates the dark side view and documents that market competition causes unethical behaviors such as earnings manipulation (Shleifer, 2004; Markarian and Santalo, 2014). Higher competition leads to an opaque information environment because managers tend to shield proprietary information (Cheng et al., 2013; Ali et al., 2014) to avoid weakening competitive advantages. For example, Stoughton et al. (2017) show that market competition slows information flow, reduces information content, and causes inefficient investment. Furthermore, Bagnoli and Watts (2010) suggest that competitive pressure compels managers to engage in earnings management and to misreport the true performance owing to the reduction in the return on effort. These competing arguments motivated our study on the impact of market competition on the valuation effect of the information environment.

As shown above, previous research has widely discussed the consequences of corporate transparency and market competition. Prior studies on market competition mainly concentrate on firm behaviors; however, the influence of competition on information and managerial incentives is ambiguous and competing. Additionally, most of the studies report indirect inferences based on the consequences mentioned above, and relatively little attention has been paid to the interactive impact of corporate transparency and market competition. Nevertheless, the value promotion effect of information transparency varies according to different competitive intensities, and it is worth exploring whether market competition substitutes or complements corporate transparency in terms of enhancing firm value. Therefore, we investigate whether competition plays an external governance role in the relationship between corporate transparency and firm value. Our objective is to extend these arguments to encompass the possibility that market competition as an external mechanism influences internal mechanisms within firms.

Theories and hypotheses development

Corporate transparency and firm value

The efficient markets hypothesis (Fama, 1970) indicates that in a stock market with sound laws, high transparency, and effective competition, all valuable information is immediately and unbiasedly reflected in prices, including present and future firm value. Based on the definition of Bushman and Smith (2003), corporate transparency implies the presence of sufficient information disclosure about the corporate situation, such as periodic performance, governance, and risk. Only when corporate transparency is improved can the spread of relevant and reliable information about firms be more accurate and timely, allowing the stock market to reach an efficient market. With the improvement of corporate transparency operating in an efficient market, companies can in turn draw more attention from the capital market and ultimately improve firm value. Hence, corporate transparency plays a vital role in promoting firm value by reducing information asymmetry in three ways: broadening the communication channels between firms and investors, enhancing the trust between managers and shareholders, and reducing inequality among investors.

First, according to asymmetric information theory and signaling theory, transparency enhances firm value directly by reducing information asymmetries between firms and outsiders. From the perspective of information transmission, the two sides of the transaction in the market have different degrees of possession and mastery of information, and they are

at an advantage and a disadvantage, respectively. Aiming to avoid being misjudged, firms with good performance are strongly motivated to distinguish themselves from those with bad performance by using information disclosure to show high-quality attributes. Firms with poor performance are forced to send signals to the market and thus improve transparency under market pressure. Hence, the risk of adverse selection is reduced accordingly. The rewards of such reduction are lowered transaction costs, barriers of corporate debt financing, and cost of capital (Leuz and Verrecchia, 2000; Patel and Dallas, 2002) and greater analysts' attention lessening market expectation deviation, which contributes towards promoting firm value. Greater transparency forms a dynamic supervision mechanism through which the market can effectively convey information about a firm's profit and risk status to investors and further avoid the moral hazard problem.

The second path of influence affects the corporate governance mechanism, mitigating the information asymmetry between stakeholders and managers. Improving transparency is conducive to the formation of the reputation incentive mechanism and pressure from the external manager market. The principal-agent theory posits a serious agency problem between managers and owners. The conflict of interest of the "rational economic man" allows managers to utilize their power to conceal information from owners to obtain more self-interest. Further, the shareholders are unable to supervise the managers effectively. Transparency mitigates managerial expropriation by increasing the cost of managerial misconduct by making it more easily detectable by shareholders (Duru et al., 2013). As the transparency increases, efficient management of assets (Bushman and Smith, 2003) is disciplined and investment efficiency improves in countries with secure property rights (Durnev et al., 2009). Additionally, large shareholders have certain information advantages, which may erode the interests of small and medium-sized shareholders; this situation presents a second kind of agency problem. Greater transparency will help reduce the loss of benefits and achieve the purpose of overall firm value improvement.

Finally, transparency enhances firm value by reducing information asymmetries among investors. Due to differences in the information environment and information transmission ability, investors are generally in unequal information positions. For instance, insiders possess richer and more accurate information than outside investors. This situation constrains outside investors from building accurate valuation parameters for stock price formation (Firth et al., 2015), possibly causing suboptimal resource allocation. Corporate transparency can mitigate such information inequality, thus assisting both insiders and outside investors in developing a better valuation system and thus creating a virtuous circle of firm value promotion. We propose hypothesis 1:

Hypothesis 1: Corporate transparency is positively associated with firm value.

Corporate transparency, market competition and firm value

Market competition exerts pressure on firms through survival of the fittest. According to principal-agent theory, the separation between ownership and control provides an opportunity for managers to pursue their own goals (e.g., growth maximization, effort minimization), which can violate the best interests of owners (e.g., profit or market value maximization) (Hart, 1983). When managers participate in firm operations, they are able to take advantage of internal information and power to damage firm value by manipulating disclosure and misleading investors. However, market competition serves as a common pressure to reduce that managerial slack because there will be no supernormal profits for managers who must maximize firm value in a competitive market (Hart, 1983; Chang et al., 2015). In other words, market competition is an effective mechanism for resource allocation. First, managers barely have resources to divert to themselves owing to the thin profit margins when intense competition exists in the product market. Second, the fiercer competition increases the possibility of company bankruptcy and liquidation, especially for firms with high costs, which motivates managers to be efficient (Schmidt, 1997; Sheikh, 2018). The threat of being insolvent forces managers to expend greater effort and make value-increasing decisions (Chhaochharia et al., 2017). Therefore, agency cost unambiguously declines with an increase in competition (Schmidt, 1997).

Furthermore, given the stronger implicit incentive due to competition (Hart, 1983), stakeholders outside firms can observe the profits of most firms, and firm owners can be fully informed about the performance of managers and peers. The outcome is better information efficiency, which is also the key effect of the influence of market competition on transparency in enhancing firm value. Market competition provides more information on the performance of firms and managers of peers in the same industry (Giroud and Mueller, 2011), which causes more pressure on managers as they aim to avoid dismissal. This information enables shareholders to better evaluate firms' performance and managers' actions relative to the industry level. Reputation is a comprehensive reflection of ability and an essential component of personal value transmitted to the external manager market. To protect their own market value, managers will reduce their alienation behaviors to stay in business. Karuna (2007) argues that competition across industries enhances the profit sensitivity of relative differences in managerial effort across firms. Starting from the long-term development goals of their company, managers allocate funds to creative activities (e.g., innovation) that can enhance competitive advantages to maximize firm value rather than on activities that yield temporary stock-price movements.

In addition, the information driven by corporate transparency is mainly historical, time delayed, and published less frequently; however, the information brought by competition is more comprehensive, timely, and forward looking. The market competition restrains the management's "ingestion" tendency and urges more voluntary disclosure by managers to improve transparency. Therefore, operating in a highly competitive market ensures better information efficiency. The market's response to signals will also positively affect companies, for example, by gaining more investor attention and trust and thus

generating a virtuous circle. Given the arguments outlined above and from the perspective of enhancing firm value through transparency, market competition can be viewed as an external disciplinary governance mechanism for minimizing principal-agent agency costs and accelerating information flow. When transparency increases firm value, product market competition reinforces this tendency. We propose hypothesis 2:

Hypothesis 2: Market competition positively moderates the relationship between corporate transparency and firm value.

Research design

Data and sample selection

The sample consists of panel data of U.S. listed companies from various sources covering 1996–2018.[1] Our primary data sources are the North America database of Compustat (for data on financial statement variables), the Institutional Brokers' Estimate System (I/B/E/S) (for data on analyst forecast), and the Center for Research in Security Prices (CRSP) database (for data on stock price information). These sources are supplemented by data from RiskMetrics (for data on board size) and Thomson Reuters (for data on institutional ownership). Observations from the financial industry (SIC 6000–6999) and the utility industry (SIC 4900–4999) are excluded to maintain comparability across firms. We further restrict our sample to observations without missing data in any of these datasets. In addition, the firm-year observations with extreme values, including a negative value, a value greater than one for leverage and cash, or a value greater than 10 for Tobin's Q, are excluded from the sample. It is a conservative cutoff level (see Deb et al., 2017). Finally, all continuous variables are winsorized at the 1st and the 99th percentiles to eliminate the extreme effect. After we merge and screen various datasets, the final sample consists of a panel of 1,644 firms and 12,665 firm-year observations spanning the period 1996–2018.

Measurement

Corporate transparency

We develop an index of corporate opacity (hereafter, *Opacity*) as a proxy for corporate transparency, following Anderson et al. (2009).[2] Corporate transparency is generally understood as the accessibility of corporate information (Bushman et al., 2004). The measurement mainly captures the market reaction to corporate information transparency by measuring the degree of decision-making relevance of stakeholders and the extent of information dissemination and interpretation by financial analysts. The opacity index is composed of four individual proxies: trading volume, bid-ask spread, analyst following, and analyst forecast errors. The trading volume (*TV: TradingVolume*) is the daily dollar trading volume for the current fiscal year. Bid-ask spread (*BAS: BidAskSpread*) is computed as the bid price minus the ask price divided by the average of the bid and ask prices, averaged across all trading days in the current year. These two proxies measure the information asymmetry among investors (Leuz and Verrecchia, 2000), and the data are obtained from CRSP. Analyst following (*AF: AnalystFollow*) is the number of analysts following each firm during the current year. Analyst forecast error (*FE: ForecastError*) is computed as the square of the difference between mean analysts' earnings forecast and actual earnings, scaled by the stock price. The data related to analyst following and forecast errors are obtained from I/B/E/S. These two proxies represent the availability of information (Chan and Hameed, 2006). Then we assign values for each of these four proxies individually, with the most opaque firms taking a value of 10 and the least opaque firms assuming a value of 1 for each of the four components after they are divided into deciles. In final, we sum these rankings for each firm and scale the result by a factor of 40 (total possible points) so that the *Opacity* ranges from 0.1 to 1.0. The lower values of *Opacity* denote more transparent firms and vice versa.

