



Information disclosure, transparency ranking system and firms' value deviation: evidence from Taiwan

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Published online: 25 September 2018
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Abstract

We examine whether the implementation of the information disclosure and transparency ranking system (IDTRS) affects firms' value deviation in Taiwan using the annual reports of the listed companies for the period 2001–2004. Using firms' value deviation as a proxy for information disclosure, we find that reducing information asymmetry can allay moral hazard. We also document a significant difference in the level of information disclosure in the years before and after the IDTRS implementation. Stronger information transparency can strengthen investment certainty and lead to less forecasting errors.

Keywords Corporate governance · Firm value deviation · Information disclosure · Transparency ranking system

JEL Classification G3 · G18 · G30 · G34 · K23

1 Introduction

The level of stock market reflects a nation's economic development. Stock prices change unpredictably. But market can become more efficient by providing investors with ample information to help them make the most favorable decisions with regard to their investment portfolios.

The agency problem between internal managers and shareholders, first raised by Jensen and Meckling (1976), suggests that internal managers' and shareholders' self-interest

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behaviors often lead to loss of investors and decline of enterprises. Similar causes are frequently observed as the insiders often possess superior information about the operation of enterprises. By contrast, other investors, due to information insufficiency, are relatively weak and naturally lacking in abilities to detect corrupt practices (Fama 1980; Fama and Jensen 1983). With the issues caused by the agency problem and the incessant fraud cases of enterprises over the years, information disclosure has recently attracted interest from both academia and practice.

Except encouraging voluntary information disclosure, financial regulators set criteria to measure firms' information transparency. In Taiwan, the Securities and Futures Institute (SFI) decided to construct the Information Disclosure and Transparency Ranking System (IDTRS) to measure firm's information transparency and encouraged them to voluntarily disclose information. With 109 criteria in 5 subcategories including the mandatory disclosure, timeliness of reporting, disclosure of financial forecast, disclosure of annual reports, and corporate website disclosure, the IDTRS measures publicly traded companies' both mandatory level and voluntary level of disclosure annually (1393 listed companies were ranked in 2015). Voluntary disclosure is regarded highly in the IDTRS, firms voluntarily disclosing information will be announced in the public and will also get higher ranking in the system. What's more, the rating results are accessible online before the result published, for companies could apply for a review. According to IDTRS's reports, most of the ranked companies concerned about their rating results and applied for reviews, which indicates that most listed companies concern about their ranking in the IDTRS. Though greater information disclosure is useful for reducing agency problem, whether this ranking system can effectively remedy the agency problem remains unanswered.

By publishing rankings of the listed firms annually, the IDTRS also aims to help ordinary investors identify the degree of information asymmetry of firms. However, differences in information disclosure often imply the existence of other problems with varying degrees of severity (Bushman and Smith 2001; Healy and Palepu 2001; Boone and White 2015), including stock liquidity (Glosten and Milgrom 1985; Diamond and Verrecchia 1991), corporate cost of capital (Botosan 1997; Sengupta 1998; Healy et al. 1999), and earnings quality (Sengupta 1998; Francis et al. 2008). These factors may affect firm value. Consequently, the transparency ranking system becomes a supplementary decision-making reference for investors. Lee and Lee (2015) conclude that IDTRS is helpful for decreasing mispricing of accruals. They also indicate that firms with high ranking in the IDTRS face with less overpricing of accruals, cash flow, and abnormal returns. Chung et al. (2015) indicate that IDTRS effectively incentivizes the voluntary information disclosure. Studies generally focus on the importance of information transparency; very few studies investigate how firms respond to the implementation of the IDTRS.

The main reason for financial regulatory bodies to introduce transparency ranking systems is to provide investors with a convenient channel through which they can know a firm's level of information disclosure, thereby helping them make more favorable investment decisions. However, the IDTRS implementation has indirectly forced firms to improve their information disclosure practices. Chung et al. (2015) observe that the implementation of the IDTRS is effective in increasing firm value. Lin and Yang (2012) examine Regulation Fair Disclosure (Reg. FD) in which all firms have to disclose information not just to certain institutions but also to the general public. They find that the enactment of Reg. FD generally helps decrease analysts' forecast error and dispersion for restructuring companies. Similar to Reg. FD, the IDTRS encourage a high level of information transparency and therefore would help improve the quality of forecast.

Sheng and Thevenot (2015) find that different participants in stock market interpret information differently. This difference is positively related to a firm's cost of capital. Thus, with more information disclosure, the IDTRS may reduce the opinion divergence and lower the cost of capital. Wang et al. (2015) address the information asymmetry problem by investigating the issue of earning forecast. They point out that financial analysts tend to follow firms that voluntarily disclose their earnings forecast than those that are forced to do so, and analysts can issue forecasts that are more accurate for the former type of firms. Chang et al. (2014) also find that analysts may cause forecast dispersion since they do not "use" the information disclosed by firms when the analysts themselves are not certain of the information. The IDTRS contributes to rebuilding the relationship between analysts and firms by showing the level of information transparency, making analysts more "certain" about the information disclosed by firms.

By using the annual reports of Taiwanese listed companies from 2001 to 2004, this paper examines whether the IDTRS improves firms' information disclosure, which is represented by firms' value deviation. Our result reveals that condition of information disclosure in Taiwan capital market have undergone a significant improvement after the IDTRS implementation. And the firm's value deviation gradually decreases during the sample period. This study contributes to the literature in the way of emphasizing the relation between IDTRS and firm's value deviation, which provides a new perspective to research the information disclosure in Taiwan and broaden the understanding of IDTRS. Chang and Fang (2006) focus on information ranking system effectively reducing the problem of earning management. Lee and Lee (2015) pay attention to IDTRS affecting the mispricing of accruals. This study also provides policy implications to the regulatory authority in developing proper information mechanism to supervise the capital market. IDTRS is useful for reducing firm's value deviation. In other words, IDTRS in some degree has achieved its goal to encourage more information disclosure and reduce information asymmetry.

The remainder of the paper is organized as follows. Section 2 reviews the relevant literature and defines the research hypotheses. Sections 3 and 4 explain the data sample and the definitions of variables used in the analysis, respectively. Section 5 analyzes the differences in value deviation before and after the introduction of the IDTRS; it also describes the methodology and results of comparative statistics, regression analysis, and sensitivity analysis. Section 6 concludes the study and provides suggestions for future research.

2 Literature review and hypotheses

2.1 Comprehensive information disclosure can effectively lower the cost of capital

Incomplete information disclosure significantly causes deviation in credit risk assessment (Liao et al. 2009), analysts and investors must bear greater risks to gain the same expected returns, compared with those having comprehensive information. Rational investors thus demand higher risk premiums to increase their returns (Spicer 1978), particularly in the case of an individual company with non-systematic risk that cannot be dispersed. Welker (1995) early asserted that relative bid-ask spreads for firms with less or incomplete information disclosure are about 50% higher than firms with comprehensive information disclosure. Hence, a company that reduces estimated risk by disclosing more information can lower its financing cost. However, Cambell et al. (2014) states that firms disclose more risk factor information would cause greater risk for themselves, but is useful for investors.

Merton (1987) indicates that the less comprehensively a company discloses information, the lower its value is, and the difference increases as the number of investors decreases. Moreover, when a company discloses information more comprehensively, investors have more confidence in the company's future prospects, and more of them will invest in the company, thereby increasing its value. Core (2001) and Healy and Palepu (2001) identify a significantly negative correlation between financial information disclosure and the cost of capital. In addition, Diamond and Verrecchia (1991) argue that an increase in information disclosure can lower information asymmetry and transaction costs, improve liquidity, and reduce a company's cost of capital (Welker 1995; Leuz and Verrecchia 2000; Heflin et al. 2003; Cheng et al. 2006; Lin 2006; Eaton et al. 2007; Yu and Chen 2017).

