Information Ratings and Capital Structure

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Abstract

We examine the impact of information asymmetry on a firm's capital structure decisions with a unique information rating scheme that draws from 114 measures over five dimensions of information disclosures on each firm from 2006 to 2012. We find that high (low) information ratings are related to lower (high) debt financing and leverage. In particular, a firm that moves from the lowest to the highest information rating experiences a 7.8% reduction in firm leverage on average. This relationship is robust to a number of firm-specific factors and agency-based measures. Our results suggest that information asymmetry is influential in a firm's pecking order behavior independent of the effect of incentive conflicts.

JEL Classification: G32

Keywords:
Asymmetric information; Capital structure; Information ratings; Pecking order theory; Incentive conflicts.

1. Introduction

Since the seminal work of Modigliani and Miller's (1958) irrelevancy proposition on capital structure in a market without frictions, there has been ongoing research to understand how market imperfections affect a firm's financing decisions. One source of market frictions is the information asymmetry between managers and investors about firm value.[1] Myers (1984) and Myers and Majluf (1984) argue that as managers know more about their firms' true values than investors, they tend to exhibit a particular preference for their financing choices. In particular, managers follow the pecking order of internal capital over debt, and external equity as a last resort in an effort to minimize adverse selection costs.

To date, the empirical findings on the pecking order model are mixed. While Shyam-Sunder and Myers (1999) show that firms' financing priorities are generally consistent with the hypothesis, Fama and French (2005) find that managers across various firm size frequently issue and retire equity. To accommodate alternative theories in explaining a firm's financing decisions, Lemmon and Zender (2004) and Bharath et al. (2009) expand the scope of testing the pecking order model with financial slack for investment

[1] Other market frictions include taxes (e.g. Graham (2000)), cost of financial distress (Andrade and Kaplan (1998)), agency costs (Jensen and Meckling (1976)), and behavioral based theories such as managerial optimism (Heaton (2002)) and market timing (Baker and Wurgler (2002)).

opportunities and costs of financial distress. However, Jung et al. (1996) and Leary and Roberts (2010) continue to cast doubt on the robustness of the prescribed order even with additional considerations. They suggest that alternative theories such as agency conflicts are better equipped to explain the observed debt and equity issuances than information asymmetry.

Given that information asymmetry is hypothesized to play an important role in a firm's financing policy, one key challenge in testing the model validity rests with how well the information barrier between managers and investors can be estimated. In this study, we take advantage of a unique information rating score on the amount of information disclosed by firms to examine the importance of information asymmetry. Based on 114 indicators on information disclosure over five different sub-categories, Taiwan's Securities and Futures Institute (SFI) aggregates the amount of disclosed information by each firm and assigns an information rating accordingly. These five categories include information related to regulatory compliance, information timeliness, forward-looking information, and information reported in annual reports and in company websites. Ranging from C- to A++, a firm that receives a C- (A++) rating is said to have the lowest (highest) corporate transparency or exhibit the highest (lowest) asymmetric information. Appendix A lists each of the 114 criteria.

Therefore, similar to a change in credit rating on the credit worthiness of a firm, an upgrade (downgrade) of a firm's information rating indicates that information asymmetry between the firm and investors is lower (higher) than before. A change in information rating is thus more definitive, intuitive, and meaningful than the noisy and inconsistent proxies that plagued previous studies. For example, firm size and Tobin's q related to firm characteristics are not only used as proxies for information asymmetry, but also incentive conflicts. While a large firm is perhaps related to higher agency costs and lower asymmetric information, it could also reflect the business life cycle of the firm. In a similar vein, a higher market-to-book assets ratio in a firm can be related to lower agency costs. However, it could also be driven by higher growth opportunities. Other more dynamic proxies, such as the level of analyst coverage and dispersion of analysts' forecasts, are highly correlated with some firm characteristics that may again be subject to different interpretations.

More sophisticated proxies related to adverse selection based on the market microstructure framework have recently been used to measure information asymmetry. For example, effective bid-ask spread (George et al. (1991)), probability of informed trading (PIN, Easley et al. (1996)), and price impact measure (Amihud (2002)) have been developed to capture the market's perception of the information advantage enjoyed by

informed traders. To further improve the measurement for information asymmetry about a firm's value, Bharath et al. (2009) form a composite index based on the first principal component of four measures of adverse selection and three measures of market liquidity.

While such advanced approaches undoubtedly increase the accuracy of the measurement, they continue to be indirect measures of asymmetric information and they are limited by the availability of high frequency and quote data. More importantly, they may still be subject to measurement errors due to "noninformational" liquidity components embedded in the proxies and composite index. In contrast, the SFI information rating is a direct measure designed to capture the multifaceted information transparency in a timely manner. It avoids the limitations associated with the existing measurements of information asymmetry about a firm's value. In addition, since Taiwan is an emerging market where investor protection is also relatively poor (La Porta et al. (1998)), it provides a fertile background to detect the impacts of information transparency and incentive conflicts, if any, on a firm's financing decisions than in a developed market.

Our results suggest that the SFI's measurements for information ratings help explain the financing decisions of Taiwanese firms between 2006 and 2012. Specifically, we find that the level and the change of information asymmetry are positively associated with debt issuances. This is consistent with pecking order theory, which states that firms with

higher (an increase in) adverse selection costs are more likely to use debt to finance their deficits. The positive relationship between information asymmetry and debt issuances still holds after controlling for firm characteristics that may affect a firm's financing decisions. Our evidence therefore confirms the important role of information asymmetry in the pecking order theory.

Our paper also broadens the scope of examining information asymmetry by incorporating numerous measures in relation to incentive conflicts based on ownership structure and divergence between cash flow rights and control rights. Accordingly, firms with higher incentive conflicts are more likely to issue debt than equity. Our subsequent investigations reveal that information ratings continue to be influential in a firm's capital structure decisions in the presence of agency cost factors. Furthermore, incentive conflicts also account, in part, for a firm's financing preferences. Therefore, our overall results suggest that both information asymmetry and incentive conflicts play important roles in explaining a firm's pecking order behavior.

The remainder of the paper is organized as follows. Section 2 discusses the background and the development of the information rating framework. In Section 3, we compare the proxies of information asymmetry in the current finance and accounting literature with those established by the SFI. Section 4 describes the data and research

design. The empirical results are reported in Section 5, and the last section concludes the paper.