Market competition

Market competition measures the relative market power of a firm. Following previous studies, we use the Herfindahl-Hirschman Index (denoted by the variable *HHI*) to measure the extent of market competition; *HHI* is defined as the sum of squared market shares of firms in an industry (Giroud and Mueller, 2011; Chang et al., 2015). Higher (lower) values of *HHI* indicate higher (lower) levels of market concentration degree and lower (greater) competition. *HHI* is measured as follows (Eq. (1)):

$$\text{HHI} = \sum_{i=1}^{N_j} S_{ij}^{2} \tag{1}$$

where S_{ij} denotes the market share of firm i in industry j, and the market share is computed as the sales revenue of the firm i divided by the total sales revenue of the industry (4-digit SIC) to which it belongs. N_j is the total number of firms in industry

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j. Since *HHI* shows a reverse relationship with industry competition, we use $1 - HHI$ to create a proxy for market competition (i.e., *MHHI*), such that higher values equate to greater competition and vice versa.

Firm value. Following Duru et al. (2013) and Sheikh (2018), we use Tobin's Q (hereafter, *Q*) as a metric of firm value. *Q* is calculated as the market value of assets divided by the book value of assets, where the market value of assets is defined as the sum of the market value of common equity (fiscal year-end prices) plus total assets minus shareholders' equity of the parent company. We then drop observations with a value exceeding 10, following Deb et al. (2017).

Control variables. Following prior research (e.g., Duru et al., 2013; Deb et al., 2017), we control several firm characteristics that have a significant impact on firm value. First, we control for fundamental factors related to firm value, including firm size (*Size*, which equals the natural logarithm of total assets), firm age (*Age*, which equals the natural logarithm of the number of months a firm has been listed in CRSP database divided by 12), leverage (*Lev*, which equals the ratio of debt to total assets), and growth (*Growth*). *Growth* represents the compounded annual growth rate in sales calculated as the sales revenue in the current year (*t*) divided by the sales in the previous year ($t - 1$) (Deb et al., 2017). The cash holding (*Cash*) is measured using cash flow scaled by cash and short-term investments to total assets. The capital expenditures (*Capex*) is the ratio of capital expenditures to total assets. The research and development expenditures (*RD*) is measured as the ratio of R&D investment to total assets to control for the firm growth opportunities. We replace missing values of *RD* with 0, and the upper limit is capped at 1 (Deb et al., 2017). In addition, a dummy variable, *DRD*, indicating whether the firm has R&D expenditures is included in models; it takes a value of 1 if the firm has R&D expenditures, and 0 otherwise. Advertising expenditures (*AD*) are calculated as advertising expenditures scaled by total assets (Sheikh, 2018).

Giroud and Mueller (2010, 2011) suggest that corporate governance affects the firm value and is also associated with market competition. Therefore, we adopt the natural logarithm of G-index (*Gscore*) in models to tease out the impact of corporate governance, as described in Gompers et al. (2003). A greater value of *Gscore* represents worse corporate governance. In addition, we follow Duru et al. (2013) and control for governance structure using board size (*BS*), measured as the natural logarithm of the number of board members. To control for ownership structure, we adopt institutional ownership (*Ins*) (the percentage of common equity owned by institutional shareholders). Finally, we control for year and industry fixed effects by including a set of 4-digit SIC code dummies and fiscal year dummies to account for unobserved heterogeneity across periods and sectors. Variable definitions are shown in Table 1.

Regression model

To estimate the relationship between corporate transparency and firm value, we first use Eq. (2) for the determinants of firm value. To determine whether market competition plays an external governance role in firm value (i.e., whether the market competition moderates the effect on firm value resulting from transparency), we estimate the multivariate model (Eq. (3)). Additionally, firm characteristics, such as *Size*, *Age*, *Growth*, *Lev*, *Cash*, *Capex*, *RD*, *DRD*, and *AD*, and corporate governance characteristics (i.e., *Gscore*, *BS*, and *Ins*) that significantly affect firm value are included in all regressions. To control for serial correlation among residuals arising out of the persistence of performance within a firm and to reduce endogeneity, we lag the dependent variables by one year, where *Q* is measured for firm *i* at period $t + 1$, and *Opacity*, controls, and moderating variables are measured for firm *i* at period *t*. In addition, $\varepsilon_{1,i,t}$ and $\varepsilon_{2,i,t}$ are the disturbance term with both zero mean and constant variance; α and β are the unknown parameters. The models are shown as follows:

$$Q_{i,t+1} = \alpha_0 + \alpha_1 Opacity_{i,t} + \alpha_n Controls_{i,t} + \text{Year. Dummies} + \text{Industry. Dummies} + \varepsilon_{1,i,t} \tag{2}$$

$$Q_{i,t+1} = \beta_0 + \beta_1 Opacity_{i,t} + \beta_2 MHHI_{i,t} + \beta_3 Opacity_{i,t} \times MHHI_{i,t} + \beta_n Controls_{i,t} + \text{Year. Dummies}$$
$$+ \text{Industry. Dummies} + \varepsilon_{2,i,t} \tag{3}$$

Empirical results and analysis

Descriptive statistics

Panel A of Table 2 provides descriptive statistics of the sample. *Q* has a mean (median) value of 1.939 (1.640), whereas the standard deviation is 1.027 with high volatility. The mean of *Opacity*, our measure of corporate transparency, is 0.495, which is approximately equal to the median of 0.500. These results suggest that the transparency of most listed companies is at a medium level. Nevertheless, there are some differences among firms for the highest and lowest values, which are 0.800 and 0.200, respectively, but the value volatility is small because the standard deviation is only 0.109. *MHHI* has mean and median values of 0.704 and 0.768, respectively. Statistics indicate that most companies face fierce competition, but with little difference. The average *Size* in the sample is 7.888, with a standard deviation of 1.498, which is caused by differences between industries. Average cash holdings, capital expenditures, and R&D expenditures are 11.8 %, 5.3 %, and 3.8 % of assets. *Gscore* has mean (median) and standard deviation values of 2.127 (2.197) and 0.304, respectively, reflecting that corporate governance levels have great differences.

Table 1
Variable definitions.

Variable	Symbol	Definition
Independent variable		
Tobin's Q	*Q*	The market value of assets divided by the book value of assets.
Dependent variable		
Opacity	*Opacity*	The opacity index constructed by Anderson et al. (2009) that ranks *TV*, *BAS*, *AF*, and *FE* into deciles with the most opaque firms assuming a value of 10 and the least opaque firms adopting a value of 1, and scales the sum of four rankings by a factor of 40.
	- *TV*	TradingVolume: The number of daily dollar trading volume for the current fiscal year.
	- *BAS*	BidAskSpread: The bid price minus the ask price divided by the average of the bid and ask prices, averaged across all trading days in current fiscal year.
	- *AF*	AnalystFollow: The number of analysts following the firm during current fiscal year.
	- *FE*	ForecastError: The square of the difference between the mean analysts' earnings forecast and actual firm earnings, scaled by the firm's stock price.
Stock return synchronicity	*Syn*	The R^2 of the regression of daily equity risk premium on market risk premium and industry risk premium using daily returns and 4-digit SIC industry data run for each firms in each year.
Market competition	*MHHI*	One minus the Herfindahl-Hirschman Index, which is calculated as the sum of the squares of the percentage of sales revenue generated by each firm in an industry using 4-digit SIC industry classification. Besides, market competition measures are based on 2-digit SIC industry classification (*MHHI2*) and 3-digit SIC industry classification (*MHHI3*) in robustness tests.
Instrumental variable		
Total disaggregation quality	*DQ*	The simple average of the sum of *DQ_BS* and *DQ_IS*, as described in Chen et al. (2015).
Balance sheet disaggregation quality	*DQ_BS*	The sum of the number of nonmissing balance sheet items counting 93 subaccounts in each group divided by the number of total items generated by 11 group accounts and multiple the ratio of assets of group to total assets, and then divided by 2, as described by Chen et al. (2015).
Income statement disaggregation quality	*DQ_IS*	The sum of the number of nonmissing income statement items counting 51 subaccounts in each group divided by the number of total items generated by 7 group accounts, and then divided by 2, as described in Chen et al. (2015).
Control variable		
Firm size	*Size*	The natural logarithm of total assets.
Firm age	*Age*	The natural logarithm of the number of months a firm has been listed in CRSP database divided by 12.
Growth	*Growth*	The ratio of sales revenue of the current fiscal year (*t*) to previous sales revenue of the previous fiscal year (*t* − 1).
Leverage	*Lev*	The ratio of total debt to total assets.
Cash holding	*Cash*	The ratio of cash and short-term investments to total assets.
Capital expenditures	*Capex*	The ratio of capital expenditures to total assets.
R&D expenditures	*RD*	The ratio of research and development expenditures to total assets.
	DRD	A dummy variable with a value of 1 if the firm has R&D expenditures in current fiscal year and 0 otherwise.
Advertising expenditures	*AD*	The ratio of advertising expenditures to total assets.
Governance index	*Gscore*	The natural logarithm of governance index, which is based on the number of shareholder rights-decreasing provisions a firm has, as described in Gompers et al. (2003).
Board size	*BS*	The natural logarithm of the total number of board members.
Institutional ownership	*Ins*	The percentage of common equity owned by institutional shareholders.
Year fixed effect	*Year*	Dummy variable
Industry fixed effect	*Industry*	Dummy variable

Correlation analysis

The Pearson and Spearman correlation matrices are shown in Panel B of Table 2. The Pearson correlation coefficient for the *Opacity* with *Q* is −0.236, which is significant at the 1 % level. The *Opacity* and *Q* have a Spearman correlation of −0.261 (p < 0.01). The higher index indicates a lower transparency level, so the corporate transparency is positively correlated with firm value, which is as expected. The dependent variable, *Q*, and *MHHI* have a significant Pearson correlation but not a statistically significant Spearman correlation. Most control variables are significantly correlated with firm value. Moreover, most of our key variables in the sample have correlation coefficients less than 0.5 and the VIF values between independent variables less than 10, suggesting variables do not pose a problem with multicollinearity.