Most studies focus on the correlation between financial information disclosure and capital costs. However, few studies address the question of whether a firm's policy on the disclosure of nonfinancial information can increase a firm's value by helping investors understand the firm's future development and its ideas about sustainability. Dhaliwal et al. (2011) examine the relationship between the voluntary disclosure of nonfinancial information and the cost of capital and report that companies with high capital costs tend to voluntarily disclose information about their corporate social responsibility (CSR) performance, because a company with outstanding CSR performance can have a lower cost of capital. Maletta and Zhang (2012) suggest that investors predict high earnings per share for firms with more positive earnings preannouncements (voluntary information disclosure), when firms' earning preannouncements are contrasting. Hence, regardless of whether the information disclosed is financial, if it accurately presents the company's ideal image and transparently reflects the firm's finances, it can lower the capital costs and boost the firm's value effectively.

2.2 Reducing information asymmetry can increase firm value

According to Chen and Liu (2013), the disclosure of firm information is valuable for corporate governance, leading to a higher stock valuation. Furthermore, by examining the effects of corporate governance provisions on shareholder value, Cunat et al. (2012) demonstrate that shareholder-sponsored governance proposals can cause abnormal stock returns. According to Healy and Palepu (2001), the most fundamental purpose of information disclosure is to inform shareholders of business performance and corporate governance. Furthermore, regulations of standards for information disclosure primarily are aimed at lowering information asymmetry (Singhvi and Desai 1971; Leftwich 1980; Verrecchia 1990; Holland 1998; Perotti and Thadden 2003; Bushee and Leuz 2005; Chung et al. 2015; Pan et al. 2015). Information disclosure is thus inextricably related to both corporate governance and firm value.

To effectively minimize the negative impact of information asymmetry on firm value, firms can improve the integrity of information disclosure and raise the quality of disclosed information. Gao (2010) reports that improving the quality of information disclosure can reduce a firm's cost of capital and thus increase shareholders' wealth. Moreover, Armstrong et al. (2011) observe that information asymmetry results in a greater increase in a firm's cost of capital than in its risk factors; therefore, the importance of improving the quality and integrity of information disclosure cannot be ignored. Hughes et al. (2007) and Lambert et al. (2007) assert that the more satisfactory the quality of the disclosed information, the lower the information asymmetry between shareholders and executives, thus leading to a higher firm value. Bloomfield and Fischer (2011) confirm the critical influence of

disclosure quality on a firm's cost of capital: when traders ignore relevant disclosures, the cost of capital decreases; however, when traders respond to relevant disclosures, the cost of capital increases.

The preceding discussion highlights the crucial relationship between corporate governance and firm value. Most studies conclude that corporate governance and firm value exhibit a positive relationship (Gompers et al. 2003; Durnev and Kim 2005; Chan and Cheung 2012). There are a few studies examining whether the same phenomenon is still present in emerging markets. For example, Klapper and Love (2004) identify that more effective corporate governance leads to higher firm value and more satisfactory firm performance in fourteen emerging markets. Furthermore, Lee and Lin (2010), Braga-Alves and Shastri (2011), Hermalin and Weisbach (2012), and Gong and Ho (2018) reach the same conclusion on the relationship between corporate governance and firm value.

In addition, reducing information asymmetry can also lessen moral hazard, which refers to a concern that business ethics at the management level depend on the extent of employees' knowledge about the affairs of the firm. High information asymmetry exists between insiders and investors in stock markets; if one party that has the information does not share it with the other party, then a severe temptation for the abuse of power can occur, which can lead to the problem of adverse selection and moral hazard. Moral hazard occurs when outside investors are not informed that the lower stock price evaluation from corporate governance systems is due to insufficient effort of the owner-manager (Chen and Liu 2013). Furthermore, Chhaochharia and Grinstein (2007) identify that the effort exerted by the owner-manager of a firm might be underestimated and presented as a lack of efficient monitoring, but it affects firm performance and leads to moral hazard. Discussing optimal securitization, Hartman-Glaser et al. (2012) emphasize that the information enhancement effect, which refers to that investors infer the quality of mortgages by observing the entire pool, is crucial to the supervision of moral hazard in mortgage contracts.

Specifically, due to information asymmetry, moral hazard is observed among many managers in different projects, which is a concern that cannot easily be solved by incentives. Tuttle et al. (1997) argue that information system professionals who have experienced the conditions of moral hazard exhibit a greater tendency to implement a system with quality problems than those who have not experienced moral hazard, although this decision in some manner is influenced by how fair or how socially acceptable it is to these professionals. Chen and Liu (2013) observe that owners and managers have a negative impact on information disclosure and corporate governance provisions, even when managers are provided paid incentives to maximize efficiency. Therefore, stock-related managerial reward will cause moral hazard that cannot be solved by outside investors. Bergmann and Friedl (2008) assert that in highly dynamic markets with a high degree of information asymmetry, an R&D manager, whose activities are not observable, is expected to have more information regarding the profitability of a specific development project. Moreover, strong incentives on the basis of the project's profit cannot effectively solve the moral hazard problem as they place considerable risk on the project managers, particularly for executing managers' routine jobs. Managers thus do not respond to the incentives actively.

Therefore, high information asymmetry between insiders and investors is likely to result in the risk of moral hazard. Better information disclosure and more transparency can address this problem by reducing the information asymmetry between insiders and investors. In the case of Taiwan, the implementation of the IDTRS will force firms to disclose more information, converting substantial private information into public information. Such more comprehensive information disclosure will reduce information asymmetry and moral

hazard, and thus generate more effective corporate governance and higher firm value for firms in Taiwan.

2.3 Increasing information disclosure reduces firms' value deviation

There is a positive relationship between disclosure rankings and stock returns, possibly because an increase in information disclosure can help rectify the deviation of market valuation (Jiao 2011). Agarwal et al. (2009) illustrate that increasing information disclosure is related to lower mutual fund performance, especially when quarterly mutual fund portfolio disclosure is required. Fraud and incorrect decisions by managers can be reduced by emphasizing companies' operation procedures (Shive and Yun 2013). From the press coverage perspective, Chen et al. (2009) report that abnormal press coverage generates intense sentiment among investors, which probably causes mispricing of a firm's stock and firm value deviation. By contrast, Hung and Chen (2012) fail to verify the negative relationship between the amount of news and a firm's value deviation.

The SFI aims to increase transparency in information disclosure in Taiwan with the establishment of the IDTRS to enhance corporate governance, which may help firms to increase their market value and lower their financing costs. Studies have found that the SFI has achieved such a goal. For example, Lee and Lee (2015) report that the IDTRS is useful in reducing accrual mispricing for investors and thus suggest that the regulatory authority should develop a mechanism to decrease the information asymmetry problem. Chung et al. (2015) and Pan et al. (2015) demonstrate that the IDTRS improves firm value and financial leverage by providing more information transparency. To explore whether compulsory information disclosure is effective in reducing information asymmetry between firms and investors and thus increasing firm value, we test the following two hypotheses.

Hypothesis 1 The implementation of the IDTRS can effectively reduce firms' value deviation.

Most studies find that additional improvement in the integrity of information disclosure can increase firm value. Voluntary disclosure of information not only enhances investors' understanding of a firm's business philosophy and financial structure but also improves the ratings of the firms provided by relevant assessment agencies. According to Gelb and Zarowin (2002) and Lundholm and Myers (2002), disclosing more information voluntarily decreases information asymmetry between investors and firms, thereby reducing the information risk of the cost of capital. Furthermore, increasing voluntary information disclosure can improve the market's expectation of the firm's future earnings. These studies also indicate that voluntarily disclosing more information before profit announcements assuages investors' anxiety and decreases stock price fluctuations. Holthausen and Verrecchia (1988) and Kim and Verrecchia (1991) observe that the market's reaction to profit announcements varies with the amount of preannouncement disclosure and the level of information asymmetry varies with company size. In other words, stock price fluctuations after profit announcements tend to be greater for smaller companies (Atiase 1985; Collins et al. 1987; Freeman 1987). The effects of preannouncement disclosure are stronger in developing markets due to their more relaxed regulations and noncompulsory public rankings (Hail 2002). That is to say, the difference between market expectations and true value tends to be lower in trading markets with a higher level of preannouncement disclosure.