2. Brief History of Information Disclosure and Ratings in Taiwan

The Company Law in Taiwan was first established in 1919 and the subsequent Security Law in 1968. They defined the rights and responsibilities of firms to protect the interests of shareholders and debt holders. However, investor protection based on these laws are either inadequate or ineffective to meet the welfare of shareholders and debt holders. La Porta et al. (1998) report that the efficiency of the judicial system and corruption in Taiwan are poorly ranked among countries with the same German legal origin.

A number of scandals and bankruptcies broke out in 1997 within Asian financial markets, which led to the Asian financial crisis and raised fear of a global economic downturn.[2] Furthermore, recent high profile corporate and accounting scandals, such as Enron, Merck, and WorldCom in the early 2000's, have paved the way for the call for stronger governance practices. Consequently, the introduction of the Sarbanes-Oxley Act of 2002 in the US, which was followed by similar governance regulations around the

[2] In response to the growing awareness of better transparency and accountability from investors, in 1999 the OECD developed a set of corporate governance standards and guidelines to protect the rights of shareholders.

world, requires publicly listed firms to comply with enhanced disclosure standards. In the case of Taiwan, the Taiwan Stock Exchange Corporation (TSE) and the Gre Tai Securities Market (GTSM) jointly adopted the Corporate Governance Best-Practice Principles (CGBPP) for firms listed on the TSE and the GTSM in 2002. The main principles of the CGBPP include protecting shareholders' rights and interests, strengthening the monitoring powers of supervisors and the board of directors, and enhancing information transparency.

Following the enactment of the CGBPP, Taiwan's Securities and Futures Institute (SFI), a quasi-government organization entrusted by the TSE and the GTSM, introduced the Information Disclosure and Transparency Ratings System (information ratings thereafter) in 2003. The main objectives of implementing information ratings are to protect shareholders' and debt holders' rights and interests, develop criteria to evaluate the level of information disclosure for publicly listed firms, and assist regulators to monitor the financial markets in Taiwan.

To assess the level of corporate transparency, information ratings identified 114 indicators as evaluation criteria, which can be further grouped into five sub-categories: (1) compliance with the mandatory information disclosures, (2) timeliness of information reporting, (3) disclosure of financial forecast, (4) disclosure of annual report, and (5)

disclosure of corporate website. Appendix B reports the measurements of information rating based on the five different dimensions. Each disclosure indicator represents a "yes" or "no" question. One point is given to the question with a "yes" answer and zero otherwise. A firm's total score is the sum of the points from each indicator. The score mechanism is therefore similar to the governance index (G-index) compiled by Gompers et al. (2003) on the strength of a firm's governance practices. Based on the scores, the SFI releases the annual full-year ranking results ranging from A++ to C- for every TWSE / GTSM listed firm covered by information ratings.[3] A firm with the highest corporate transparency is assigned an A++ rating, whereas a firm with the lowest corporate transparency is given a C- rating.

To ensure the accuracy of the assessments, information ratings are provided to all the covered firms with remote web-based access to review the preliminary evaluation results, including the score on each of the 114 indicators and the overall corporate transparency ranking. Upon receiving the preliminary results, all firms are allowed to express their opinions regarding areas of concern. If a firm disagrees with the preliminary findings, it is allowed to file a report within a certain time frame explaining areas of concern to the information ratings committee for further review. A revised evaluation

[3] The full-year ranking results are accessible to the general public through the website of the Securities and Futures Institute at http://www.sfi.org.tw.

result is given if (1) at least two thirds of the committee members are present at the meeting and (2) the majority of the participants agree with the revision. This two-stage screening process improves the accuracy and objectivity of the evaluation results and should represent the most direct measurement for the level of information asymmetry between firms and investors that is available to date.

3. Information Asymmetry Measurements

3.1 Proxies for information asymmetry in the finance literature

The proxies for information asymmetry in the extant finance literature can be categorized into three groups. The first group is based on firm characteristics such as firm size, market-to-book equity, growth opportunities, or intangible assets (e.g. Titman and Wessels (1988), Harris and Raviv (1990), Rajan and Zingales (1995), Baker and Wurgler (2002), Korajczyk and Levy (2003), Frank and Goyal (2003), and Lemmon and Zender (2010)). Large firms are often viewed as exhibiting lower information asymmetry, while firms with high market-to-book equity are often characterized by high growth opportunities. The latter, which is also related to intangible assets, is in turn associated with the information opaqueness of a firm. However, these firm characteristics are well known to be proxies for systematic risk (Fama and French (1993)) or mispricing of a firm

by irrational investors (Lakonishok et al. (1994)). Therefore, these measurements represent noisy measures of asymmetric information at best. Bharath et al. (2009) further argue that they are inherently static and persistent.

The second group is related to more dynamic proxies, such as the level of analyst coverage and dispersion of analysts' earnings forecasts. These dynamic proxies, however, are often found to have different or conflicting interpretations and are likely to be noisy proxies that capture similar firm characteristics as the first group (e.g. Krishnaswami and Subramaniam (1999), Chang et al. (2006), Gomes and Phillips (2012)). For example, large firms tend to be covered by more analysts and firms with high book-to-market, growth opportunities, or intangible assets generate higher dispersion of earnings forecast.

The last group includes more sophisticated proxies based on the adverse selection component in the market microstructure framework. Effective bid-ask spread (George et al. (1991)), probability of informed trading (Easley et al. (1996, 1997a, 1997b)), and price impact measure (Amihud (2002)) are common candidates for measuring the information gap between informed and noisy traders. Although these measurements are an improvement on estimating the extent of information asymmetry, they remain a less direct measure that is restricted by limited data availability and multifaceted interpretations of liquidity (see Frank and Goyal (2003), Hasbrouck (2009), Bharath et al. (2009)).

On the contrary, information ratings draw from both direct financial and non-financial information. Therefore, these measures are likely to be superior because they are not sensitive to the way in which asymmetric information is extracted. As a result, they are more robust to firm characteristics, different analyst interpretations, and high-frequency data unavailability that may cause sample selection bias.