Baseline regression analysis

Transparency and firm value

The results for the ordinary least squares (OLS) regression with robust standard errors clustered at firm and year levels are reported in Table 3. The OLS regression tests the relationship between the transparency and firm value and the effect of market competition on this relationship. Model 1 shows primary results of adding control variables only; Model 2, which is estimated by Eq. (2), shows the results of adding control variables along with *Opacity*; and Model 3 represents the full model (Eq. (3)) incorporating control variables, *Opacity*, *MHHI*, and the moderating effect of market competition. All models use a one-year lag measure of *Q* at period *t* + 1, and *Opacity*, controls, and moderator variables are measured at period *t*.

Table 2
Descriptive statistics and correlation coefficients.

Panel A: Descriptive Statistics														
	Q	Opacity	MHHI	Size	Age	Growth	Lev	Cash	Capex	RD	DRD	AD	Gscore	BS	Ins
Mean	1.939	0.495	0.704	7.888	3.097	1.085	0.246	0.118	0.053	0.038	0.554	0.011	2.127	2.215	0.749
STD	1.027	0.109	0.211	1.498	0.802	0.194	0.151	0.129	0.048	0.073	0.497	0.026	0.304	0.239	0.166
MIN	0.680	0.200	0.000	4.402	0.405	0.465	0.000	0.000	0.002	0.000	0.000	0.000	1.099	1.609	0.123
Q1	1.256	0.400	0.623	6.759	2.603	0.996	0.135	0.026	0.021	0.000	0.000	0.000	1.946	2.079	0.654
Median	1.640	0.500	0.768	7.728	3.192	1.067	0.237	0.072	0.038	0.005	1.000	0.000	2.197	2.197	0.779
Q3	2.264	0.575	0.857	8.839	3.676	1.151	0.341	0.164	0.067	0.041	1.000	0.008	2.303	2.398	0.878
MAX	8.118	0.800	0.959	12.399	4.533	2.552	0.788	0.719	0.374	0.731	1.000	0.205	2.773	2.833	0.997
Panel B: Correlation Coefficients														
Q	1.000	−0.261***	0.004	0.056***	0.028***	0.141***	−0.168***	0.279***	0.016*	0.301***	0.241***	0.166***	−0.050***	0.044***	−0.001
Opacity	−0.236***	1.000	−0.093***	−0.380***	−0.004	−0.080***	−0.006	−0.040***	−0.039***	−0.072***	−0.006	−0.176***	0.032***	−0.197***	0.079***
MHHI	0.023***	−0.056***	1.000	−0.099***	−0.184***	0.054***	0.001	0.074***	0.091***	0.028***	−0.093***	−0.025***	−0.017*	−0.131***	−0.035***
Size	0.018**	−0.368***	−0.121***	1.000	0.383***	−0.032***	0.214***	−0.051***	−0.027***	−0.033***	−0.001	0.075***	0.018**	0.555***	0.046***
Age	0.002	−0.012	−0.176***	0.372***	1.000	−0.133***	0.062***	−0.059***	−0.020**	0.044***	0.127***	0.036***	0.160***	0.422***	−0.083***
Growth	0.111***	−0.061***	0.053***	−0.030***	−0.121***	1.000	−0.052***	−0.093***	−0.007	0.062***	0.001	−0.020**	−0.053***	−0.051***	−0.086***	0.016*
Lev	−0.128***	−0.013	−0.027***	0.193***	0.033***	−0.052***	1.000	−0.347***	0.001	−0.151***	−0.091***	0.018**	0.093***	0.148***	−0.039***
Cash	0.279***	−0.035***	0.095***	−0.118***	−0.104***	0.010	−0.287***	1.000	−0.217***	0.418***	0.272***	0.077***	−0.153***	−0.149***	0.157***
Capex	−0.012	−0.034***	0.118***	−0.014	−0.063***	0.091***	0.009	−0.194***	1.000	−0.219***	−0.185***	−0.003	0.046***	0.051***	−0.181***
RD	0.276***	−0.107***	0.156***	−0.072***	−0.081***	0.043***	−0.159***	0.575***	−0.159***	1.000	0.902***	−0.046***	−0.032***	−0.075***	−0.022**
DRD	0.200***	−0.001	−0.093***	0.009	0.120***	−0.016*	−0.097***	0.266***	−0.241***	0.474***	1.000	−0.060***	0.028***	0.007	−0.053***
AD	0.162***	−0.153***	−0.042***	0.002	0.035***	−0.059***	0.019**	−0.009	0.014	−0.087***	−0.090***	1.000	−0.063***	0.114***	−0.009
Gscore	−0.058***	0.033***	−0.012	−0.007	0.131***	−0.058***	0.075***	−0.138***	−0.017*	−0.087***	0.032***	−0.016*	1.000	0.180***	−0.083***
BS	0.014	−0.199***	−0.132***	0.549***	0.395***	−0.082***	0.137***	−0.202***	−0.025***	−0.160***	0.006	0.098***	0.179***	1.000	−0.165***
Ins	−0.013	0.054***	−0.035***	0.058***	−0.024***	0.009	−0.030***	0.114***	−0.112***	0.000	−0.035***	−0.082***	−0.024***	−0.117***	1.000

Note. This table reports descriptive statistics (Panel A) and correlation coefficients (Panel B) of the variables. The sample covers 12,665 firm-year observations for the period 1996–2018. In Panel A, STD is the standard deviation, MIN is the minimum value, Q1 is the 25% quantile, Q3 is the 75% quantile, and MAX is the maximum value. All mean, standard deviation, median, min, max, Q1, and Q3 values are based on the baseline file. Panel B provides the Pearson correlation coefficients (lower left) and Spearman correlation coefficients (upper right) of the variables. We present the variable definitions in Table 1. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 3
The effect of corporate transparency and market competition on value.

	OLS results			HLM results	
	Model 1	Model 2	Model 3	Model 4	Model 5
Opacity		−1.470***	−0.752***	−1.195***	−0.390
		(−15.52)	(−2.68)	(−12.62)	(−1.36)
MHHI (Ind_MHHI)			0.418*		0.559***
			(1.84)		(2.69)
*Opacity*MHHI (Opacity*Ind_MHHI)*			−0.979**		−1.197***
			(−2.54)		(−3.06)
Size	0.031***	−0.019**	−0.019**	−0.028***	−0.028***
	(3.52)	(−2.04)	(−2.11)	(−3.66)	(−3.64)
Age	0.033***	0.047***	0.048***	0.025**	0.027**
	(2.63)	(3.81)	(3.84)	(2.30)	(2.40)
Growth	0.521***	0.496***	0.495***	0.497***	0.496***
	(10.39)	(9.97)	(9.93)	(12.70)	(12.68)
Lev	−0.538***	−0.521***	−0.516***	−0.491***	−0.484***
	(−7.75)	(−7.56)	(−7.49)	(−8.85)	(−8.77)
Cash	1.769***	1.795***	1.799***	1.781***	1.782***
	(16.96)	(17.35)	(17.38)	(23.02)	(23.02)
Capex	2.022***	2.021***	2.001***	1.795***	1.748***
	(7.88)	(8.01)	(7.93)	(8.77)	(8.58)
RD	0.693**	0.551*	0.542*	0.435**	0.441***
	(2.36)	(1.89)	(1.86)	(2.54)	(2.58)
DRD	0.268***	0.238***	0.236***	0.229***	0.229***
	(10.03)	(8.95)	(8.89)	(10.39)	(10.41)
AD	5.481***	5.143***	5.204***	5.073***	5.068***
	(8.87)	(8.38)	(8.45)	(13.82)	(13.76)
Gscore	−0.130***	−0.137***	−0.138***	−0.121***	−0.123***
	(−4.01)	(−4.27)	(−4.30)	(−4.17)	(−4.27)
BS	0.153***	0.133***	0.136***	0.149***	0.145***
	(3.41)	(3.01)	(3.07)	(3.65)	(3.54)
Ins	0.167***	0.101	0.100	0.067	0.062
	(2.60)	(1.60)	(1.57)	(1.23)	(1.12)
Intercept	0.515***	1.742***	1.447***	−0.028***	1.201***
	(3.03)	(9.52)	(5.97)	(−3.66)	(5.96)
Year F. E.	Yes	Yes	Yes	Yes	Yes
Ind. F. E.	Yes	Yes	Yes	No	No
Adj. R² (R²)	37.49 %	38.77 %	38.79 %	43.40 %	43.48 %
F-value	28.906***	28.496***	71.202***	—	—
N	12,665	12,665	12,665	12,665	12,665

Note. This table reports the results from OLS and HLM regressions. Model 1 shows the regression results of adding only controls; Model 2 shows the regression results of adding *Opacity* and controls; and Model 3 shows the regression results of moderating effect of *MHHI*. Model 4 and Model 5 show the results of HLM tests on industry level. We present the variable definitions in Table 1. The *t*-values are in the parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Adj. R² (R²) is the adjusted (unadjusted) power of explanation of OLS (HLM) regressions.

Model 1 and Model 2 yield adjusted R² values of 37.49 % and 38.77 %, respectively, indicating that the independent variables as a whole have high explanatory power and capture a significant portion of the variation in firm value. The OLS results of Model 2 indicate that *Opacity* has a significantly negative relationship with *Q* with the coefficient of −1.470 (p < 0.01). Thus, the finding is consistent with prior perspectives (e.g., Duru et al., 2013) that transparency enhances firm value since a greater index represents lower transparency, supporting Hypothesis 1.

Transparency and firm value: Effect of market competition. We demonstrate a positive and significant association between transparency and firm value in the discussion above, and we hypothesize that such a relationship is even stronger when market competition is added. Model 3 in Table 3 displays the estimated results. We test Hypothesis 2 via the two-way interaction term *Opacity*MHHI*. The coefficient on this term is −0.979, which is significant at the 1 % level, suggesting that the interaction variable is significantly and negatively associated with firm value.[3] Moreover, the estimated coefficient of −0.979 for *Opacity*MHHI* and −0.752 for *Opacity* suggests that a standard deviation increase in *Opacity* of 0.109 (in Table 2) is associated with a decrease in firm value from 0.148 to 0.173 for the range of *MHHI* from the 25 % quantile (0.623, in Table 2) to the 75 % quantile (0.857, in Table 2). With a standard deviation increase in *Opacity*, the coefficient of −1.470 for *Opacity* in Model 2 (Table 3) represents a decrease in firm value of 0.160. Therefore, compared with the impact of *Opacity* on firm value, the

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[3] We also examine the effect of market competition on firm value by separately adding *MHHI* (Test 1) and adding *MHHI* and *Opacity* together (Test 2) in the primary regression. The results show that the relationship between transparency and firm value in Test 2 is consistent with Model 2 in Table 3. Comparatively, neither of the coefficients on *MHHI* for *Q* in Test 1 and Test 2 is significant. However, the market competition (*MHHI*) is positively related to firm value (*Q*) (0.418, p<0.1) in moderating regression. Thus, market competition plays a pure moderating role.

impairment effect of *MHHI* on firm value relative to *Opacity* increases by 15.58 %. Therefore, the market competition has a positive regulating effect on the influence of transparency on firm value, which provides strong support for Hypothesis 2.