To minimize the adverse effects of information asymmetry on investors and firms, the SFI instituted the IDTRS; no such independent ranking system that evaluated firms had been previously established. Before the implementation of the IDTRS, firms took preemptive measures to make their information disclosure more comprehensive to avoid being ranked lower than anticipated. Thus, firms' value deviation was effectively lowered before the IDTRS implementation. Consequently, our second hypothesis is formulated as follows.

Hypothesis 2 When the time draws closer to the implementation of the IDTRS, the deviation of firm value gets smaller.

3 Data sample

To examine whether the IDTRS¹ compels Taiwanese companies to improve their information disclosure practices, we consider the annual reports of listed Taiwanese companies for the period 2001–2004 (2 years before and after the first implementation of the IDTRS in 2003²) as our samples. The sample selection criteria are as follows. (1) We consider the methods of the IDTRS in selecting companies; we, however, exclude companies that have been listed for less than a year. (2) To compare the changes in value deviation before and after the IDTRS implementation, all companies are required to have complete financial and accounting information for the 4 years. (3) To provide more accurate estimate of value deviation, we exclude industries with fewer than five companies listed in any year of the sample period. We obtain the data from the *Taiwan Economic Journal*, which cover 702 companies (2808 firm-years) and include 22 industries (see Appendix 1 for details).

4 Methodology

We use a system implementation dummy variable (whether the IDTRS is implemented) to quantify the effects of the IDTRS implementation on firms' value deviation. The variable is set to 1 for the sample data from 2003 and 2004, 0 for the sample data from 2001 and 2002. To measure first estimation of firms' value deviation, we use Eq. (1) provided by Rhodes-Kropf et al. (2005) to predict firms' value deviation (error term). The equation is following:

$$\ln(m_{ijt}) = \alpha + \beta_1 \ln(B_{ijt}) + \beta_2 \ln(NI_{ijt}^+) + \beta_3 I_{<0} \ln(NI_{ijt}^+) + \beta_4 LEV_{ijt} + \varepsilon_{ijt} \quad (1)$$

where $\ln(m_{ijt})$ is natural log of market capitalization of sample firms, $\ln(B_{ijt})$ is natural log of book value of equity, NI is the absolute value of net income and $I_{<0}$ is a dummy variable, taking a value of 1 when the net income is negative, and 0 otherwise. LEV is the leverage ratio, calculated as firm i 's debt in industry j in year t divided by its total assets.

In addition, we use Eq. (2) to compare two firms' value difference between predict imputed value and actual value, getting the firms' value deviation estimation provided by Berger and Ofek (1995) and Rhodes-Kropf et al. (2005) in an alternative manner:

¹ The 114 questions used to compile the transparency scores for each sample firm are shown in Appendix 3 (Pan et al. 2015).

² In 2003–2004, the firm information disclosure score separates disclosure and nondisclosure.

$$Deviation = \ln \left[\frac{Actual\ value_{it}}{Imputed\ value_{it}} \right] \quad (2)$$

where $Actual\ value_{it}$ is the market value of equity plus the book value of debt, and $Imputed\ value_{it}$ is the sum of total capital and the accounting item that we use three alternative measurement include (1) sales (2) assets (3) earnings before interest, tax, depreciation, and amortization (EBITDA) for the median single-segment firm in segment industry i in year t . For example, we follow Rhodes-Kropf et al. (2005), multiplying sales revenue times the median market value for a company in the industry during the sample year (we differentiate between industries based on the industry code used by the stock exchange) divided by the median sales revenue for the industry in imputed value. The definition of firms' value deviation used in this paper is the value of the sample firm's actual market value divide by its imputed market value. The higher difference value meaning higher firms' value deviation.

To clarify how the implementation of the IDTRS influences firms' value deviation, we refer to previous studies on value deviation and incorporate the following control variables into the regression analysis. We consider additional variables on firm characteristics and corporate governance in Eq. (3).

$$\begin{aligned} Deviation_{ijt} = & \alpha + \beta_0 IDTRS + \beta_1 \ln(B_{ijt}) + \beta_2 \ln(NI_{ijt}^+) + \beta_3 I_{<0} \ln(NI_{ijt}^+) + \beta_4 LEV_{ijt} \\ & + \beta_5 ROA_{ijt} + \beta_6 AGE_{ijt} + \beta_7 SDS_{ijt} + \beta_8 SLS_{ijt} + \beta_9 TSC_{ijt} + \beta_{10} TSV_{ijt} \\ & + \beta_{11} Dummy(DIV)_{ijt} + \beta_{12} Dummy(TSE)_{ijt} + \beta_{13} Dummy(INDUSTRY)_{ijt} + \varepsilon_{ijt} \end{aligned} \quad (3)$$

where Berger and Ofek (1995) and Rhodes-Kropf et al. (2005) use $Deviation_{ijt}$ in four methods to estimate firms' value deviation in market capitalization and book value of sample firms; ROA is the earning to book value of assets. AGE is a firm's survival age. SDS is the percentage of total outstanding shares owned by directors and supervisors. SLS is the percentage of total outstanding shares owned by the largest shareholder. TSC is measured by the times of seating to cash flow rights. TSV is measured by the times of seating to voting rights. $Dummy(DIV)$ is 1 if cash dividends are paid and 0 otherwise. $Dummy(TSE)$ is 1 if the stock of the observed firm is traded in the Taiwan Stock Exchange and 0 if it is traded in the GreTai Securities Market (OTC). $Dummy(INDUSTRY)$ denotes a set of binary variables where Dummy industry 1 is set to 1 when the observed firm is in the cement industry and 0 when it is in another industry, Dummy industry 2 is set to 1 when the firm is in the food industry and 0 when it is in another industry, and so on. Thus, the total number of industry dummies is 21.

5 Empirical results

5.1 Summary statistics

Table 1 shows the summary statistics of the characteristics and governance measures of the sample firms. The mean (median) of firm value deviation ($Deviation\ 1$) is 0.94 (0.76), and that of $Deviation\ 2$ is 0.74 (0.51). The right-skewed distribution indicates that the majority of sample firms have lower than average value deviation. Among the firm characteristics used for control variables, the average (median) $\ln(BE)$ measured by return on equity is 14.81 (14.62), suggesting that most of the Taiwanese firms' book value of equity is high.

Table 1 Summary statistics of all firms

	Mean	STD	Min	Q1	Median	Q3	Max	N
Deviation 1	0.94	1.36	-2.14	0.01	0.76	1.61	6.72	2808
Deviation 2	0.74	1.39	-2.50	-0.18	0.51	1.39	6.50	2808
Deviation 3	0.24	1.35	-3.26	-0.65	0.08	0.90	6.27	2808
Deviation 4	3.02	1.42	-0.26	2.06	2.81	3.77	8.64	2808
IDTRS (0,1)	0.50	0.50	0.00	0.00	0.50	1.00	1.00	2808
Ln (BE)	14.81	1.33	10.64	13.87	14.62	15.51	19.80	2808
Ln (NI)+	12.18	1.74	4.28	11.14	12.14	13.18	18.34	2808
Dummy (NI)-	0.25	0.43	0.00	0.00	0.00	0.00	1.00	2808
LEV	0.46	0.18	0.02	0.34	0.46	0.57	0.99	2808
ROA	0.02	0.10	-2.50	0.00	0.03	0.07	0.40	2808
AGE	27.41	11.77	4.00	18.00	26.00	36.00	59.00	2808
SDS	25.09	14.00	0.13	14.92	22.36	32.68	95.33	2808
SLS	15.88	11.43	0.00	7.90	14.01	21.56	73.51	2808
TSC	8.78	48.39	0.00	1.79	2.96	5.35	1190.50	2808
TSV	4.21	18.91	0.31	1.54	2.36	3.62	526.32	2808
Dummy (DIV)	0.54	0.50	0.00	0.00	1.00	1.00	1.00	2808
Dummy (TSE)	0.76	0.42	0.00	1.00	1.00	1.00	1.00	2808

This table reports descriptive statistics of explanatory variables, company characteristics, and agency-based proxies for sample firms. The definitions of the variables are shown in detail in Appendix 2

The average *LEV* is 0.46, and the average *FIRM AGE* is 27.41 years. For agency-based corporate governance variables, the *SDS* of 25.09% is relatively small, compared with the average *SLS* of 15.88%, suggesting that firm managers generally do not take control over the company at the expense of shareholders. This implies a considerable separation of ownership and control among the sample firms. The average of *Dummy(TSE)* is 0.76, indicating that more than 76% of the firms in the sample are well established. Overall, the descriptive statistics highlight a high degree of separation between ownership and control. Consequently, controlling shareholders or family members are major determinants that may affect a firm's value deviation.