Furthermore, in response to investors' increasing demand for quality corporate disclosure, the SFI has incorporated voluntary disclosure measurements such as the willingness to disclose consolidated financial forecast information and the amount of non-audit fees from the same auditor into the evaluation criteria. This non-financial voluntary information may be helpful in enhancing the accuracy of analysts' forecasts (Vanstraelen et al. (2003)). It follows that firms that voluntarily disclose non-mandatory items are more likely to have low information asymmetry (e.g. Ajinkya et al. (2005), Karamanou and Vafeas (2005)).

3.2 Proxies for information asymmetry in the accounting literature

Existing studies in the accounting literature also share similar proxies to measure information asymmetry as the finance literature. They include those based on firm characteristics (e.g. Firth (1979), Lang and Lundholm (1993)), analyst coverage

(Piotroski and Roulstone (2005)), and market microstructure framework (Heflin et al. (2005), Ecker et al. (2006)). Additional proxies include public listing of a firm and auditor's reputation.

In addition to these standard proxies, the accounting literature also relies on a broader set of information from published reports (e.g. annual reports) and investor relations measures (see Khanna et al. (2004), Bushman et al. (2004), Francis et al. (2005), Brown and Hillegeist (2007)) provided by the Association for Investment Management and Research (AIMR) and the Center for International Financial Analysis and Research (CIFAR). These proxies for information asymmetry / disclosure are evaluated based on the completeness, clarity, and timeliness of information across a broad spectrum of industries.

One limitation of using investor relations measures is that the rating scale and criteria used by leading analysts may differ across industries. Therefore, while disclosure results within the same industry are comparable, those across different industries are likely to be subject to analysts' individual biases (Brown and Hillegeist (2007)). Furthermore, firms evaluated by investor relations associations tend to be larger with wider analyst coverage. This creates sample selection bias and may reduce the variation in firms' disclosure quality, as large firms are generally expected to have lower information asymmetry (e.g.

Bhushan (1989), Lang and Lundholm (1993), Brown and Hillegeist (2007)).

By contrast, the SFI forms a research team composed of experts from independent parties – consisting of the accounting and finance profession, academic researchers, in-house research staff, and IT personnel – to evaluate the information quality of all listed firms, except for some firms with inadequate data or under regulatory investigation. Therefore, information ranking is based on the same set of information criteria and is not skewed to large firms. It follows that the information ratings should provide a more robust and comprehensive measure for a firm's information asymmetry.

4. Research Design and Data

4.1 Research design

We first follow the standard approach of Shyam-Sunder and Myers (1999) to test the pecking order model by regressing net debt issuance, $\Delta D_{i,t}$, on the financing deficit, $DEF_{i,t}$, as follows:

$$\Delta D_{i,t} = \alpha + \beta DEF_{i,t} + \varepsilon_{i,t} \quad (1)$$

where $\Delta D_{i,t}$ is the long-term debt issuance minus long-term debt reduction for firm i at time t, and $DEF_{i,t}$ is defined by the accounting cash flow identity,

$$DEF_{i,t} = DIV_{i,t} + CEX_{i,t} + \Delta WC_{i,t} - CF_{i,t} \quad (2)$$

where $DIV_{i,t}$ are dividend payments, $CEX_{i,t}$ are capital expenditures, $\Delta WC_{i,t}$ is the net change in working capital, and $CF_{i,t}$ is the operating cash flow after interest and taxes. All variables are scaled by total assets. The pecking order model predicts that the slope coefficient β should be close to 1 according to the strict version of the theory (Shyam-Sunder and Myers (1999)) and lower than 1 but still positive based on the modified version (Lemmon and Zender (2004)).

If information asymmetry is a driver for financing decisions, firms with higher information ratings should be related to lower β coefficients. In particular, the negative relationship between information rating and β should be monotonic across the rating categories. Therefore, we assess the relationship between the extent of debt issuance and information rating by estimating the coefficient for an interaction term of $DEF_{i,t}$ and $IR_{i,t}$ in the following augmented version of Eq. (1):

$$\Delta D_{i,t} = \alpha + \beta DEF_{i,t} + \gamma DEF_{i,t} * IR_{i,t} + \varepsilon_{i,t} \quad (3)$$

where $IR_{i,t}$ is the information rating for firm *i* at time *t*. To operationalize the information

ratings in our analysis, we assign a score from 1 to 7 for firms whose ratings vary from C- to A++. However, only five information ratings between C- and A++ are provided from 2006 to 2010. To ensure compatibility of scores over the entire sample period, we standardize the scores by mapping information ratings with their corresponding scores, as reported in Appendix C.

We further examine if firms that are found to increase (decrease) information transparency from the previous year have lower (higher) net debt issuance ($\Delta D_{i,t}$) as follows:

$$\Delta D_{i,t} = \alpha + \beta DEF_{i,t} + \gamma DEF_{i,t} * \Delta IR_{i,t} + \varepsilon_{i,t} \quad (4)$$

where $\Delta IR_{i,t}$ is the change in information rating for firm *i* from time *t-1* to *t*.

For further tests on the effect of information asymmetry, we follow Frank and Goyal (2003) and Bharath et al. (2009) by examining if a firm's leverage is a function of its information asymmetry along with firm characteristics. As in Shyam-Sunder and Myers (1999) and Bharath et al. (2009), we use the broadest measure of leverage as the ratio of total debt to market value of assets. For firm characteristics, we include tangibility, Tobin's q, firm size, and firm profitability (PF). Accordingly, we estimate the following

regression:

$$Leverage_{i,t} = \alpha + \beta_1 IR_{i,t} + \beta_2 Tang_{i,t} + \beta_3 QRatios_{i,t} + \beta_4 Size_{i,t} + \beta_5 Pf_{i,t} + \varepsilon_{i,t} \quad (5)$$

where $Leverage_{i,t}$ is the ratio of total debt divided by market value of assets for firm *i* and time *t*. $Tang_{i,t}$ is the ratio of fixed to total assets, $QRatios_{i,t}$ is the ratio of market-to-book assets, $Size_{i,t}$ is the natural log of sales, $Pf_{i,t}$ is the profitability, and control industry and year effects. Based on Eq. (5), we also estimate changes in firm leverage from the previous year on changes in independent variables to assess if changes in rating scores lead to corresponding changes in firms' leverage.