Additionally, consistent with Sheikh (2018) and Yu et al. (2018), we find that *Size* has a negative association with firm value (−0.019, p < 0.05), which may indicate the diseconomies of scale. *Lev* is also negatively correlated with firm value because high asset-liability ratio is a symbol of high debt and financial risk. Consistent with existing literature, *Age* (0.048, p < 0.01), *Growth* (0.495, p < 0.01), *Cash* (1.799, p < 0.01), *Capex*, *RD*, and *AD* have a positive and significant association with firm value. Corporate governance has a positive correlation with firm value, with a coefficient of −0.138 (p < 0.01) on *Gscore*. In sum, these results are consistent with some studies that find that better growth potential, stronger profitability, more capital and R&D investment, and better corporate governance are related to a higher firm value.

Given the preceding results, market competition appears to play an external governance role by providing a way to reduce information asymmetry and to align managerial interests and agency costs, which supports the bright side perspective. Specifically, different from the dark side view, which argues that companies tend to create an opaque environment to maintain advantages (e.g., Ali et al., 2014), our results demonstrate that competition prevents managers from diverting resources for themselves and concealing information. Instead, it enhances the way in which transparency leads to value. In other words, market competition, which is regarded as an external governance mechanism, is more important when it works complementarily with corporate transparency.

Hierarchical linear models. We employ hierarchical linear models (HLMs) of industry for two main reasons. First, companies in the same industry inevitably interact with each other. From an industry-level perspective, companies are affected by their peers, and they also face similar policies and environments. Therefore, the differences between industries will lead to differences in the impact of competition on the relationship between transparency and firm value. Some differences in firm characteristics that we focus on cannot be explained at an individual level but need to be considered at a group level. Second, the empirical tests above mainly use OLS regression, an unbiased estimation based on the mutual independence of samples. However, as discussed above, if the firms are within a specific industry, the assumption of independence becomes unreliable. With such embedded structural data, conventional OLS may underestimate standard errors and overestimate coefficients (Su et al., 2016). In contrast, HLMs cover the multilevel nature of firm value and thus ensure the independence of random errors at both individual and industry levels. Such models contribute to solving the potential estimation bias by including random components of clustering (Su et al., 2016).

We assume that the greater the corporate transparency is, the stronger the promotion effect on firm value at an industry level (Hypothesis 3). We also assume that the higher industry market competition (*Ind_MHHI*) is, the stronger its role in moderating the relationship between transparency and firm value across industry levels (Hypothesis 4). We establish the following three models of level 1 and level 2 to investigate whether industry-level market competition plays a role in moderating cross-level interaction. Level 1 is the individual level (Eq. (4)), and level 2 is the industry level (Eq. (5) and Eq. (6)).

$$Level1 : Q_{i,j,t+1} = \alpha_{0j} + \alpha_{1j}Opacity_{i,j,t} + \alpha_{nj}Controls_{i,j,t} + Year.Dummies + e_{1.i,j,t} \tag{4}$$

$$Level2 : \alpha_{0j} = \gamma_{00} + \gamma_{01}Ind\_MHHI_j + \mu_{0j} \tag{5}$$

$$\alpha_{1j} = \gamma_{10} + \gamma_{11}Ind\_MHHI_j + \mu_{1j} \tag{6}$$

The results of intra-class correlation coefficient (ICC) analysis illustrate that the intra-group correlation of market competition in the industry is 0.863. Marinšek (2017) indicates that an appropriate settlement is represented by a value of ICC that is higher than 0.1, which means units within a cluster likely have a high degree of homogeneity. Prior studies suggest that the closer ICC is to 1, the more suitable it is for cross-level analysis. The market competition is highly correlated with the industry level, and thus this study is suitable for HLM at the industry level.

Table 3 presents the results of HLM tests. Concerning the transparency effects, we find a significant relationship between opacity and Tobin's Q in Model 4 (−1.195, p < 0.01), supporting Hypothesis 3. The original positive relationship between transparency and firm value is verified again (Hypothesis 1). Turning to the industry level (Model 5), the coefficient on *Opacity*Ind_MHHI* with is also negative and significant (−1.197, p < 0.01), indicating that the industry market competition positively heightens the promotion effect of transparency on firm value as a cross-level regulating variable. The patterns lend support to Hypothesis 4. Thus, market competition warrants attention as a cross-level external governance mechanism.

Controlling for potential endogeneity issues

Omitted variable bias-corrected estimates

A potential endogeneity concern is that our baseline results might be biased because of some omitted variables. To address this concern, we adopt the bias-corrected tests proposed by Oster (2019). Oster (2019) argues that the sensitivity of treatment effects (coefficient movements) of interest should be scaled by R^2 movements after including controls to represent the omitted variable bias. We follow this argument and calculate the estimator to correct estimates for omitted variable bias based on the coefficients and R^2 from two-stage regressions, namely bias-adjusted coefficient (*β-adj.*). We also

compute the set of bias-adjusted treatment effects (*Identified set*). According to Oster (2019), the omitted variable bias might be less if *β-adj.* is close to the unadjusted coefficient of interest and the *Identified set* excludes zero.

We report the results of two-stage estimates and bias-corrected estimates in Table 4. In the first stage, we estimate a regression of *Q* on our independent variable, *Opacity*, only with the year and industry fixed effect. In the second stage, we further add all control variables not controlled in the first regression set but included in the above baseline tests. We focus on the two coefficients on *Opacity* and the R^2 obtained from the two-stage regressions. The coefficients of interest are both negative and significant. Then we calculate the *β-adj.* and the *Identified set* by setting two key input parameters. First, we set the value of the relative degree of selection on unobserved variables and observed variables (δ) to 1 as recommended by Oster (2019). Second, the R^2_{max} is obtained from a hypothetical regression of *Q* on *Opacity* and all unobserved and observed controls. We set R^2_{max} ($R^2_{max} = \Pi R^2$) as 1.3 times (Π = 1.3) the R^2 of the controlled regression as suggested by Oster (2019), and we also consider Π = 1.5 and Π = 2.0. The bias-adjusted coefficients (*β-adj.*) are −1.474, −1.476, and −1.482 under three R^2_{max} settings, which are fairly similar to the unadjusted coefficient on *Opacity* (−1.470). Moreover, all the sets of bias-adjusted treatment effects (*Identified set*) exclude zero. In sum, the coefficients of interest are stable, alleviating the concern about omitted variable bias.

Instrumental variable regressions

While we lead the dependent variable to avoid potential endogeneity in baseline regressions, the results might still be spurious owing to unobservable endogenous pairings between transparency and value. For instance, better-performing firms tend to be more transparent (reverse causality). To address these concerns, we adopt disclosure disaggregation quality proposed by Chen et al. (2015) as our instrumental variables to estimate IV-2SLS regressions.

A valid instrumental variable should have no direct effect on the dependent variable but be associated with the suspected endogenous variable. Disclosure disaggregation quality (*DQ*) captures the level of disaggregation and the fineness of financial data through a count of nonmissing Compustat accounting line items in annual reports. Different from the existing disclosure quality measurement, *DQ* does not measure the number of information itself. It instead concerns the number of subaccounts of information. Consider the following scenario. We assume that the total assets of a firm are 100, and there are 10 reporting subaccounts of assets. If the manager manipulates disclosure number, the reported assets will likely be less or more than 100. On the contrary, although the manager manipulates disclosure disaggregation quality, it will only decrease the number of reporting items, such as just reporting eight subaccounts of assets. The total assets will still be 100. Hence, *DQ* can be a good instrument for corporate transparency because the change in *DQ* will influence the amount of information available (i.e., transparency), but it will not affect the number of financial information itself and thus the firm value will not be altered. Following Chen et al. (2015), we count the number of nonmissing accounting items reported in annual financial reports, including balance sheets and income statements as captured by Compustat, with a greater number representing more detailed information.

The two main steps are to count the number of nonmissing line items and to screen them based on the nesting feature (i.e., the sum of the components equals the total) and the basic templates "Balancing Models" of Compustat. For disclosure disaggregation quality of the balance sheet (*DQ_BS*), we link 93 subaccounts to 25 intermediate groups of accounts (parent accounts) and further nest them to the 11 highest level group accounts on the balance sheet according to Balance Sheet template that the sum of total assets and total liabilities equals shareholders' equity (see appendix in Chen et al. (2015)). The screening mechanisms of the balance sheet are as follows: (1) the number of subaccounts is counted only if the parent account is nonzero, and (2) applicable subaccounts are added up to check whether the sum is equal to the parent account. In addition, all missing fields are coded as missing items for DD2–DD5 (Debt Maturing 2nd–5th years) accounts. For disclosure disaggregation quality of income statement (*DQ_IS*), we link 51 subaccounts to seven group accounts according to the two-level nesting structure (see appendix in Chen et al. (2015)). Then all associated subaccounts are excluded if the group account is zero. *DQ_BS* (Eq. (7)), *DQ_IS* (Eq. (8)), and *DQ* (Eq. (9)) are computed using the following formulas, where *k* indexes group accounts.

$$DQ_{BS} = \sum_{k=1}^{11} \left\{ \left(\frac{Nonmis\sin g\ items}{Total\ items} \right) \times \frac{Assets_k}{Total\ assets} \right\} \div 2 \qquad (7)$$

$$DQ\_IS = \sum_{k=1}^{7} \left\{ \left(\frac{Nonmis\sin g\ items}{Total\ items} \right) \right\} \div 7 \qquad (8)$$

$$DQ = (DQ\_BS + DQ\_IS) \div 2 \qquad (9)$$

Table 5 reports the results of the 2SLS estimations separately using different instruments (*DQ, DQ_BS, DQ_IS*), as well as Kleibergen-Paap rk LM statistics and Cragg-Donald Wald F statistics. In the first stage, the dependent variable is *Opacity*, and the independent variables are three instruments, respectively, and all controls are also included with year and industry fixed effects. Consistent with our expectations, *DQ* (−0.116), *DQ_BS* (−0.060), and *DQ_IS* (−0.060) are negatively correlated with *Opacity*, and the coefficients are statistically significant at 1 % level. Further, the Kleibergen-Paap rk LM statistics (testing for under-identification) are all significant at the 1 % level, which indicates that these instruments are separately correlated with an endogenous variable. The Cragg-Donald F-test statistics of all three instruments are all greater than the critical value of

Table 4
The results of bias-corrected tests.