To check for multicollinearity among explanatory variables, we estimate the correlations between these variables. Table 2 presents generally weak correlations between the variables in each pair. Therefore, the potential for multicollinearity problems is low. Overall, the correlation results suggest that these proxies adequately capture various dimensions of firm characteristics and the governance practices of the sample firms.

5.2 Regression results for information disclosure and transparency ranking system

Table 3 represents a regression analysis performed with a different method of estimating the sample firms' value deviation (Berger and Ofek 1995; Rhodes-Kropf et al. 2005), including the previously discussed control variables. The results reveal the coefficient of the system implementation dummy variable.

The results for *Deviation 1* reveal that the coefficient on the *IDTRS* is -0.10 (t-statistic = -4.65), implying that the implementation of the *IDTRS* is associated with a 10%

Table 2 Pearson correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) IDTRS (0,1)	1												
(2) Ln (BE)	0.03	1											
(3) Ln (NI)+	0.49***	0.07***	1										
(4) Dummy (NI)-	-0.07***	-0.07***	0.00	1									
(5) LEV	0.02	0.05***	0.13***	0.19***	1								
(6) ROA	0.08***	0.03	0.08***	-0.60***	-0.29***	1							
(7) AGE	-0.02	0.00	0.01	0.01	0.12***	-0.05**	1						
(8) SDS	0.01	-0.08***	-0.08***	-0.14***	-0.08***	0.13***	-0.08***	1					
(9) SLS	-0.02	0.15***	-0.06***	-0.03	0.04**	0.02	0.00	-0.15***	1				
(10) TSC	0.18***	0.01	0.12***	0.05***	0.01	-0.10***	-0.10***	-0.07***	-0.07***	1			
(11) TSV	0.12***	-0.01	0.07***	0.07***	0.03*	-0.16***	-0.02	-0.15***	-0.08***	0.64***	1		
(12) Dummy (DIV)	0.11***	0.08***	0.20***	-0.41***	-0.21***	0.37***	-0.01	0.19***	0.02	-0.02	-0.04**	1	
(13) Dummy (TSE)	0.16***	0.00	0.36***	-0.09***	0.09***	0.11***	0.26***	-0.10***	0.00	0.02	0.05**	0.12***	1

This table reports the Pearson correlation coefficients between independent variables. The definitions of the variables are shown in detail in Appendix 2. *, **, *** denote statistical significance at 10%, 5%, and 1%, respectively

Table 3 The regression result for information disclosure and transparency ranking system

	Rhodes-Kropf et al. (2005)	Berger and Ofek (1995)		
	Deviation (1)	Deviation (2)	Deviation (3)	Deviation (4)
Intercept	-12.07*** (-85.81)	-12.68*** (-81.91)	-11.57*** (-65.52)	-9.55*** (-48.91)
IDTRS (0,1)	-0.10*** (-4.65)	-0.23*** (-9.49)	-0.12*** (-4.62)	-0.32*** (-10.59)
Ln (BE)	0.71*** (57.33)	0.76*** (55.41)	0.66*** (41.96)	0.71*** (41.18)
Ln (NI)+	0.16*** (17.68)	0.14*** (13.72)	0.18*** (15.58)	0.12*** (9.14)
Dummy (NI)-	-0.07** (-2.15)	-0.05 (-1.40)	-0.04 (-0.90)	0.18*** (4.07)
LEV	1.50*** (23.14)	1.50*** (21.04)	0.53*** (6.57)	1.66*** (18.46)
ROA	1.53*** (10.94)	1.33*** (8.66)	1.45*** (8.29)	1.45*** (7.50)
AGE	-0.01*** (-14.96)	-0.01*** (-11.18)	-0.02*** (-12.56)	-0.01*** (-8.52)
SDS	8.E-04 (1.00)	2.E-03** (2.09)	0.00 4.E-04	9.E-04 (0.82)
SLS	2.E-04 (0.20)	2.E-03** (2.23)	-9.E-04 (-0.73)	6.E-03*** (4.76)
TSC	-7.E-04*** (-2.32)	-6.E-04* (-1.94)	-1.E-03*** (-4.12)	-7.E-04* (-1.73)
TSV	1.E-03* (1.86)	2.E-03** (2.07)	1.E-03 (1.34)	3.E-03*** (2.58)
Dummy (DIV)	-0.06*** (-2.61)	-0.04 (-1.36)	-0.10*** (-3.27)	-0.06* (-1.83)
Dummy (TSE)	0.15*** (5.33)	0.09*** (2.72)	0.18*** (4.98)	0.23*** (5.76)
Industry dummy	Yes	Yes	Yes	Yes
Adj R ²	0.83	0.81	0.73	0.71
N	2808	2808	2808	2808

This table reports the impact of information disclosure and transparency ranking system on firm's value deviation. All models are based on Eq. (2). The definitions of the variables are shown in detail in Appendix 2. T-statistics (based on robust standard errors) are reported in parentheses. *, **, *** denote statistical significance at 10, 5, and 1%, respectively

decrease in firms' value deviation. Thus, the results suggest that the monitoring role of the IDTRS is effective in reducing firms' value deviation. Moreover, the IDTRS coefficient is -0.23 (t-statistic = -9.49) for *Deviation 2*, -0.12 (t-statistic = -4.62) for *Deviation 3*, and -0.32 (t-statistic = -10.59) for *Deviation 4*. All the results are similar to the one for *Deviation 1*. Moreover, we observe a negative relationship between the IDTRS implementation

and firms' value deviation. Hence, the empirical results in Table 3 support our Hypothesis 1.³

These results holds after controlling for proxies related to firm characteristics, such as firm performance (*ROA*) and debt to assets (*LEV*). The positive relationship between *ROA* and firms' value deviation and the negative relationship between *LEV* and firms' value deviation are consistent with the observations of previous studies. In addition, we identify a negative relationship between *FIRM AGE* and firms' value deviation. Compared with the newly listed companies, the established companies tend to achieve more transparency in information disclosure thanks to their larger scale and longer history. Furthermore, investors are more familiar with these established companies. As expected, the agency-based measurements of corporate governance are influential in firms' value deviation. This suggests that firms in Taiwan with family members on the board of directors and serving as supervisors are not as valuable as those firms without family members. Cash flow rights and control rights have no power to explain firms' value deviation.

5.3 Sensitivity analysis

We continue to scrutinize the consistency of the results in Table 3 for a sensitivity analysis. We investigate whether those results vary according to the level of information transparency observed in a firm. Table 4 indicates that the length of the sample period might affect the results. Accordingly, in the regression in Table 4, we compare the results between the sample periods 2 years before and 2 years after the IDTRS implementation.

Results of the fixed year effects regression analysis reveal that the relationship between value deviation and the system implementation dummy variable remains negative and significant, although a comparison with Column 1 (coefficient = -0.08 and t -statistic = -2.73) in Table 3 highlights that the decrease in value deviation is not nearly as large as that in the 4-years sample regression. Similarly, the coefficient of the dummy year 2002 is -0.12 and t -statistic = -3.76 (Table 4, Column 2). Moreover, we observe that the reduction in value deviation elicited by the IDTRS is mainly reflected in the initial years. The results in Table 4 substantiate our Hypothesis 2 (before the IDTRS implementation, firms took preemptive measures to prevent the potentially negative effects of being ranked poorly) and demonstrate that our findings are robust to the changes in the method used to estimate value deviation. These results also evidence that firms whose information transparency ranking is about to be revealed aim to avoid the low liquidity and high capital costs that tend to accompany low transparency. These firms, consequently, endeavor to increase their level of disclosure before their ranking is revealed.