Finally, Leary and Roberts (2010) suggest that agency-based explanations seem to account for a firm's financing decisions more than information asymmetry. Similar to other firms in East Asian countries (with the exception of Japan), Claessens et al. (2002) find that Taiwanese firms are typically family-controlled and exhibit a substantial wedge between ownership and control. The corporate control is enhanced through cross-holdings and pyramidal structures in the firms. As a result, 66% of firms in Taiwan are in family hands compared to 2.9% that are widely held for the ultimate control of firms at the cutoff level of 10% of voting rights.

To control for agency-based effect, we use six well known agency cost proxies in two dimensions of principal-agent conflicts – ownership structure and divergence of cash flow rights and control rights. The former (see Coles et al. (2008)) includes the proportions of share ownership of board directors and supervisors (SDS), the largest shareholders (SLS), controlling family (TFS), and individual investors (SID). The latter (see La Porta et al. (1999)) includes times of controlling family shareholdings to cash flow rights (TFC) and voting rights (TFV). These two ratios measure the extent to which the proportion of share ownership of controlling families exceeds cash flow rights and voting rights for the ultimate control of firms. Appendix D provides the definition of each of the agency-based proxies. Extending Eq. (5), we include the agency cost variables along with information ratings and firm characteristics,

$$Leverage_{i,t} = \alpha + \beta_1 IR_{i,t} + \beta_2 Tang_{i,t} + \beta_3 QRatios_{i,t} + \beta_4 Size_{i,t} + \beta_5 Pf_{i,t} + \beta_6 AB_{i,t} + D_i + \varepsilon_{i,t,} \quad (6)$$

where $AB_{i,t}$ are measures of agency-based factors. Similar to Eq. (5), we also estimate Eq. (6) with changes in leverage on changes in all explanatory variables.

4.2 Data and summary statistics

Our data are obtained from the Taiwan Economic Journal (TEJ), the most reliable database for publicly listed firms in Taiwan. The sample period begins in 2006 when the current ranking format is first available and ends in 2012. Our sample firms include all the firms publicly listed on the Taiwan Stock Exchange and the Gre Tai Securities Market. Following Shyam-Sunder and Myers (1999), Fama and French (2005), Leary and Roberts (2010), and Dong et al. (2012), we exclude financial firms and regulated firms. This is because the operations of firms in these industries are subject to different regulations and their financial statements may pose different analytical problems than those of regular firms. After excluding data with missing observations and eliminating variables with extreme values, our final sample consists of 1,278 firms and 7,466 firm-year observations.

We first present the distribution of sample firms by industry in Table 1. It shows that among the 27 industries, firms in electronic components, semiconductor, and computer peripherals are more represented in the sample, capturing about 14.0%, 9.6%, and 8.2% of the sample firms, respectively. The remaining two thirds of the sample firms are distributed among the other 24 industries. As Taiwan's economy is skewed more toward high-tech industries, it is not surprising that our sample also reflects the relative importance of these industries. With the number of observations closely proportional to

the number of sample firms in each industry, it indicates that our total sample size is not biased toward firms in particular industries.

Table 2 reports the summary statistics of each variable in the models discussed earlier. Ranging from 1 to 7, the mean and median of the information ratings (IR) are 3.47 and 3.00, respectively. Similarly, the standardized information ratings (IRS) vary from -2.47 to 3.20 with the mean of -0.04 greater than the median of -0.43. The rightly skewed distribution indicates that there are few firms receiving high ratings and the majority of sample firms have lower than average information rating. Among firm characteristics, tangibility and Q-ratios appear to be low with an average of 0.21 and 1.36, respectively. However, firms on average seem to be profitable with average asset returns of 7.94%. As expected, firm size varies widely from NT$90 million to NT$276.859 billion. The variability of firm size in our sample ensures that our data does not suffer from the variation in firms' disclosure quality due to firm size (e.g. Bhushan (1989), Lang and Lundholm (1993), Brown and Hillegeist (2007)).

For agency-based governance measures, the percentage of shareholdings of directors and supervisors (SDS) ranges from 5.13% to 69.23% with an average of 22.84%. Most of the insiders' shareholdings fall below 20%. It is interesting to note that the largest shareholder (SLS), who tends to be a member of the controlling family, holds an average

of 19.11% of total outstanding shares, which is comparable to the average 18% of shares owned by the largest three shareholders reported by La Porta et al. (1999). As the average percentage of individual shareholdings (SID) is rather high at 64.55%, it requires a relatively small controlling family ownership (TFS) of 28.07% to take control of a firm.

In addition to the measures of ownership structure, we also use two proxies to measure the divergence between cash flow rights and control rights to measure incentive conflicts in each sample firm. The average times of controlling family shareholdings over voting rights (TFV) and cash flow rights (TFC) for ultimate control of firms are 0.91 and 2.19, respectively. They imply that the shareholdings of controlling family are, on average, less than those needed for firm controls. Therefore, it appears that the separation of ownership and control is large for the sample firms. When measured relative to cash flow rights for ultimate control, the incentive conflicts seem less severe with shareholdings of controlling family more than twice the cash flow rights.

To see how a firm's information rating is related to its firm characteristics, we sort the sample firms according to their ratings (from 1 to 7). Table 3 reports the time series averages of firm-specific variables over the sample period for each rating category. Consistent with Bharath et al. (2009), Panel A shows that firms with higher information ratings are larger (NET_SALES) and are associated with higher Tobin's q (QRATIO) and

profitability (PF). However, there is a less discernible relationship between information ratings and tangibility. These results also apply to the standardized information ratings (IRS) reported in Panel B. Using information ratings to measure the degree of information asymmetry of a firm should therefore facilitate a more direct test on the pecking order model without resorting to the proxies based on firm characteristics.

Before testing the adequacy of the pecking order model, we estimate the correlations between all explanatory variables. Panels A and B of Table 4 present the correlations between the variables at the level and the change. They show that the correlations between most pairs are generally low. The results seem to indicate that firm-specific measures adequately capture various aspects of firm characteristics. One exception is between QRATIO (Tobin's q) and PF (profitability) where their correlations are 0.41 (0.53 for Spearman's rank correlation) in Panel A. These observations are not surprising since Tobin's q, which is often used to measure a firm's performance, also reflects profitability.