Two-stage Regression Results			Oster (2019) Tests Results			
	Uncontrolled	Controlled		$\Pi = 1.3\ (\delta = 1)$	$\Pi = 1.5\ (\delta = 1)$	$\Pi = 2.0\ (\delta = 1)$
Opacity	−1.468***	−1.470***	*β-adj.*	−1.474	−1.476	−1.482
	(−15.66)	(−15.52)	Identified set	[−1.474, −1.470]	[−1.476, −1.470]	[−1.482, −1.470]
Year F.E.	Yes	Yes				
Ind. F.E.	Yes	Yes				
R^2	33.91 %	40.44 %				
N	12,665	12,665				

Note. This table reports the results of bias-corrected tests proposed by Oster (2019) including two-stage estimates and bias-corrected estimates. On the left side of this table, the first column shows the baseline regression results of Q on *Opacity* only with year and industry fixed effects; the second column reports the regression results of Q on *Opacity* with all control variables (*Size, Age, Growth, Lev, Cash, Capex, RD, DRD, AD, Gscore, BS, Ins*) and year and industry fixed effects. The right side of this table reports the bias-adjusted coefficients (*β-adj.*) and the set of bias-adjusted treatment effects (*Identified set*) following Oster (2019), setting the relative degree of selection on unobserved variables and observed ones (δ) to 1 and R^2_{max} ($R^2_{max} = \Pi R^2$) as 1.3 times (Π = 1.3), 1.5 times (Π = 1.5), and 2.0 times (Π = 2.0) the R^2 obtained from controlled regression. The *t*-values are in the parentheses. ***, **, and * indicate statistical significance at the 1 %, 5 %, and 10 % levels, respectively.

Table 5
The results of IV-2SLS with endogenous opacity.

	IV: *DQ*		IV: *DQ_BS*		IV: *DQ_IS*	
	IV 1st stage	IV 2nd stage	IV 1st stage	IV 2nd stage	IV 1st stage	IV 2nd stage
Opacity		6.874***		6.676***		8.797***
		(4.00)		(3.33)		(3.24)
MHHI		1.125***		1.141***		1.202***
		(3.15)		(3.19)		(3.35)
*Opacity*MHHI*		−2.287***		−2.320***		−2.446***
		(−3.51)		(−3.54)		(−3.73)
IV	−0.116***		−0.060***		−0.060***	
	(−6.40)		(−4.77)		(−4.00)	
Size	−0.034***	0.207***	−0.034***	0.200***	−0.033***	0.268***
	(−41.26)	(3.75)	(−41.12)	(3.07)	(−40.88)	(2.99)
Age	0.009***	−0.015	0.010***	−0.013	0.009***	−0.032
	(7.30)	(−0.78)	(7.37)	(−0.59)	(7.28)	(−1.16)
Growth	−0.016***	0.606***	−0.016***	0.602***	−0.017***	0.636***
	(−3.67)	(10.29)	(−3.58)	(9.67)	(−3.83)	(9.40)
Lev	0.009	−0.591***	0.010	−0.588***	0.012*	−0.611***
	(1.42)	(−8.06)	(1.47)	(−7.85)	(1.75)	(−7.95)
Cash	0.017**	1.680***	0.016*	1.684***	0.018**	1.649***
	(2.02)	(15.42)	(1.91)	(15.10)	(2.13)	(14.50)
Capex	−0.008	2.001***	−0.006	2.001***	−0.003	2.002***
	(−0.33)	(7.82)	(−0.25)	(7.81)	(−0.14)	(7.79)
RD	−0.093***	1.181***	−0.095***	1.159***	−0.094***	1.354***
	(−4.59)	(3.49)	(−4.68)	(3.24)	(−4.65)	(3.48)
DRD	−0.019***	0.376***	−0.020***	0.371***	−0.020***	0.413***
	(−6.61)	(8.65)	(−7.10)	(7.72)	(−6.78)	(6.66)
AD	−0.221***	6.747***	−0.231***	6.697***	−0.220***	7.168***
	(−5.11)	(9.19)	(−5.33)	(8.63)	(−5.06)	(8.23)
Gscore	−0.005	−0.107***	−0.005*	−0.108***	−0.005	−0.098***
	(−1.63)	(−3.24)	(−1.70)	(−3.25)	(−1.46)	(−2.83)
BS	−0.013***	0.222***	−0.014***	0.219***	−0.013***	0.247***
	(−2.98)	(4.47)	(−3.02)	(4.26)	(−2.96)	(4.29)
Ins	−0.043***	0.394***	−0.044***	0.384***	−0.044***	0.474***
	(−6.76)	(3.98)	(−6.90)	(3.55)	(−6.88)	(3.46)
Intercept	0.913***	−4.619***	0.882***	−4.445***	0.868***	−6.182***
	(43.26)	(−3.27)	(44.19)	(−2.70)	(47.13)	(−2.74)
Year F. E.	Yes	Yes	Yes	Yes	Yes	Yes
Ind. F. E.	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	48.42 %	39.30 %	48.34 %	39.28 %	48.31 %	39.29 %
F-value	92.989***	73.538***	91.604***	73.447***	93.206***	74.179***
N	12,665	12,665	12,665	12,665	12,665	12,665
Kleibergen-Paap rk LM statistic	40.82***		22.77***		16.40***	
Cragg-Donald Wald F statistic	42.11		24.59		17.33	

Note. This table reports the results from IV-2SLS regressions. The two-stage results use total disclosure disaggregation quality (*DQ*), balance sheet disclosure disaggregation quality (*DQ_BS*), and income statement disclosure disaggregation (*DQ_IS*) as instrumental variables (IV). We present the variable definitions in Table 1. The *t*-values are in the parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Adj. R^2 is the adjusted power of explanation. The Stock-Yogo weak identification test critical values are the following: 10% maximal IV size, 16.38; 15% maximal IV size, 8.96; 20% maximal IV size, 6.66; and 25% maximal IV size, 5.53.

16.38 (10 % maximal IV size), suggesting a rejection of weak identification. In addition, the F-value of using *DQ, DQ_BS*, and *DQ_IS* as instruments separately in the first stage is more than 10. These results illustrate that *DQ, DQ_BS*, and *DQ_IS* serve as valid instruments separately. In the second stage, the three specifications are similar to baseline regressions except that the independent variable is now instrumented by *DQ, DQ_BS,* and *DQ_IS*. The estimates of *Opacity*MHHI* on *Q* are all negative and significant (*DQ*: −2.287, p < 0.01; *DQ_BS*: −2.320, p < 0.01; *DQ_IS*: −2.446, p < 0.01). In general, these results suggest that the moderating effects of market competition are still significant, supporting the positive role of market competition. The concern over endogeneity is thus lowered in our study.[4]

Robustness tests

Alternative variables tests

This section examines alternative transparency and market competition measures. First, we adopt the stock return synchronicity as an alternative variable of corporate transparency. The stock return synchronicity represents the extent of firm-specific information contained in stock prices (Chan and Hameed, 2006). We measure stock return synchronicity (*Syn*) using the R^2 from running the following model (Eq. (10)) using daily returns for each firm in each year, so the R^2 is the annual variable for each firm. The variable $r_{i,t}$ is the daily stock returns for firm *i*, $r_{f,t}$ is the daily risk-free rate, $r_{m,t}$ is the market index return defined as the value-weighted returns of all CRSP firms, $r_{j,t}$ is the market-value weighted return rate of 4-digit industry (excluding the return of individual firm own), and $\varepsilon_{i,t}$ is the error term that measures firm-specific risk. We compute the R^2 using two intervals of moving windows: one-year lag *rmrf* and *indret* (Model 1), and one-year lead and lag *rmrf* and *indret* (Model 2). Second, for market competition, we compute *MHHI* based on 2-digit SIC (*MHHI2*) and 3-digit SIC (*MHHI3*).

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_i^M rmrf + \beta_i^I indret + \varepsilon_{i,t} \tag{10}$$

$$rmrf = r_{m,t} - r_{f,t} \tag{11}$$

$$indret = r_{j,t} - r_{f,t} \tag{12}$$

The regression estimates using *Syn* (*MHHI2* and *MHHI3*) are presented in Panel A (Panel B) of Table 6. For brevity, we do not show the coefficients on control variables. The results show that the coefficients on variables of interest (Panel A: *Syn*, *Syn*Ind_MHHI*; Panel B: *MHHI2*, *MHHI3*, *Opacity*MHHI2*, *Opacity*MHHI3*, *Opacity*Ind_MHHI2*, *Opacity*Ind_MHHI3*, *Opacity*MHHI2*, *Opacity*MHHI3*) are consistent with the previous baseline results, implying that the empirical results are relatively robust, regardless of the transparency and market competition measure. Therefore, our results are not driven by any specific methods of variable measurement.