To test how much the results are influenced by outliers, in Table 5 we only use 1–99% of firms' value deviations in the sample. Results for *Deviation 1* reveal that the coefficient on the IDTRS is -0.08 (t -statistic = -4.05), implying that the implementation of the IDTRS is associated with an 8% decrease in firms' value deviation. Among the four models, the results of *Deviation 1* are similar to those in Table 3. In addition, we observe a negative relationship between the IDTRS implementation and firms' value deviation. The new coefficient of the system implementation dummy variable demonstrates that our Hypothesis 1 still holds true. Although the decrease in value deviation is slightly less, it is still

³ We also separate these two types of firms and compare the results includes both the firms traded on Taiwan Stock Exchange and the firms traded on OTC. Both two type IDTRS of firms have similar result. Because of the limitation of length, we use the description instead of the form.

Table 4 The robustness check for fixed year effects

	Rhodes-Kropf et al. (2005)	Berger and Ofek (1995)		
	Deviation (1)	Deviation (2)	Deviation (3)	Deviation (4)
Intercept	-12.02*** (-85.37)	-12.61*** (-81.58)	-11.49*** (-65.06)	-9.45*** (-48.39)
Dummy 2002	-0.08*** (-2.73)	-0.12*** (-3.76)	-0.15*** (-4.09)	-0.18*** (-4.37)
Dummy 2003	-0.07*** (-2.45)	-0.20*** (-6.03)	-0.12*** (-3.12)	-0.33*** (-7.90)
Dummy 2004	-0.21*** (-6.96)	-0.38*** (-11.38)	-0.29*** (-7.60)	-0.49*** (-11.64)
Ln (BE)	0.71*** (57.19)	0.76*** (55.33)	0.65*** (41.80)	0.71*** (41.03)
Ln (NI)+	0.17*** (18.20)	0.14*** (14.39)	0.18*** (16.17)	0.12*** (9.66)
Dummy (NI)-	-0.07** (-2.23)	-0.05 (-1.51)	-0.04 (-1.02)	0.18*** (3.97)
LEV	1.50*** (23.26)	1.50*** (21.21)	0.54*** (6.65)	1.66*** (18.60)
ROA	1.51*** (10.89)	1.31*** (8.60)	1.44*** (8.24)	1.43*** (7.44)
AGE	-0.01*** (-14.96)	-0.01*** (-11.18)	-0.02*** (-12.57)	-0.01*** (-8.50)
SDS	6.E-04 (0.78)	2.E-03* (1.82)	-3.E-04 (-0.27)	6.E-04 (0.57)
SLS	1.E-04 (0.13)	2.E-03** (2.17)	-9.E-04 (-0.77)	6.E-03*** (4.77)
TSC	-7.E-04*** (-2.35)	-6.E-04** (-1.97)	-1.E-03*** (-4.13)	-7.E-04* (-1.71)
TSV	1.E-03* (1.82)	2.E-03** (2.03)	1.E-03 (1.28)	3.E-03*** (2.53)
Dummy (DIV)	-0.06*** (-2.56)	-0.04 (-1.30)	-0.10*** (-3.24)	-0.06* (-1.80)
Dummy (TSE)	0.15*** (5.28)	0.08*** (2.64)	0.18*** (4.91)	0.23*** (5.70)
Industry dummy	Yes	Yes	Yes	Yes
Adj R ²	0.84	0.81	0.74	0.71
N	2808	2808	2808	2808

This table reports the impact of information disclosure and transparency ranking system on firm's value deviation each year. The definitions of the variables are shown in detail in Appendix 2. T-statistics (based on robust standard errors) are reported in parentheses. *, **, *** denote statistical significance at 10, 5, and 1%, respectively

significantly different in the years before the IDTRS implementation, compared with the years after the IDTRS implementation.

Similarly, in Table 6 we further investigate whether the inverse relationship between the IDTRS implementation and value deviation is sensitive to companies' initial level of

Table 5 Sample characteristics on robustness regression

	Rhodes-Kropf et al. (2005)	Berger and Ofek (1995)		
	Deviation (1)	Deviation (2)	Deviation (3)	Deviation (4)
Intercept	-11.11*** (-70.38)	-11.96*** (-66.82)	-10.86*** (-58.79)	-8.67*** (-39.32)
IDTRS (0,1)	-0.08*** (-4.05)	-0.21*** (-8.66)	-0.11*** (-4.62)	-0.30*** (-10.22)
Ln (BE)	0.65*** (49.92)	0.71*** (48.21)	0.61*** (39.64)	0.66*** (36.09)
Ln (NI)+	0.15*** (16.97)	0.13*** (12.90)	0.16*** (15.65)	0.10*** (7.90)
Dummy (NI)-	-0.11*** (-3.65)	-0.09*** (-2.50)	-0.09*** (-2.51)	0.14*** (3.12)
LEV	1.55*** (23.92)	1.51*** (20.55)	0.83*** (10.98)	1.78*** (19.72)
ROA	1.40*** (10.36)	1.24*** (8.13)	1.32*** (8.36)	1.30*** (6.90)
AGE	-0.01*** (-13.32)	-0.01*** (-9.55)	-0.01*** (-11.39)	-1.E-02*** (-7.24)
SDS	5.E-05 (0.07)	1.E-03 (1.47)	2.E-05 (0.02)	7.E-04 (0.59)
SLS	3.E-04 (0.28)	3.E-03*** (2.41)	-5.E-04 (-0.49)	6.E-03*** (4.97)
TSC	-5.E-04* (-1.92)	-5.E-04* (-1.64)	-2.E-03*** (-4.71)	-6.E-04 (-1.60)
TSV	8.E-04 (1.17)	1.E-03 (1.56)	1.E-03 (1.28)	2.E-03*** (2.36)
Dummy (DIV)	-0.05** (-2.07)	-0.03 (-1.22)	-0.08*** (-2.68)	-0.05 (-1.37)
Dummy (TSE)	0.18*** (6.65)	0.10*** (3.10)	0.20*** (6.29)	0.26*** (6.67)
Industry dummy	Yes	Yes	Yes	Yes
Adj R ²	0.78	0.74	0.70	0.63
N	2634	2634	2634	2634

This table reports the impact of information disclosure and transparency ranking system on firm's value deviation. All models are based on Eq. (2). The definitions of the variables are shown in detail in Appendix 2. We use observations with the 1–99% of firms' value deviation. T-statistics (based on robust standard errors) are reported in parentheses. *, **, *** denote statistical significance at 10, 5, and 1%, respectively

transparency. If a firm is relatively transparent before the IDTRS implementation, to make its transparency ranking public, it might not change its information disclosure practices much because it has little room for improvement. Accordingly, in Column 1 of Table 6, we classify sample companies as fairly transparent in the first IDTRS rankings. As expected, the regression coefficients exhibit a much less significant test statistic (-3.35 versus -4.65 in the original regression in Table 3, Column 1). Moreover, we compare Column 2 of Table 6 with Table 3 and observe a much less significant test statistic (-7.23 versus -9.49). In other words, although the inverse relationship between the IDTRS

Table 6 The effect of sample characteristics under disclosure firm

	Rhodes-Kropf et al. (2005)	Berger and Ofek (1995)		
	Deviation (1)	Deviation (2)	Deviation (3)	Deviation (4)
Intercept	-12.72*** (-58.59)	-13.10*** (-60.53)	-12.50*** (-47.29)	-10.57*** (-40.84)
IDTRS (0,1)	-0.13*** (-3.35)	-0.28*** (-7.23)	-0.18*** (-3.75)	-0.31*** (-6.75)
Ln (BE)	0.80*** (35.99)	0.82*** (36.90)	0.74*** (27.35)	0.83*** (31.39)
Ln (NI)+	0.13*** (7.41)	0.14*** (7.70)	0.17*** (7.76)	0.08*** (4.03)
Dummy (NI)-	0.18*** (2.57)	0.05 (0.73)	0.21*** (2.56)	0.31*** (3.83)
LEV	1.04*** (8.70)	1.19*** (9.95)	0.19 (1.27)	1.11*** (7.80)
ROA	3.01*** (9.27)	1.79*** (5.51)	3.27*** (8.26)	2.63*** (6.79)
AGE	-0.01*** (-7.85)	-0.02*** (-10.08)	-7.E-03*** (-3.70)	-0.01*** (-5.38)
SDS	-7.E-04 (-0.49)	-1.E-03 (-0.90)	-3.E-03 (-1.47)	-2.E-03 (-0.98)
SLS	-5.E-04 (-0.24)	1.E-03 (0.49)	-3.E-03 (-1.11)	7.E-03*** (2.90)
TSC	-1.E-03*** (-4.14)	-1.E-03*** (-3.77)	-3.E-03*** (-6.47)	-1.E-03*** (-3.14)
TSV	3.E-04 (0.19)	2.E-04 (0.14)	-1.E-03 (-0.58)	-3.E-03** (-2.01)
Dummy (DIV)	-0.14*** (-3.09)	-0.09** (-2.02)	-0.23*** (-4.12)	-0.08 (-1.42)
Dummy (TSE)	0.08 (1.35)	5.E-03 (0.08)	0.08 (1.21)	-4.E-03 (-0.06)
Industry dummy	Yes	Yes	Yes	Yes
Adj R ²	0.89	0.89	0.83	0.84
N	888	888	888	888