Similar to the low correlations among firm characteristics, those among agency-based variables are mostly below 0.3. This also applies to correlations between firm characteristics variables and agency-based variables. Notably, the correlation between TFS and SDS is relatively high at 0.64 (0.66 for Spearman's rank correlation). Given that the majority of Taiwanese firms are family controlled, the proportion of ownership of

controlling family is closely linked to that of the directors and supervisors who tend to be a member of the controlling family. Similarly, the correlation between TFS and TFV of 0.51 (0.61 for Spearman's rank correlation) tends to be higher because TFV, the times of TFS over voting rights for the ultimate firm control, is more driven by variations in TFS than voting rights, which tend to be low for controlling family. Nevertheless, the overall correlations among the explanatory variables should not pose multicollinearity problems.

5. Empirical Results

5.1 The basic pecking order model test

To test the pecking order model, we begin by estimating the relationship between net debt issuance and financing deficit according to Eq. (1). Models 1 and 2 of Table 5 show that the relationship is significantly positive ($\beta = 0.142$ and 0.148) with or without controlling for industry and year fixed effects. The preliminary results are thus consistent with the modified version of the pecking order model in which β lies between 0 and 1 (see Myers and Majluf (1984), Lemmon and Zender (2004), Bharath et al. (2009)).

In our next step, we include an interaction term between financing deficits and information ratings according to Eq. (3) to examine if information asymmetry is an important factor behind a firm's financing choices. Firms with higher information ratings

should be related to lower adverse selection costs, which in turn should lead to less debt and more equity. Consistent with this prediction, Models 3 and 4 of Table 5 show a significant and negative relationship between the interaction term and net debt issuance. The results are robust to how we measure information ratings. Using standardized information rating (IRS) for the interaction term, Models 5 and 6 show that the interaction term remains negatively related to net debt issuance. It is important to note that adding the interaction term for information ratings increases the adjusted R^2 from 0.13 to 0.26, indicating that information ratings account for a large variation in net debt issuance.

Furthermore, if a firm's information rating is upgraded (downgraded) from the previous year, it should adhere less (more) to the pecking order behavior and hence rely less (more) on debt as information asymmetry is reduced. It follows that the interaction term, DEF*ΔIRS, which includes the change in standardized information rating from the previous year in Eq. (4), should also be negatively related to net debt issuance. Models 7 and 8 of Table 5 confirm the negative impact of a change in information ratings. Our results so far indicate that the level of and the change in the information ratings play an important role in a firm's capital structure decisions.

5.2 The augmented pecking order model test

Next, we present the results of the augmented pecking order model based on Bharath et al. (2009) in Eq. (5). Consistent with earlier results, Models 1 to 4 in Table 6 show that information ratings measured by IR and IRS vary negatively with leverage. The negative relationship is also economically significant where an upgrade to a higher rating lowers the total debt-to-market value of assets by 1.3% (Model 2). Therefore, a firm that moves from the lowest rating to the highest rating is, on average, related to a reduction of 7.8% in total debt relative to market value of assets. Our results are also consistent with Frank and Goyal (2003) and Leary and Roberts (2010) who report that large firms tend to adhere to the pecking order. Small firms with similar levels of information asymmetry are less likely to be influenced by pecking order considerations. As expected, firms with lower firm performance (QRATIO) and profitability (PF), and higher growth opportunities (TANG) tend to have higher leverage.

Frank and Goyal (2003) argue that the conventional leverage regression (i.e. Eq. (5)) is used to explain the level of leverage, while the pecking order regression is intended to explain the change of leverage. They suggest that running the leverage regression in the first differences may help to identify the factors that drive the change of leverage. Therefore, we take the first differences of leverage and the explanatory variables, and estimate the regressions based on Eq. (6). We also include lagged leverage as suggested

by Bharath et al. (2009) to account for the mean reversion in leverage documented in prior literature. Models 5 to 8 of Table 6 present the results for the change of leverage. We find that changes in information ratings (ΔIR) and standardized information ratings (ΔIRS) remain negatively related to the change of firm leverage after controlling for firm characteristics, industry, and firm fixed effects.

5.3 The pecking order model test with agency-based factors

Another important source of market frictions that can influence the pecking order behavior is incentive conflicts in the sense of Jensen and Meckling (1976). It is argued that firms with high agency costs tend to prefer debt over equity to internalize the costs of private benefits. Leary and Roberts (2010) find that proxies related to agency costs have more explanatory powers than those related to information asymmetry. To test these two competing hypotheses, we introduce a number of agency-based proxies based on ownership structure and divergence between cash flow rights and control rights according to Eq. (6). These measures directly reflect the extent of incentive conflicts between managers and investors rather than noisy proxies used in previous studies such as firm size, Tobin's q, or profitability, which we also use as control variables in our tests. Coupled with the information ratings drawn from 114 different information measures to

rank a firm's corporate transparency, our analysis should be better equipped to distinguish these two underlying determinants of capital structure.

Panels A and B of Table 7 present the results of the effects of information asymmetry and agency costs on firm leverage at the level and the change, respectively. As shown in Panel A, information ratings (IR) continue to be important in explaining firm leverage in the presence of firm characteristics and several different agency-based measures. Furthermore, it appears that the economic significance of IR is largely unaffected after controlling for various groups of agency-based measures. For a firm that moves from the lowest to the highest rating, its leverage ratio is reduced, on average by 6.6%. Our results also change little when we use standardized information rating (IRS) as the measurement for information asymmetry. Panel B of Table 7 shows that the relationship between IRS and firm leverage is robust to different model specifications. Again, the predictions of variables related to firm characteristics are similar to those reported in earlier results. In sum, our findings are consistent with Bharath et al. (2009) who report that information asymmetry is an important factor for a firm's financing choices.