Cross-sectional variation tests

To further check the robustness, we test the cross-sectional variation in the increase in market competition. The full sample is divided into eight groups according to market competition in ascending order by year, which indicates that groups 1 to 8 hold increasing market competition by year. Table 7 provides the results of OLS regressions in each group and the *z*-test results between Group 1 and Group 8. As shown in Panel A, the coefficients on *Opacity* from Group 1 to Group 8 show a slightly downward trend. Moreover, we compare the coefficients on *Opacity* between the weakest (Group 1) and strongest (Group 8) market competition group by estimating *z*-test following Clogg et al. (1995) and Paternoster et al. (1998). Panel B of Table 7 shows the difference between the weakest and strongest market competition group is significant at the 5 % level in both one-tail and two-tail *z*-tests. Consistent with Hypothesis 2, this result indicates that fiercer market competition is beneficial to the positive relationship between corporate transparency and firm value.[5]

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[4] In addition, we transform the *MHHI* into a predicted value (*PreMC*) to further rule out the possible endogeneity related to *Opacity*MHHI*. We are grateful to an anonymous referee for suggesting this endogeneity test. We choose two instruments for *MHHI*: (1) the percentage change in the number of firms in the same 3-digit SIC following Lewellen and Resutek (2019), and (2) the barriers to entry of industries (3-digit SIC) measured as the minimum value of property, plant, and equipment. The *PreMC* is defined as the residual of regressing the percentage change in the number of firms and the barriers to entry on *MHHI3* by year. Specifically, we multiply the percentage change in the number of firms by 100 and take the logarithm of the minimum value of property, plant, and equipment to maintain a statistical balance with *MHHI3*. Consistent with Lewellen and Resutek (2019), we require the industries with at least 10 firms in year *t* so that the sample here is 9,654 observations. Untabulated analyses indicate that the OLS and HLM results remain similar to our main findings. In IV-2SLS, we use disaggregation disclosure quality as instruments for transparency as before. The coefficients on *Opacity*PreMC* are all negative and significant, implying that the moderating effect is less affected by endogeneity issues. In sum, endogeneity is less of a concern in this study even after considering the market competition.

[5] We also explore whether our conclusions remain unchanged in time-series regressions. The results are untabulated due to limited space. We are grateful for that suggestion from an anonymous referee. We partition our sample into two periods with the year of 2008 as the boundary. During 2008, many firms struggled for survival in the global economic crisis. We find that opacity is negatively associated with the firm value in two periods, but the market competition only has a significant and positive moderating impact on this relationship before 2008. Further, we investigate the effect of bankruptcy risk induced by the crisis in our study after 2008. We measure bankruptcy risk following Shumway (2001). We find that after the economic crisis, bankruptcy risk has a detrimental effect on firm value. More importantly, the bankruptcy risk plays an opposite role to market competition in the relationship between opacity and firm value and thus weakens the effect of market competition, which causes the differences in results before and after 2008. This issue awaits future research.

Table 6

The results of robustness tests—Alternative *Opacity* and *MHHI* measures.

Panel A: Alternative *Opacity* measure Synchronicity)

	OLS results				HLM results	
	Model 1		Model 2		Model 1	Model 2
	(1)	(2)	(3)	(4)	(5)	(6)
Syn	0.387***	−0.048	0.416***	−0.089	0.022	−0.035
	(9.30)	(−0.53)	(10.17)	(−0.96)	(0.20)	(−0.31)
MHHI (Ind_MHHI)		−0.366***		−0.436***	−0.175**	−0.233**
		(−3.16)		(−3.65)	(−1.97)	(−2.48)
*Syn*MHHI (Syn*Ind_MHHI)*		0.636***		0.731***	0.366**	0.485***
		(4.94)		(5.55)	(2.40)	(3.16)
Intercept	0.498***	0.764***	0.523***	0.836***	0.738***	0.764***
	(2.95)	(4.14)	(3.09)	(4.51)	(5.40)	(5.52)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year F. E.	Yes	Yes	Yes	Yes	Yes	Yes
Ind. F. E.	Yes	Yes	Yes	Yes	No	No
Adj. R^2 (R^2)	37.93%	38.02%	38.02%	38.13%	42.70%	42.76%
F-value	29.872***	72.064***	29.755***	72.157***	−	−
N	12,665	12,665	12,665	12,665	12,665	12,665

Panel B: Alternative *MHHI* measure (2-digit *MHHI* and 3-digit *MHHI*)

	OLS results		HLM results		IV 2nd stage results					
	MHHI2	MHHI3	MHHI2	MHHI3	MHHI2			MHHI3		
					IV: DQ	IV: DQ_BS	IV: DQ_IS	IV: DQ	IV: DQ_BS	IV: DQ_IS
Opacity	2.205**	−0.385	2.669**	−0.296	9.399***	6.681***	24.505***	9.250***	8.190***	12.420***
	(2.05)	(−1.06)	(2.25)	(−0.79)	(4.45)	(3.18)	(5.79)	(5.11)	(3.89)	(4.54)
MHHIn (Ind_MHHIn)	1.499**	0.774***	1.809***	0.670**	4.257***	4.150***	4.351***	2.164***	2.164***	2.216***
	(2.30)	(2.82)	(2.66)	(2.57)	(4.02)	(3.85)	(4.06)	(4.69)	(4.68)	(4.82)
*Opacity*MHHIn (Opacity*Ind_MHHI)*	−4.423***	−1.509***	−4.675***	−1.287***	−9.593***	−9.426***	−9.782***	−4.076***	−4.075***	−4.171***
	(−3.73)	(−3.25)	(−3.59)	(−2.71)	(−4.64)	(−4.48)	(−4.67)	(−4.87)	(−4.85)	(−5.01)
Intercept	0.346	1.139***	0.122	1.152***	−3.909***	−1.782	−15.877***	−6.134***	−5.263***	−8.716***
	(0.62)	(4.30)	(0.19)	(4.73)	(−3.29)	(−1.57)	(−5.01)	(−4.30)	(−3.16)	(−3.92)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year F. E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind. F. E.	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2 (R^2)	29.21%	36.53%	31.09%	40.06%	27.39%	27.40%	39.26%	36.37%	36.32%	36.37%
F-value	43.600***	78.568***	−	−	40.528***	40.609***	28.724***	76.821***	76.866***	76.749***
N	12,665	12,665	12,665	12,665	12,665	12,665	12,665	12,665	12,665	12,665

Note. This table reports the results of robustness tests using alternative *Opacity* and *MHHI* measures. In Panel A, we use Synchronicity (*Syn*) instead for *Opacity* to re-examine OLS and HLM regressions. In Panel B, we use 2-digit MHHI (*MHHI2*) and 3-digit MHHI (*MHHI3*) instead for *MHHI* to re-examine OLS, HLM, and IV-2SLS regressions. Controls include *Size*, *Age*, *Growth*, *Lev*, *Cash*, *Capex*, *RD*, *DRD*, *AD*, *Gscore*, *BS*, and *Ins*. We present the variable definitions in Table 1. The *t*-values are in the parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Adj. R^2 (R^2) is the adjusted (unadjusted) power of explanation of OLS (HLM) regressions.

Additional analysis

Prior studies provide strong evidence that market competition substitutes for corporate governance by verifying that firms with weak governance mechanisms benefit more from market competition (e.g., Chhaochharia et al., 2017; Boubaker et al., 2018). For instance, Giroud and Mueller (2010) show that the adoption of anti-takeover legislation reduces the detrimental impact of the takeover threats and insulates managers from external discipline, and that firms operating in concentrated industries experience lower operating performance compared with those in nonconcentrated industries. In this vein, Giroud and Mueller (2011) suggest that good-quality governance and firm value show a positive relation only in non-competitive industries. In other words, strong market competition reduces the importance of good corporate governance. Good-quality governance will no longer enhance firm value in the context of fierce market competition (Chou et al., 2011).

Better corporate governance benefits firms by constraining managers' behaviors such as self-dealing (Chauhan et al., 2016) and managerial slack (Chang et al., 2015). We provide evidence that corporate transparency is positively associated with firm value. However, contrary to corporate governance, we find that transparency adds value to companies when they operate under strong market competition. An assumption underlying our analysis is that market competition could positively moderate the relation between corporate transparency and firm value from an information perspective. A potential concern, however, is that corporate governance structure and corporate information environment have an endogenous relation (Armstrong et al., 2012), namely, corporate transparency reflects both corporate governance and corporate information. Thus, in this section, we further consider the relationship between transparency, governance, and market competition and its effect on firm value to address this concern.

Table 7
Cross-sectional variation in the increase in market competition.

Panel A: OLS results	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8
Opacity	−2.445***	−2.565***	−1.498***	−1.980***	−2.052***	−1.961***	−2.657***	−1.685***
	(−10.62)	(−9.82)	(−6.23)	(−8.36)	(−8.54)	(−7.88)	(−8.68)	(−6.61)
Size	−0.069***	−0.117***	−0.020	−0.056***	−0.001	−0.079***	−0.114***	−0.027
	(−3.32)	(−4.44)	(−0.96)	(−2.58)	(−0.05)	(−4.11)	(−4.58)	(−1.16)
Age	0.064*	0.087**	−0.041	0.001	0.113***	0.010	0.051	−0.011
	(1.82)	(2.46)	(−1.37)	(0.04)	(3.56)	(0.37)	(1.40)	(−0.29)
Growth	0.490***	0.545***	0.443***	0.414***	0.512***	0.548***	0.840***	0.694***
	(3.71)	(3.79)	(3.74)	(3.20)	(4.02)	(4.24)	(5.87)	(4.11)
Lev	−0.373**	−0.184	−0.509***	−0.376**	−0.098	−0.315	−0.480**	−0.459***
	(−2.01)	(−1.05)	(−2.96)	(−2.08)	(−0.53)	(−1.60)	(−2.50)	(−2.59)
Cash	0.767**	1.233***	1.235***	1.373***	1.719***	1.606***	1.767***	1.430***
	(2.52)	(4.30)	(3.44)	(4.92)	(6.77)	(5.57)	(7.34)	(4.69)
Capex	1.944***	1.685**	1.027**	2.125***	1.862***	1.750***	0.662	0.854**
	(3.21)	(2.35)	(2.04)	(4.16)	(3.71)	(3.90)	(1.32)	(2.15)
RD	−0.540	−0.559	3.201***	1.711***	0.209	1.895***	1.032**	1.198**
	(−0.74)	(−0.82)	(3.65)	(3.10)	(0.45)	(3.03)	(2.20)	(2.10)
DRD	−0.002	0.178***	0.188***	0.322***	0.461***	0.292***	0.211***	0.547***
	(−0.05)	(3.33)	(3.93)	(6.20)	(8.16)	(5.25)	(3.01)	(7.67)
AD	3.545***	8.377***	7.863***	9.316***	3.856***	1.917	8.108***	9.357***
	(4.37)	(6.33)	(6.96)	(6.80)	(3.20)	(1.60)	(3.81)	(6.38)
Gscore	−0.210***	−0.308***	−0.142*	−0.065	−0.146*	−0.135	−0.054	0.100
	(−2.77)	(−3.65)	(−1.76)	(−0.87)	(−1.72)	(−1.53)	(−0.52)	(1.13)
BS	0.067	0.363***	0.191*	0.092	0.091	0.468***	0.523***	0.204
	(0.54)	(2.59)	(1.72)	(0.68)	(0.80)	(3.86)	(3.85)	(1.63)
Ins	−0.197	−0.434***	−0.569***	0.099	0.608***	0.442**	0.088	−0.507**
	(−1.44)	(−2.77)	(−3.64)	(0.62)	(4.04)	(2.41)	(0.46)	(−2.58)
Intercept	3.601***	3.410***	2.825***	2.725***	1.603***	1.634***	2.400***	1.914***
	(8.91)	(7.62)	(7.21)	(6.17)	(3.40)	(3.61)	(4.51)	(3.94)
Year F. E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R²	16.91 %	20.68 %	23.78 %	27.78 %	24.66 %	26.51 %	25.74 %	27.54 %
F-value	10.065***	11.627***	11.293***	12.128***	12.833***	12.608***	14.193***	13.406***
N	1,577	1,578	1,592	1,579	1,588	1,594	1,566	1,591