This table reports the impact of information disclosure and transparency ranking system under disclosure firm on firm's value deviation. All models are based on Eq. (2). The definitions of the variables are shown in detail in Appendix 2. T-statistics (based on robust standard errors) are reported in parentheses. *, **, *** denote statistical significance at 10, 5, and 1%, respectively

implementation and value deviation does not change with the transparency ranking of the sample firms, more (less) transparent firms facing the imminent public announcement of their transparency rankings respond by improving information disclosure, thereby lowering value deviation in less (more) conspicuous ways.

In Table 7, we consider how differences across industries or in classification methods might affect our results. Using the classification methods employed by the *Taiwan Economic Journal*, Taiwan Stock Exchange, Gre-Tai Securities Market, and database of the Kimo-Yahoo website, we select only listed firms from the electronics industry to analyze

Table 7 The effect of sample characteristics under electronic industry

	Rhodes-Kropf et al. (2005)	Berger and Ofek (1995)		
	Deviation (1)	Deviation (2)	Deviation (3)	Deviation (4)
Intercept	-13.73*** (-106.20)	-13.95*** (-105.31)	-14.24*** (-100.79)	-11.83*** (-88.92)
IDTRS (0,1)	-0.28*** (-14.42)	-0.44*** (-21.52)	-0.37*** (-17.15)	-0.30*** (-14.64)
Ln (BE)	0.81*** (65.45)	0.82*** (63.98)	0.81*** (59.92)	0.81*** (63.57)
Ln (NI)+	0.19*** (19.49)	0.19*** (18.80)	0.19*** (17.72)	0.19*** (18.93)
Dummy (NI)-	-0.17*** (-5.63)	-0.16*** (-5.41)	-0.16*** (-5.12)	-0.17*** (-5.47)
LEV	1.50*** (22.61)	1.50*** (22.05)	1.48*** (20.47)	1.49*** (21.87)
ROA	1.17*** (11.77)	1.18*** (11.62)	1.18*** (10.93)	1.17*** (11.48)
AGE	-9.E-03*** (-6.73)	-9.E-03*** (-6.59)	-9.E-03*** (-6.17)	-9.E-03*** (-6.54)
SDS	2.E-03** (2.14)	2.E-03** (2.23)	2.E-03*** (2.34)	2.E-03** (2.21)
SLS	2.E-03* (1.67)	2.E-03* (1.74)	2.E-03 (1.49)	2.E-03 (1.59)
TSC	-1.E-04 (-0.53)	-1.E-04 (-0.52)	-2.E-04 (-0.58)	-2.E-04 (-0.55)
TSV	5.E-03*** (2.68)	5.E-03*** (2.67)	5.E-03*** (2.50)	5.E-03*** (2.61)
Dummy (DIV)	-0.02 (-0.76)	-0.02 (-0.75)	-0.02 (-0.90)	-0.02 (-0.82)
Dummy (TSE)	0.09*** (3.50)	0.09*** (3.43)	0.09*** (3.28)	0.09*** (3.43)
Industry dummy	Yes	Yes	Yes	Yes
Adj R ²	0.96	0.96	0.95	0.96
N	1044	1044	1044	1044

This table reports the impact of information disclosure and transparency ranking system under electronic industry on firm's value deviation. All models are based on Eq. (2). The definitions of the variables are shown in detail in Appendix 2. T-statistics (based on robust standard errors) are reported in parentheses. *, **, *** denote statistical significance at 10, 5, and 1%, respectively

the link between the IDTRS implementation and firms' value deviation. Both the coefficient and significance of the system implementation dummy variable are stronger than those in Table 3. These results show that the IDTRS is especially effective in the electronics industry. The results still support Hypothesis 1: the introduction of a transparency ranking system compels firms to raise their level of information transparency to reduce value deviation.

Finally, using fixed effects analysis methods, we use variable averages of the 2 years before and after the IDTRS implementation to re-estimate the relationship between system

implementation and firm value. Due to the space constraints, we do not report the result of this part in the paper. In addition, to test the consistency of our results, we repeat the regressions using different measurement methods for control variables such as debt-to-asset ratio, return on assets, and total assets. Again, these changes in methodology and variable calculation techniques do not significantly influence the relationship between the IDTRS implementation and firm value deviation—the coefficients and significance level remain similar to those in Table 3.

6 Conclusions

By using firms' value deviation as an indicator of their information transparency level, we demonstrate that Taiwan's introduction of the IDTRS is remarkably effective in spurring firms to improve their information disclosure practices. Our empirical analysis confirms that this result does not vary with changes in the research methodology, value deviation estimators, control variable measurement techniques, or the sample period used. This suggests that firms facing the prospect of their transparency ranking being made public exert strong efforts toward improving their information disclosure to eschew from receiving a poor transparency ranking, that might be associated with disadvantages such as lower liquidity or higher cost of capital.

Our study mainly contributes to confirming the positive effects of the transparency ranking system on information disclosure. The system achieves its purpose of stimulating firms to become more transparent, although its evaluation criteria or standards are not perfect. Moreover, in accordance with the findings of Chung et al. (2015) and Pan et al. (2015), the introduction of the IDTRS ameliorates problems with regards firm value and information asymmetry. The relevant agencies, therefore, might consider publicizing how adequately or poorly firms perform in specific areas, which would enable investors to clearly identify the differences in information quality and increase the positive effects of the ranking on information transparency.

This study contributes to the literature by emphasizing the relation between IDTRS and firm's value deviation, which provides a further study of information disclosure regulation in Taiwan and broadens the understanding of IDTRS. Our conclusions validate to the hypothesis that Taiwan's implementation of a transparency ranking system is effective in boosting firms' information disclosure. Evidence suggests that reducing information asymmetry can prevent moral hazard, which concerns to business ethics at the management level. However, whether a more stringent system would be more effective remains unquestioned. Furthermore, certain related topics warrant future empirical analysis. For example, whether listed firms' transparency rankings affect their liquidity and cost of capital and whether ranking results can serve as reliable references for investors to construct investment portfolios. To conclude, our finding, to some extent, supports the cost-effectiveness of IDTRS and validates the information ranking system in Taiwan, as the IDTRS's effectiveness in encouraging higher level of information disclosure can be of significance for investors and analysts to forecast a firm's performance in stock market. Being encouraged to voluntarily disclose more information, firms' cost of capital in some degree reduces, and the capital market presents better images. Investors and analysts would be more certain about the information disclosed by firms and thus reduce forecast errors and dispersion.

We anticipate that our study will inspire more detailed analyses on related topics and provide a reference for future research; essentially, requiring firms to improve the quality of the disclosed information is an effective reflection of how investors "vote with their feet"

and their ideas on firm value and stock prices. Thus, managers can be spurred to rectify their weaknesses. Moreover, benign competition among enterprises can be promoted, and more effective external mechanisms of corporate governance can be developed accordingly.

Acknowledgements We thank Cheng-Few Lee (the Editor) and two anonymous reviewers for helpful comments. Professor Jiang thanks the Ministry of Science and Technology of Taiwan for partial financial support (MOST 105-2410-H-155-030). This work was also supported by Shantou University under Grant “Shantou University Research Fund” (2015WQNCX031), the Humanistic and Social Science Research Base—Shantou University Research Institute for Cooperation of Guangdong and Taiwan Enterprises under Grant “Major Research Project Fund”, and the fundamental research for the central universities (2017QN034).