It is worth noting that incentive conflicts are also influential in a firm's pecking order behavior. Panels A and B of Table 7 show that some measurements of ownership structures capture variations in firm leverage. Interestingly, we find that shareholdings of

board directors and supervisors (SDS) are positively related to firm leverage. One would expect that as board directors and supervisors own more shares, the principal-agent conflicts would be lower, which in turn would reduce firm leverage. However, Yeh et al. (2001) point out that controlling families in Taiwan often set up nominal investment firms to increase their controls by assigning family members or their designated persons to the board after the investments firms are elected for board positions. As a result, higher SDS do not necessarily indicate lower agency cost. Rather, it may reflect an increase in corporate control by the controlling family. It also follows that higher shareholdings of controlling family (TFS) and the largest shareholder (SLS), who is often a member of the controlling family, increase firm leverage. By the same token, share ownership of individual investors (SID) measures the diffusion of share ownership. An increase in SID is related to higher agency costs and higher firm leverage.

Finally, we find limited success for proxies for divergence between cash flow rights and control rights in explaining a firm's financing decisions. The results for times of controlling family shareholdings over cash flow rights (TFC) and voting rights (TFV) for ultimate firm control are mixed. Given that these measures are related to ownership structure measures, and especially to controlling family shareholdings, their importance

might be subsumed by ownership structure proxies. Overall, our results do suggest that agency-based conflicts are another important determinant of pecking order behavior.

6. Conclusion

This paper sets out to examine the impact of information asymmetry on a firm's capital structure decisions. Against the backdrop of an emerging market where information asymmetry and incentive conflicts between managers and investors tend to be more severe, we use a unique information score on all listed firms based on 114 measures of corporate transparency across five dimensions of information disclosure as a composite measure for information asymmetry. Such a comprehensive and direct measure avoids the multiple interpretations, time invariance, and sample selection bias that often plagues noisy proxies for information asymmetry in previous studies.

We find that information asymmetry affects a firm's financing choices. An upgrade in information ratings is related to a reduction in net debt or firm leverage. These results are consistent with the observed pecking order behavior as lower asymmetric information of a firm reduces its adverse selection costs, which in turn relies less on debt financing. This negative relationship between firm leverage and information rating is robust to various firm characteristics including firm size, growth opportunities, and profitability,

which are often used as proxies for information asymmetry in the literature.

Our finding that information asymmetry is related to pecking order theory does not imply that other determinants are less influential in explaining a firm's financing decisions. In particular, firms with the same level of information ratings but higher agency costs are likely to rely more on debt over equity financing. However, the impact of incentive conflicts on a firm's financing preferences is unlikely to subsume the effect of information asymmetry. It appears that both underlying market frictions play an important role in explaining how a firm makes its capital structure decisions.

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Table 1 Distribution of firms by industry

This table reports the distribution of sample firms by industry. No. of firms (obs.) is the number of firms (observations) in each industry. % of firms (obs.) represented is the percentage of firms (observations) represented by each industry. The classifications of industry are obtained and cross-checked from the Taiwan Stock Exchange, Gre Tai Securities Market, and Kimo-Yahoo website.

	Industry	no. of firms	no. of obs.	% of firms represented	% of obs. represented
1	Auto	5	35	0.40	0.50
2	Biotechnology and medical care	47	245	3.70	3.30
3	Building material and construction	67	373	5.20	5.00
4	Cement	7	48	0.50	0.60
5	Chemical and biological technology	37	241	2.90	3.20
6	Communications network operator	66	398	5.20	5.30
7	Computer peripherals	105	628	8.20	8.40
8	Electric cables	17	99	1.30	1.30
9	Electric machinery	62	385	4.90	5.20
10	Electronic access	44	263	3.40	3.50
11	Electronic components	179	1,028	14.00	13.80
12	Food	23	160	1.80	2.10
13	Glass ceramic	4	28	0.30	0.40
14	Information services	39	237	3.10	3.20
15	Oil, gas, and electricity	12	84	0.90	1.10
16	Other electronics	71	396	5.60	5.30
17	Others	70	404	5.50	5.40
18	Paper	7	49	0.50	0.70
19	Photoelectric	105	527	8.20	7.10
20	Plastics	28	185	2.20	2.50
21	Rubber	11	74	0.90	1.00
22	Semiconductor	123	654	9.60	8.80
23	Shipping	24	144	1.90	1.90
24	Sightseeing	11	77	0.90	1.00
25	Steel	39	239	3.10	3.20
26	Textile	54	340	4.20	4.60
27	Trade department	21	125	1.60	1.70
	Total	1278	7466	100.0	100.0

Table 2 Summary statistics of all firms

This table reports the descriptive statistics of firm characteristics and agency-based proxies of sample firms. The definitions of the variables are provided in detail in Appendix D.

	MIN	Q1	MEDIAN	MEAN	Q3	MAX	STD
IR	1.00	3.00	3.00	3.47	5.00	7.00	1.15
IRS	-2.47	-0.54	-0.43	-0.04	1.00	3.20	0.98
TANG	0.00	0.06	0.16	0.21	0.30	0.75	0.18
Q RATIOS (%)	49.12	90.17	114.61	136.35	156.23	446.47	80.82
SIZE (million NT$)	90	1,079	2,481	14,447	6,569	276,859	82,981
PF (%)	-20.79	3.30	7.76	7.94	13.12	32.08	9.84
SDS (%)	5.13	12.65	19.26	22.84	29.24	69.23	13.95
SLS (%)	0.02	11.44	17.24	19.11	24.64	55.06	11.12
SID (%)	10.59	48.75	68.47	64.55	82.68	98.99	22.30
TFS (%)	1.28	13.54	25.18	28.07	40.02	75.51	17.94
TFC	1.00	1.00	1.00	2.19	1.15	17.86	10.32
TFV	0.38	0.89	0.97	0.91	1.00	1.00	0.14

Table 3 Firm characteristics across information rating quantiles

This table reports means of various firm characteristics for firms in each information rating quantile. TANG, QRATIO, NET_SALES, and PF stand for tangibility, Tobin's q, firm size, and profitability, respectively. Panel A (B) displays means of various firm-specific variables in each IR (IRS) based information rating quantile.