Panel B: *z*-test results			
Dif	**z**	**Prob1**	**Prob2**
−0.76	−2.213	0.0173	0.0347

Note. This table shows cross-sectional variation in the increase in market competition. The full sample is divided into eight groups based on *MHHI* by year. Group 1 to Group 8 are in ascending order according to *MHHI*, which means market competition is gradually increasing. The results show the coefficients on *Opacity* in OLS regressions with year fixed effect in each group. In Panel A, the *t*-values are in the parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Adj. R² is the adjusted power of explanation. In Panel B, Dif is the difference between coefficients on *Opacity* of Group 1 and Group 8, z is the *z*-value, Prob1 is the one-tail p-value, and Prob2 is the two-tail p-value.

Information asymmetry is the leading cause of agency problems, and internal corporate governance is designed to solve these problems. In turn, the quality of corporate governance determines the transparency of the corporate information environment. Hence, corporate governance and information environment mutually affect each other. Armstrong et al. (2012) also find a relation between changes in corporate governance induced by the passage of state antitakeover laws and the corporate information environment. Nevertheless, corporate governance is not equal to corporate transparency. The information environment is one of the outcomes of different governance mechanisms, which is a reflection of corporate governance. Corporate governance also covers more than corporate transparency. It is noteworthy that Anderson et al. (2009) also present that the opacity index comprises an internal component (represented by three disclosure quality control proxies) and an external component. Consistent with Anderson et al. (2009), we obtain the proxy for corporate transparency by decomposing the opacity index into governance and an external component. Based on our research purpose, we only adopt *Gscore* to tease out the effect of internal corporate governance in the opacity index.[6] The residual (ε) of the following model (Eq. (13)) is the measure of external opacity (*External*).

$$Opacity_{i,t} = \alpha_0 + \alpha_1(CorporateGovernanceProxy)_{i,t} + \varepsilon_{i,t} \tag{13}$$

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[6] We also follow Anderson et al. (2009) and employ three disclosure quality control proxies (Corporate governance, Earnings quality, and ΔEPS) to decompose *Opacity* into disclosure quality component and market scrutiny component. The first proxy is *Gscore*. The second proxy is earnings quality, measured as the association between accruals and cash flow. The third proxy is the difference in EPS from year/t to year t−1. We use the market scrutiny component instead for *Opacity*. The untabulated results show that all the coefficients of interest remain similar to the above results, which indicates that the results of additional tests are robust.

Table 8
The effect of opacity and market competition on value—External component of *Opacity*.

	OLS results		HLM results	
	(1)	(2)	(3)	(4)
External	−1.470***	−0.744***	−1.064***	−0.044
	(−15.51)	(−2.66)	(−9.91)	(−0.15)
*External*MHHI (Ind_MHHI)*		−0.989**		−1.719***
		(−2.56)		(−4.10)
MHHI (Ind_MHHI)		−0.077		−0.045
		(−0.85)		(−0.85)
Size	−0.019**	−0.019**	−0.030***	−0.030***
	(−2.04)	(−2.12)	(−3.90)	(−3.94)
Age	0.047***	0.048***	0.024**	0.026**
	(3.81)	(3.84)	(2.20)	(2.31)
Growth	0.496***	0.495***	0.494***	0.491***
	(9.97)	(9.93)	(12.65)	(12.59)
Lev	−0.521***	−0.516***	−0.481***	−0.479***
	(−7.56)	(−7.49)	(−8.70)	(−8.68)
Cash	1.795***	1.799***	1.777***	1.786***
	(17.35)	(17.38)	(23.07)	(23.20)
Capex	2.021***	2.001***	1.636***	1.596***
	(8.01)	(7.93)	(8.16)	(7.95)
RD	0.551*	0.542*	0.437***	0.439***
	(1.89)	(1.86)	(2.61)	(2.62)
DRD	0.238***	0.236***	0.248***	0.249***
	(8.95)	(8.89)	(11.60)	(11.54)
AD	5.143***	5.205***	5.121***	5.147***
	(8.38)	(8.45)	(14.12)	(14.22)
Gscore	−0.141***	−0.142***	−0.119***	−0.117***
	(−4.40)	(−4.42)	(−4.12)	(−4.05)
BS	0.133***	0.136***	0.145***	0.141***
	(3.01)	(3.07)	(3.55)	(3.47)
Ins	0.101	0.100	0.081	0.076
	(1.60)	(1.57)	(1.48)	(1.38)
Intercept	1.008***	1.076***	0.997***	1.044***
	(5.91)	(6.02)	(8.39)	(8.24)
Year F.E.	Yes	Yes	Yes	Yes
Ind. F.E.	Yes	Yes	No	No
Adj. R² (R²)	38.77 %	38.79 %	44.05 %	44.11 %
F-value	28.499***	71.219***	—	—
N	12,665	12,665	12,665	12,665

Note. This table reports the results from OLS and HLM regressions using external component of *Opacity*. We obtain the proxy for corporate transparency by decomposing the opacity index into governance component and external component (*External*) to rule out the effects of corporate governance in opacity index. We test the relationship between *External* and firm value and the moderating effects of market competition. We present the variable definitions in Table 1. The *t*-values are in the parentheses. Adj. R² (R²) is the adjusted (unadjusted) power of explanation of OLS (HLM) regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 8 presents the results of using *External* instead of *Opacity* as the independent variable. We find that *External* has a significantly negative relationship with Q in column (1) and column (3). In addition, the coefficients on *External*MHHI* are significant and negative at both the individual and industry levels (OLS: −0.989, $p < 0.05$; HLM: −1.719, $p < 0.01$). Hence, the empirical results of the opacity index excluding the internal corporate governance are still robust. For further robustness, we follow Armstrong et al. (2012) to capture the corporate information environment[7] and re-estimate Eq.(2), Eq.(3), and Eq. (4), replacing *Opacity* with each information environment measure separately. As expected, in untabulated results, three of eight variables pass the OLS tests, but six of eight variables pass the HLM tests. Their effect direction is consistent with the theoretical expectation, implying that our findings are confirmed once again from the corporate information environment perspective.

Regarding the analysis discussed above, the positive effect of market competition on the relationship between transparency and firm value is indeed dominantly driven by the corporate information environment component. This result suggests that when companies face fierce market competition, corporate transparency enhances firm value once again, while corporate governance cannot. The principal reason is that corporate governance ensures operating efficiency, while corporate transparency aims at the improvement of information efficiency. In addition, our measurement of corporate transparency mainly captures the market reaction of corporate information rather than serving as a direct proxy to describe

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[7] Owing to data availability, we finally adopt eight proxy variables, grouped as follows: (1) information asymmetry: bid-ask spread and net purchase ratio of insiders; (2) private information gathering: idiosyncratic volatility; (3) financial statement informativeness: the value relevance of financial statements, and the association between accruals and cash flows; (4) analyst behavior: analyst forecast coverage, disagreement among analysts' annual EPS forecasts, and the earnings forecast error. Owing to space limitations, we do not show the measurement details of variables and results in the text.

the impact of corporate governance on the information environment. Stronger market competition prompts companies to focus on operating to gain a competitive advantage and thus partly substitutes corporate governance. In contrast, strong market competition promotes the flow of information related to the industry. As a result, transparency will be further improved and thus add value to companies with the help of market competition. However, corporate governance is designed to relieve agency problems that arise between managers and shareholders and between major shareholders and minority shareholders. The market competition provides an almost similar function on restricting manager behaviors and partly substitutes those mechanisms (Chou et al., 2011). Since corporate transparency can expose and restrict more agency problems, market competition complements transparency rather than effectively replacing it.

Correspondingly, we conduct an analysis of whether the impact of market competition on the relationship between transparency and firm value differs under different corporate governance practices by dividing the full sample into subsamples of strong and weak corporate governance. We take observations below the median value of *Gscore* to represent strong governance (N = 5,934) and those above the value of the median value of *Gscore* as weak governance (N = 6,731). We then re-estimate Eq. (3) for the two subsamples and examine if the coefficient changes.

Table 9
The results of OLS and IV-2SLS tests in different degree of corporate governance.