Appendix 1

Distribution of firms by industry

	Industry	Obs. of firm	Obs. of disclosure firm	Mean Age	Mean ROA
1	Cement	28	12	45.71	0.02
2	Food	92	40	35.65	0.02
3	Plastics	92	60	35.91	0.03
4	Textile	200	60	32.00	-0.01
5	Electric machinery	152	32	30.21	0.03
6	Electric cables	56	4	36.29	0.01
7	Chemical and biological technology	164	44	33.22	0.06
8	Glass ceramic	16	4	37.25	0.01
9	Paper	28	8	44.29	0.00
10	Steel	132	24	29.88	0.03
11	Rubber	40	20	39.50	0.04
12	Auto	16	8	47.50	0.05
13	Electronics	1044	432	20.31	0.03
14	Building material and construction	220	24	27.62	-0.02
15	Shipping	76	12	33.79	0.04
16	Sightseeing	52	4	31.23	0.00
17	Finance and insurance	84	24	31.33	0.01
18	Trade department	52	12	32.62	0.01
19	Securities	20	12	21.80	0.00
20	Investment and credit	12	4	16.33	0.08
21	Oil, gas and electricity	44	4	23.82	0.04
22	Other	188	44	26.81	0.02
	Total	2808	888	Average 32.41	0.02

This table reports the distribution of sample firms by industry. Obs. of firms represents the observations of firms by each industry. Obs. of disclosure firms is the observations of firms in each industry. The mean Age is average firm survival age, and mean ROA is average earning to assets. The classifications of industry are obtained and cross-checked from the Taiwan Stock Exchange, Gre-Tai Securities Market, and Kimo-Yahoo website

Appendix 2

Variable definitions

Variable	Explanation
Deviation1	Market value of equity plus book value of debt to total assets (Rhodes-Kropf et al. 2005)
Deviation2	Market value of equity plus book value of debt to imputed value of total capital to sales for the median single-segment firm in industry and year (Berger and Ofek 1995)
Deviation3	Market value of equity plus book value of debt to imputed value of total capital to assets for the median single-segment firm in industry and year (Berger and Ofek 1995)
Deviation4	Market value of equity plus book value of debt to imputed value of total capital to EBITDA for the median single-segment firm in industry and year (Berger and Ofek 1995)
<i>Firm characteristics</i>	
IDTRS (0,1)	Information Disclosure and Transparency Ranking System (IDTRS) is a dummy indicator. It is 1 if the sample year is after and including 2003 and is 0 if before and including 2002
Ln (BE)	Natural log of book value of equity
Ln (NI)+	Natural log of absolute value of net income
Dummy (NI)-	It is 1 if the net income is negative and else is 0
LEV	The ratio of debt to book value of assets
ROA	Earning to book value of asset.
AGE	Firm AGE
<i>Agency-based measurements</i>	
SDS	Percentage of total outstanding shares owned by directors and supervisors
SLS	Percentage of total outstanding shares owned by largest shareholder
TSC	Times of seating to cash flow rights = seating rights %/cash flow rights %
TSV	Times of seating to voting rights = seating rights %/voting rights %
Dummy (DIV)	It is 1 if the cash dividend bigger than 0 and else is 0
Dummy (TSE)	It is 1 if the listed company and 0 is OTC firm

Appendix 3

Information disclosure and transparency measures

I. Compliance with the mandatory information disclosures (Questions 1–12)

- 1 Whether companies comply with Procedures for Verification and Disclosure of Material Information of Listed Companies, and whether companies have no records of breach penalty or other more serious punishment due to violation of the above regulations?
- 2 Whether companies comply with Procedures for Holding Material Information Press Conference of Listed Companies, and whether companies have no records of breach penalty or other more serious punishment due to violation of the above regulations?
- 3 Whether companies comply with Procedures for Information Reporting of Listed Companies, and whether companies have no records of breach penalty or other more serious punishment due to violation of the above regulations?
- 4 Whether the announcement of ownership change of directors, supervisors, managers, and shareholders with more than 10% ownership complies with TWSE/GTSM's regulations and whether companies have no records of punishment due to violation of the above regulations?
- 5 Whether company's announcements of lending and guarantee from the company itself and its subsidiaries have no records of punishment due to violation of regulators' rules?
- 6 Whether company's announcements of asset disposal or acquisition have no records of punishment due to violation of regulators' rules?
- 7 Whether company announces major events that have significant impact on shareholders' rights or stock price on a timely basis, and whether company has no records of punishment due to violation of the above regulations?
- 8 Whether company has reported, on a timely basis, the internal control statement (four months within the completion of accounting year) and internal audit related operations, and whether company has no records of punishment due to violation of the above regulations?
- 9 Whether company discloses auditor's fee based on regulation and whether company has no records of punishment due to violation of the above regulations?
- 10 Whether company's financial report needs adjustment or re-statement as required by regulator, TWSE, or GTSM?
- 11 Whether company discloses clarification based on regulators' rules when the material information that has some impact on stock price is reported by the press media or investors, and whether company receives no notification of improvement in this matter?
- 12 Whether company reports and announces shareholder handbook and meeting supplement in time, and whether company receives no penalty associated with the violation of the above regulations?

II. Timeliness of information reporting (Questions 13–39)

- 13 Whether company announces monthly financial report in time?
- 14 Whether company announces consolidated monthly financial report in time? (This item receives extra bonus point)
- 15 Whether company announces monthly operating income and before tax income statement in time? (This item receives extra bonus point)
- 16 Whether the company announces monthly guarantees and lending information backed up by the company itself and its subsidiaries in time?
- 17 Whether company announces operating income, operating income by products for major subsidiaries, and intra-company sales and its sales percentage between the company itself and its major subsidiaries on a timely basis?
- 18 Whether company announces monthly amount of derivative product trading for the company itself and its subsidiaries in time?

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- 19 Whether company reports the investment information in Mainland from the company and its overseas subsidiaries based on the Operating Rules for Information Report of Listed Companies?
- 20 Whether company reports independent directors' and supervisors' position, experience, and education background and their part-time jobs as directors and supervisors for other companies in time?
- 21 Whether company reports treasury stock related operations to regulators, TWSE, or GTSM in time?
- 22 Whether company reports annual exercised and unexercised employee stock warrant information in time based on the Rules for Information Reporting of Listed Companies?
- 23 Whether company reports annual report in time?
- 24 Whether company finishes annual report within 2 months of accounting year-end? (This item receives extra bonus point)
- 25 Whether company reports annual report within 3 months of accounting year-end? (This item receives extra bonus point)
- 26 Whether company reports semi-annual report in time?
- 27 Whether company reports semi-annual report within 1 month of accounting half year-end? (This item receives extra bonus point)
- 28 Whether company reports first quarter and third quarter financial reports in time?
- 29 Whether company reports consolidated financial statements in time?
- 30 Whether company reports annual report in time?
- 31 Whether company reports first quarter and third quarter consolidated financial statements in time?
- 32 Whether company reports first quarter and third quarter consolidated financial statements within 1 month of first quarter-end and third quarter-end respectively in time? (This item receives extra bonus point)
- 33 Whether company reports accounting manager's qualifications and on-the-job professional training situation in time?
- 34 Whether company reports shareholder handbook and meeting supplement 30 days before the start of shareholder meeting? (This item receives extra bonus point)
- 35 Whether company reports English version shareholder handbook and meeting supplement 30 days before the start of shareholder meeting? (This item receives extra bonus point)
- 36 Whether company reports English version shareholder annual report and uploads it to market observation post system (MOPS)? (This item receives extra bonus point)
- 37 Whether company discloses English version material information concurrently when Chinese version material information is announced? (This item receives extra bonus point)
- 38 Whether company reports the date of shareholders' meeting in time based on pre-announcement reporting mechanism of publicly listed firms?
- 39 Whether company reports financial statements in XBRL format in time? (This item receives extra bonus point)
- III. Disclosure of financial forecast (Questions 40–44)
- 40 Whether company discloses financial forecast information of the current year voluntarily? (This item receives extra bonus point)
- 41 Whether company discloses consolidated financial forecast information of the current year voluntarily? (This item receives extra bonus point)
- 42 Whether company explains the possible factors that may lead to a discrepancy between financial forecast and actual financial results in advance (warning of forward looking information)?
- 43 Whether company has received rectification from regulator, and records of flaw from TWSE/GTSM due to the delayed update (correction) of financial forecast information?
- 44 Whether company has received rectification from regulator, and records of flaw from TWSE/GTSM due to unreasonable basic assumptions on the delayed update (correction) of financial forecast information?
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 IV. Disclosure of annual report (Questions 45–94)
(1) *Transparency in financial and operating information*