	TANG	QRATIO (%)	NET_SALES (Million NT$)	PF (%)
Panel A: Information rating (IR)				
Lowest	0.29	124.08	5,171	5.02
2	0.24	132.18	4,183	6.36
3	0.19	136.81	10,794	7.82
4	0.20	119.11	12,916	6.79
5	0.20	139.89	24,602	9.15
6	0.27	161.48	48,522	12.78
Highest	0.25	213.35	88,392	16.13
Panel B: Standardized information rating (IRS)				
Lowest	0.31	124.78	3,478	4.77
2	0.24	132.39	4,087	5.93
3	0.20	126.32	10,001	6.21
4	0.20	137.17	10,633	7.98
5	0.20	131.99	21,523	8.12
6	0.21	150.84	32,071	11.34
Highest	0.27	172.03	63,817	13.75

Table 4 Correlation matrix between explanatory variables at the level and change

This table reports the correlation coefficients between independent variables. Pearson's correlation coefficients are below the diagonal, while the Spearman's rank correlation coefficients are above the diagonal. Panel A (Panel B) shows the correlation coefficients between the level (change) of independent variables. The definitions of the variables are shown in detail in Appendix D.

Panel A	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) IR		0.93 ***	-0.04 ***	0.06 ***	0.19 ***	0.11 ***	-0.01	-0.04 ***	-0.12 ***	-0.04 ***	0.12 ***	-0.04 ***
(2) IRS	0.98 ***		-0.02 **	0.10 ***	0.20 ***	0.15 ***	-0.01	-0.06 ***	-0.11 ***	-0.04 ***	0.12 ***	-0.06 ***
(3) TANG	-0.04 ***	-0.03 ***		-0.09 ***	-0.06 ***	0.04 ***	0.05 ***	0.03 ***	0.01	0.09 ***	0.01	0.20 ***
(4) QRATIO	0.05 ***	0.07 ***	-0.09 ***		0.05 ***	0.53 ***	0.01	0.04 ***	-0.20 ***	-0.03 ***	0.02 *	-0.09 ***
(5) SIZE	0.23 ***	0.24 ***	-0.03 **	0.02 *		0.25 ***	-0.15 ***	-0.10 ***	-0.34 ***	-0.07 ***	0.17 ***	0.00
(6) PF	0.12 ***	0.14 ***	0.05 ***	0.41 ***	0.24 ***		0.03 ***	-0.01	-0.25 ***	-0.01	0.04 ***	-0.12 ***
(7) SDS	0.00	0.01 ***	0.07 ***	0.02	-0.08 ***	0.06 ***		-0.08 ***	-0.30 ***	0.66 ***	0.14 ***	0.29 ***
(8) SLS	-0.05 ***	-0.07 ***	0.03 **	0.03 ***	-0.11 ***	0.00	-0.15 ***		-0.23 ***	0.34 ***	-0.05 ***	0.23 ***
(9) SID	-0.15 ***	-0.15 ***	-0.04 ***	-0.18 ***	-0.37 ***	-0.25 ***	-0.41 ***	-0.25 ***		-0.35 ***	-0.34 ***	-0.25 ***
(10) TFS	-0.04 ***	-0.04 ***	0.08 ***	-0.03 **	-0.08 ***	0.01	0.64 ***	0.40 ***	-0.39 ***		0.18 ***	0.61 ***
(11) TFC	0.11 ***	0.11 ***	0.01	0.06 ***	0.08 ***	0.05 ***	0.11 ***	-0.06 ***	-0.11 ***	0.02 ***		0.12 ***
(12) TFV	-0.01	-0.02 *	0.13 ***	-0.07 ***	-0.02 *	-0.10 ***	0.25 ***	0.19 ***	-0.21 ***	0.51 ***	0.02	

*, **, *** denote statistical significance at 1%, 5%, and 10%, respectively.

Panel B	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) △IR		0.86 ***	0.03 ***	-0.05 ***	0.00	-0.02 *	0.02	0.01	0.02	0.01	0.00	0.00
(2) △IRS	0.97 ***		-0.03 ***	0.06 ***	0.00	0.04 ***	-0.01	0.00	0.02	0.00	0.00	0.01
(3) △TANG	0.03 **	0.01		-0.19 ***	-0.19 ***	-0.24 ***	0.04 ***	0.01	0.03 ***	0.02 *	0.00	0.00
(4) △QRATIO	-0.06 ***	-0.01	-0.14 ***		0.05 ***	0.35 ***	-0.03 **	0.02	-0.08 ***	0.02 **	0.01	0.08 ***
(5) △SIZE	0.00	0.00	-0.10 ***	0.03 **		0.39 ***	-0.08 ***	-0.04 ***	-0.11 ***	-0.10 ***	-0.01	-0.04 ***
(6) △PF	-0.02	0.01	-0.21 ***	0.23 ***	0.26 ***		-0.03 **	0.03 **	-0.13 ***	0.00	0.00	0.02
(7) △SDS	0.01	-0.01	0.01	0.00	-0.03 **	0.00		-0.18 ***	-0.05 ***	0.35 ***	-0.04 **	0.06 ***
(8) △SLS	0.02 *	0.02	0.01	-0.01	-0.01	0.04 **	-0.42 ***		-0.28 ***	0.25 ***	-0.01	0.09 ***
(9) △SID	0.03 **	0.02 **	0.03 ***	-0.07 ***	-0.07 ***	-0.11 ***	-0.17 ***	-0.22 ***		-0.04 ***	-0.06 ***	-0.03 **
(10) △TFS	0.00	-0.01	0.02	0.00	-0.02	0.05 ***	0.35 ***	0.29 ***	-0.17 ***		-0.04 ***	0.34 ***
(11) △TFC	0.02	0.01	0.00	0.00	0.02 *	0.03 ***	0.08 ***	-0.03 **	-0.03 **	0.03 ***		0.00
(12) △TFV	0.01	0.01	0.01	0.01	-0.02 *	-0.01	0.07 ***	0.04 ***	-0.04 ***	0.22 ***	0.02 **	

*, **, *** denote statistical significance at 1%, 5%, and 10%, respectively.