Panel A: Subsample tests results	OLS results		IV 2nd stage results IV: *DQ*		IV: *DQ_BS*		IV: *DQ_IS*	
	Strong Governance	Weak Governance	Strong Governance	Weak Governance	Strong Governance	Weak Governance	Strong Governance	Weak Governance
Opacity	−1.047***	−0.577	12.657***	2.960	7.433**	4.373**	22.034***	2.583
	(−2.66)	(−1.44)	(3.92)	(1.59)	(2.05)	(2.00)	(4.15)	(0.93)
MHHI	−0.108	0.838***	−0.548	2.208***	−0.582	2.282***	−0.376	2.279***
	(−0.31)	(2.74)	(−0.90)	(4.74)	(−0.96)	(4.87)	(−0.61)	(4.89)
*Opacity*MHHI*	−0.414	−1.450***	0.567	−4.074***	0.634	−4.215***	0.233	−4.215***
	(−0.72)	(−2.70)	(0.50)	(−4.78)	(0.56)	(−4.91)	(0.21)	(−4.93)
Size	−0.022*	−0.015	0.416***	0.045	0.259**	0.092	0.694***	0.028
	(−1.65)	(−1.16)	(4.38)	(0.73)	(2.39)	(1.25)	(4.36)	(0.29)
Age	0.074***	0.016	−0.059*	0.004	−0.011	−0.007	−0.143***	0.009
	(3.67)	(0.98)	(−1.69)	(0.20)	(−0.29)	(−0.28)	(−2.78)	(0.31)
Growth	0.589***	0.370***	0.821***	0.396***	0.738***	0.416***	0.966***	0.388***
	(7.22)	(6.33)	(8.28)	(5.95)	(7.04)	(6.00)	(8.19)	(5.32)
Lev	−0.291***	−0.788***	−0.814***	−0.759***	−0.628***	−0.748***	−1.142***	−0.760***
	(−2.82)	(−7.98)	(−5.14)	(−7.59)	(−3.62)	(−7.39)	(−5.30)	(−7.55)
Cash	1.574***	1.878***	1.544***	1.823***	1.553***	1.782***	1.527***	1.838***
	(10.62)	(12.24)	(10.39)	(11.04)	(10.40)	(10.49)	(10.27)	(10.46)
Capex	1.824***	2.280***	1.533***	2.293***	1.649***	2.314***	1.324***	2.287***
	(4.72)	(7.14)	(3.84)	(7.02)	(4.06)	(7.10)	(3.27)	(6.96)
RD	1.129**	−0.236	3.506***	−0.159	2.662***	−0.122	4.990***	−0.172
	(2.57)	(−0.59)	(5.09)	(−0.39)	(3.50)	(−0.30)	(5.23)	(−0.42)
DRD	0.296***	0.198***	0.595***	0.229***	0.487***	0.258***	0.786***	0.219***
	(6.13)	(6.66)	(7.42)	(4.73)	(5.61)	(4.80)	(6.60)	(3.29)
AD	3.879***	5.627***	6.132***	6.158***	5.303***	6.552***	7.601***	6.020***
	(4.50)	(6.37)	(6.24)	(5.84)	(5.18)	(5.91)	(6.39)	(4.94)
BS	0.101	0.147**	0.424***	0.157**	0.308***	0.165**	0.627***	0.154**
	(1.47)	(2.43)	(4.33)	(2.50)	(3.00)	(2.62)	(4.54)	(2.40)
Ins	0.180*	−0.070	0.895***	−0.002	0.641***	0.051	1.344***	−0.021
	(1.80)	(−0.79)	(4.83)	(−0.01)	(3.24)	(0.41)	(4.75)	(−0.15)
Intercept	1.264***	1.420***	−10.092***	−0.948	−5.885**	−2.141	−17.592***	−0.582
	(3.49)	(4.53)	(−3.91)	(−0.60)	(−2.03)	(−1.15)	(−4.11)	(−0.24)
Year F. E.	YES	YES	YES	YES	YES	YES	YES	YES
Ind. F. E.	YES	YES	YES	YES	YES	YES	YES	YES
Adj. R²	37.54 %	45.12 %	40.14 %	46.30 %	39.98 %	46.31 %	40.16 %	46.31 %
F-value	104.794***	46.576***	3,680.147***	37.006***	204.760***	167,724,808.420***	128.455***	35.337***
N	5,934	6,731	5,934	6,731	5,934	6,731	5,934	6731

Panel B: z-test results															
OLS				IV: *DQ*				IV: *DQ_BS*				IV: *DQ_IS*			
Dif	z	Prob1	Prob2	Dif	z	Prob1	Prob2	Dif	z	Prob1	Prob2	Dif	z	Prob1	Prob2
−1.036	−1.317	0.0989	0.1979	−4.641	−3.272	0.0013	0.0027	−4.849	−3.413	0.0009	0.0019	−4.448	−3.176	0.0017	0.0034

Note. This table reports the results of subsamples tests (Panel A) from OLS and the second stage of IV-2SLS regressions, and z-test (Panel B); the sample consists of 12,665 observations which are divided into two subsamples by the median value of corporate governance. Strong (weak) corporate governance firms are those firms located below (above) the 50% quantile of *Gscore*, which consists of 5,934 (6,731) observations. In IV-2SLS tests, we use total disclosure disaggregation quality (*DQ*), balance sheet disclosure disaggregation quality (*DQ_BS*) and income statement disclosure disaggregation (*DQ_IS*) as instruments, respectively. We present the variable definitions in Table 1. In Panel A, the *t*-values are in the parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Adj. R² is the adjusted power of explanation. In Panel B, Dif is the difference between coefficients on *Opacity*MHHI*; *z* is the *z*-value; Prob1 is the one-tail p-value; and Prob2 is the two-tail p-value.

The results are presented in Table 9. In Panel A, OLS results show that the coefficient of *Opacity*MHHI* is negative and strongly significant ($\beta = -1.450$, $p < 0.01$) with weak corporate governance. In contrast, as expected, it is not significant with strong corporate governance. In Panel B, we illustrate that the difference between coefficients on *Opacity*MHHI* is only slightly significant in one-tail *z*-test ($p < 0.1$), which primarily verifies that the effect of competitive pressure on value promotion of transparency is more effective for firms with weaker corporate governance. However, as discussed before, the OLS regressions may be biased owing to potential simultaneity. So we re-examine the IV-2SLS regressions in subsamples using the same instruments as before (*DQ, DQ_BS,* and *DQ_IS*). Notably, *Opacity*MHHI* is significantly and negatively associated with firm value in the second stage in all weak corporate governance subsample regressions no matter what the instruments are. In comparison, the results for the three strong governance subsample regressions of the second stage show that competition has no effect on the relationship between transparency and firm value. Moreover, Panel B shows that all the differences between the coefficients of *Opacity*MHHI* in strong governance and weak governance are significant at the 1 % level in both one-tail and two-tail *z*-tests no matter whether *DQ, DQ_BS,* or *DQ_IS* is used as the instrument.

Therefore, if corporate governance is weak, competition acts as an external substitute monitoring mechanism, thus enhancing the value promotion effect of transparency again. However, in contrast, competition is ineffective when corporate internal governance is good. These results prove that market competition substitutes for corporate governance, a relationship that is highlighted in many empirical studies (e.g., Giroud and Mueller, 2010, 2011; Chou et al., 2011). In comparison, the crux of our study is that firms with different degrees of governance react differently to the effect of competition in terms of the relationship between corporate transparency and firm value. Gupta et al. (2018) argue that the external governance environment complementarily affects a firm's cost of equity capital in association with firm-level corporate governance. Similarly, we emphasize that the information efficiency of corporate transparency should combine with external governance mechanisms and thereby improve firm value. The role of market competition relative to transparency may be irreplaceable, but this moderating effect can be substituted by corporate governance to some extent. The impact of corporate governance on this relation may be greater than that of corporate information efficiency.

We caution that corporate governance and corporate transparency cannot be completely separated, and the examinations above only extract what we can control. Despite our best efforts, the discussion and inference in this section are rough, and it is a limitation of the current study.

Conclusions

This study empirically investigates the effect of market competition on the relationship between transparency and firm value using a sample of U.S. listed companies for fiscal years 1996–2018. We introduce the external governance mechanism into a logical framework with the aim of contributing to the debate on the bright side and dark side of market competition and the interactive effect of the corporate information environment and market competition on firm value.

Overall, the empirical results indicate that corporate transparency has a significantly positive relationship with firm value. The greater transparency brings more comprehensive information to investors, such that risks are expected to be effectively controlled and investors' confidence is expected to be strengthened, which is conducive to the improvement of firm value. In addition, this study demonstrates that external discipline imposed by market competition significantly strengthens the promotion of firm value by transparency at both the individual firm and industry levels. Under competitive pressure, the bankruptcy threat and the reputation incentive arising from market competition play positive roles in reducing agency problems and accelerating information flow, supporting the bright side viewpoint coinciding with prior research (e.g., Chhaochharia et al., 2017). Our theoretical and empirical results are robust to endogenous issues and alternative measures of interest. We also obtain similar conclusions in a cross-sectional variation test. Further, considering the endogenous relationship between transparency and corporate governance, we find that different from the substitutive effect of market competition on corporate governance, corporate transparency promotes the firm value of information efficiency when market competition is strong. In addition, we reveal that the impact of market competition on the relationship between transparency and value is only significant in the context of weak governance. This result supports the substitutive perspective that the external governance pressure from market competition acts as an alternate governance mechanism for internal governance while playing a complementary role for corporate transparency.

The results of this study have several managerial implications for companies, market, and authorities. Companies should be urged to take the extent of market competition into account when heightening overall governance efficiency to reduce information asymmetry and agency problems. Since the findings confirm the complementary perspective on market competition and corporate transparency and the substitutive relation between competition and internal governance, they show that creating and maintaining a fair market competition environment is an effective external governance mechanism. The market should be encouraged to play its role in restricting managers and exerting the survival pressure on companies. Moreover, standard setters should establish different rules and regulations on corporate governance and information disclosure according to market intensity. Lastly, authorities should develop a more comprehensive and objective transparency evaluation system for companies. This action will facilitate a better corporate information environment and improve the positive effect of the complementary relationship between transparency and market competition on the promotion of firm value.

There are some limitations to this study that can guide future research. First, we follow Anderson et al. (2009) and measure transparency using the opacity index, which helps us capture the corporate information environment. It would be valu-

able to establish a comprehensive and dynamic proxy to capture the essence of the concept of corporate transparency. Second, Su et al. (2016) find that corporate social responsibility serves as a positive signal that affects firm performance in emerging economies. Hence, research on other economies with different cultures and institutional mechanisms would be interesting to see whether and how our findings differ.

Declaration of Competing Interest

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

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