- 45 Whether company discloses important accounting policy in annual report?
- 46 Whether the accounting standards that the company adopts are the same as the generally accepted accounting principles in Taiwan?
- 47 Whether the annual report discloses accounting adjustments due to the adoption of different accounting principles (Taiwan Vs. IFRS/U.S. GAAP)? (This item receives extra bonus point)
- 48 Whether company discloses the methods of fixed asset depreciation and depreciation age limit?
- 49 Whether company discloses the rules and methods of asset and liability valuation? (This item receives extra bonus point)
- 50 Whether company uses buying price or selling price to decide the fair value of non-stock and non-warrants derivative products? (This item receives extra bonus point)
- 51 Whether company discloses analytical information that is conducted by different departments in annual report?
- 52 Whether company discloses the name of certified audit firm and the unqualified (modified unqualified) audit report in annual report?
- 53 Whether company discloses the amount and types of other non-audit fees that are paid to the same certified audit firm or its affiliated enterprises in annual report? (This item receives extra bonus point)
- 54 Whether company discloses organizational and ownership structures in annual report?
- 55 Whether company discloses the guarantee, lending, and other derivative trading information of itself or its affiliated enterprises in annual report?
- 56 Whether company discloses trading information for related persons (including its affiliation) in annual report?
- 57 Whether company discloses the review of company's operation from the management team in annual report?
- 58 Whether company discloses information about industry trend and macroeconomics environment in annual report?
- 59 Whether company discloses long-term and short-term sales expansion project in annual report?
- 60 Whether company discloses future R&D plan and its estimated expenses in annual report?
- 61 Whether company discloses R&D investment plan and progress in annual report? (This item receives extra bonus point)
- 62 Whether company discloses detailed information about the products and services manufactured and provided by the company in annual report?
- 63 Whether company discloses the amount produced and sold and product mix in annual report?
- 64 Whether company discloses industry-specific Key Performance Indicators (KPI) in annual report? (This item receives extra bonus point)
- 65 Whether company discloses historical performance indicator (such as ROE, ROA, etc.) in annual report?
- 66 Whether company discloses risk management policy in annual report?
- 67 Whether company discloses the organizational structure of risk management in annual report? (This item receives extra bonus point)
- 68 Whether company discloses the adoption of hedge accounting and its associated objective and methods in annual report?
- 69 Whether company discloses managers' participation in corporate governance related on-the-job training in annual report? (This item receives extra bonus point)
- 70 Whether company discloses the information of employees' on-the-job training in annual report?
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- 71 Whether company discloses all kinds of employees' welfare, retirement plan, and their current practice in annual report?
- 72 Whether company discloses certificates (regulator certified) holding situation for the personnel responsible for the transparency of finance information in annual report? (This item receives extra bonus point)
- 73 Whether company discloses the ethic or moral rules for employees in annual report? (This item receives extra bonus point)
- 74 Whether company discloses the Procedures for Internal Material Information Processing in annual report? (This item receives extra bonus point)
- 75 Whether company discloses work environment and safety related protective measures in annual report? (This item receives extra bonus point)
- 76 Whether company discloses corporate social responsibility in annual report?
- (2) *Board meeting and ownership structure*
- 77 Whether company discloses directors' or supervisors' names, education, experience, ownership, and the date of becoming board members in annual report?
- 78 Whether company discloses the classification of titles of directors and supervisors based on "independence" in annual report?
- 79 Whether company discloses the part-time positions that are held by directors and supervisors in annual report?
- 80 Whether company discloses directors' and supervisors' remuneration in annual report?
- 81 Whether company discloses the detailed breakdown of directors' and supervisors' remuneration except those items required for disclosure by regulators in annual report? (This item receives extra bonus point)
- 82 Whether company discloses the compensation of CEO, and vice presidents, and top management in annual report?
- 83 Whether company discloses the current situation (increase or decrease) of the stocks being used as collaterals by directors, supervisors, managers, and large shareholders in annual report?
- 84 Whether company discloses the board meeting attendance situation for directors and supervisors, and the attendance situation of audit committee meeting for independent directors in annual report?
- 85 Whether company discloses governing information regarding the operation of board meeting and audit committee meeting separately in annual report?
- 86 Whether company discloses training for directors and supervisors in annual report?
- 87 Whether company discloses the discussion of corporate governance in annual report?
- 88 Whether company discloses the resignation and dismissal situation for personnel related to corporate disclosure and financial report in annual report?
- 89 Whether company discloses the names and positions of top 10 employee stock warrants recipients in annual report?
- 90 Whether company discloses the bonus amount, names and positions of top 10 employees who receive stock bonus in annual report? (This item receives extra bonus point)
- 91 Whether company discloses managers' names, stock ownership, education, experience, current part-time positions in other companies, and the number of employee stock warrants in annual report?
- 92 Whether company discloses the amount and percentage of stock ownership for top 10 shareholders in annual report?
- 93 Whether company discloses the information of related persons between top 10 shareholders in annual report?
- 94 Whether company discloses the review of execution situation (for the items decided for execution in shareholder meeting) in annual report? (This item receives extra bonus point)
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 V. Company website disclosure (Questions 95–114)

- 95 Whether company has corporate website that discloses public information (including detailed financial data) on website?
- 96 Whether company discloses shareholders annual report on corporate website?
- 97 Whether company discloses public information (including detailed financial data) in English on website?
- 98 Whether company discloses shareholder meeting information in English on corporate website?
- 99 Whether company discloses monthly operating profit/loss (financial holding companies, banks, and bills finance companies disclose profit and loss for the departments with continued operation) and accumulated operating profit/loss for the current year on corporate website?
- 100 Whether company discloses the reports of monthly revenue and the monthly revenue for the previous 24 months on corporate website?
- 101 Whether company discloses the compliance of TWSE's rule regarding the qualifications of appointing independent directors on corporate website?
- 102 Whether company discloses execution items of board meeting on corporate website?
- 103 Whether company discloses complete meeting minutes of board meeting on corporate website?
- 104 Whether company discloses dividends and stock price information on corporate website?
- 105 Whether company discloses material information on corporate website?
- 106 Whether company discloses articles of incorporation, and the operating procedures for acquisition and disposal of assets, lending, guarantee, and derivative trading on corporate website?
- 107 Whether company provides shareholders Q&A function on corporate website?
- 108 Whether company discloses information on whether the company holds a conference for institutional investor and posts meeting related information on corporate website?
- 109 Whether company discloses the audio or video recording throughout the conference of institutional investors on corporate website?
- 110 Whether shareholders are allowed to exert their voting rights in writing or via electronic media and whether such voting methods and their execution situation are posted on corporate website?
- 111 Whether company discloses the election regulation regarding the directors and supervisors to be elected are nominated by a nominating committee?
- 112 Whether company discloses corporate organizational structure, managers' positions, power, and their responsibility on corporate website?
- 113 Whether company discloses the organization and operation of internal audit on corporate website?
- 114 Whether company discloses corporate social responsibility on corporate website?
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This appendix lists the 114 questions used to compile the transparency scores for each sample firm. The questions fall into five categories of information disclosures: compliance with the mandatory information disclosures, timeliness of information disclosure, disclosure of financial forecast, disclosure of annual reports, and corporate website disclosure. Each sample firm is assigned a rating whether is yes or no based on these questions. Data resource: National Development Council (Taiwan) & Pan et al. (2015)

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