Table 5 Results of the pecking order model test

This table reports the panel regression results of net debt issuance based on Eqs. (3) and (4). DEF is defined as the accounting cash flow identity in Eq. (2). DEF* IR, DEF* IRS, and DEF* ΔIRS are the interaction terms. *, **, *** denote statistical significance at 1%, 5%, and 10%, respectively.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Intercept	0.169 ***	-0.891	0.123 ***	-1.078	0.122 ***	-1.151	0.155 ***	-0.970
	(4.19)	(-0.72)	(3.28)	(-0.95)	(3.28)	(-1.02)	(3.90)	(-0.80)
DEF	0.142 ***	0.148 ***	0.554 ***	0.559 ***	0.220 ***	0.225 ***	0.150 ***	0.155 ***
	(33.24)	(34.13)	(45.72)	(46.21)	(49.42)	(50.27)	(35.23)	(36.14)
DEF* IR			-0.096 ***	-0.096 ***				
			(-35.94)	(-36.03)				
DEF* IRS					-0.116 ***	-0.117 ***		
					(-37.20)	(-37.33)		
DEF* ΔIRS							-0.027 ***	-0.028 ***
							(-14.64)	(-14.74)
Industry Dummy	NO	YES	NO	YES	NO	YES	NO	YES
Year Dummy	NO	YES	NO	YES	NO	YES	NO	YES
Adj R^2	0.13	0.14	0.26	0.27	0.26	0.27	0.15	0.16
N	7,465	7,465	7,465	7,465	7,465	7,465	7,465	7,465

Table 6 Results of the augmented pecking order model test

This table reports the panel regression results of firm leverage based on Eq. (5). IR, IRS, TANG, QRATIO, SIZE, and PF stand for information rating, standardized information rating, tangibility, Tobin's q, firm size, and profitability, respectively. *, **, *** denote statistical significance at 1%, 5%, and 10%, respectively.

	Model 1	Model 2	Model 3	Model 4		Model 5	Model 6	Model 7	Model 8
Intercept	12.444 ***	-6.066	7.518	-10.265 **	Intercept	3.661	2.598	3.658	2.596
	(2.36)	(-1.20)	(1.42)	(-2.02)		(1.20)	(0.87)	(1.19)	(0.87)
IR	-1.522 ***	-1.295 ***			△IR	-0.343 ***	-0.305 ***		
	(-9.79)	(-8.74)				(-2.83)	(-2.59)		
IRS			-1.773 ***	-1.513 ***	△IRS			-0.420 ***	-0.379 ***
			(-9.91)	(-8.88)				(-3.02)	(-2.80)
TANG	12.737 ***	15.706 ***	12.737 ***	15.706 ***	△TANG	12.824 ***	5.849 ***	12.832 ***	5.857 ***
	(11.72)	(15.10)	(11.72)	(15.11)		(5.84)	(2.70)	(5.85)	(2.71)
QRATIO	-0.094 ***	-0.069 ***	-0.094 ***	-0.069 ***	△QRATIO	-0.033 ***	-0.030 ***	-0.033 ***	-0.030 ***
	(-41.07)	(-29.21)	(-41.07)	(-29.20)		(-18.49)	(-16.76)	(-18.50)	(-16.77)
SIZE	2.892 ***	3.637 ***	2.896 ***	3.641 ***	△SIZE	0.505 *	1.822 ***	0.507 *	1.823 ***
	(24.06)	(30.92)	(24.10)	(30.95)		(1.82)	(6.55)	(1.82)	(6.55)
PF		-0.505 ***		-0.505 ***	△PF		-0.264 ***		-0.264 ***
		(-26.92)		(-26.92)			(-20.01)		(-20.01)
					$Leverage_{t-1}$	-0.148 ***	-0.132 ***	-0.148 ***	-0.132 ***
						(-23.05)	(-20.99)	(-23.05)	(-20.99)
Industry Dummy	YES	YES	YES	YES	Industry Dummy	YES	YES	YES	YES

Year Dummy	YES	YES	YES	YES	Year Dummy	YES	YES	YES	YES
Adj R^2	0.44	0.49	0.44	0.49	Adj R^2	0.53	0.56	0.53	0.56
N	6,930	6,930	6,930	6,930	N	6,930	6,930	6,930	6,930

Table 7 Results of pecking order model test with agency-based factors

This table reports the panel regression results of firm leverage based on Eq. (6). IR, IRS, TANG, QRATIO, SIZE, and PF denote information rating, standardized information rating, tangibility, Tobin's q, firm size, and profitability, respectively. Panel A (Panel B) reports the results for IR (IRS). *, **, *** denote statistical significance at 1%, 5%, and 10%, respectively.

Panel A Leverage and information ratings

	Model 1	Model 2	Model 3	Model 4		Model 5	Model 6	Model 7	Model 8
Intercept	-37.740 ***	-37.662 ***	-37.670 ***	-34.517 ***	Intercept	-41.324 ***	-41.247 ***	-41.253 ***	-38.095 ***
	(-6.92)	(-6.88)	(-6.88)	(-6.10)		(-7.58)	(-7.53)	(-7.53)	(-6.74)
IR	-1.114 ***	-1.114 ***	-1.113 ***	-1.111 ***	IRS	-1.302 ***	-1.302 ***	-1.301 ***	-1.299 ***
	(-7.59)	(-7.59)	(-7.56)	(-7.55)		(-7.71)	(-7.71)	(-7.68)	(-7.67)
TANG	15.435 ***	15.441 ***	15.441 ***	15.624 ***	TANG	15.435 ***	15.440 ***	15.441 ***	15.624 ***
	(15.02)	(15.02)	(15.02)	(15.15)		(15.03)	(15.02)	(15.02)	(15.15)
QRATIO	-0.065 ***	-0.065 ***	-0.065 ***	-0.065 ***	QRATIO	-0.065 ***	-0.065 ***	-0.065 ***	-0.065 ***
	(-27.54)	(-27.52)	(-27.51)	(-27.51)		(-27.54)	(-27.52)	(-27.51)	(-27.51)
SIZE	4.597 ***	4.595 ***	4.595 ***	4.589 ***	SIZE	4.600 ***	4.598 ***	4.598 ***	4.592 ***
	(34.35)	(34.09)	(34.06)	(34.01)		(34.37)	(34.11)	(34.09)	(34.04)
PF	-0.481 ***	-0.481 ***	-0.481 ***	-0.486 ***	PF	-0.481 ***	-0.481 ***	-0.481 ***	-0.486 ***
	(-25.82)	(-25.80)	(-25.80)	(-25.89)		(-25.82)	(-25.80)	(-25.80)	(-25.89)
SDS	0.105 ***	0.103 ***	0.103 ***	0.095 ***	SDS	0.105 ***	0.103 ***	0.103 ***	0.095 ***
	(7.29)	(4.80)	(4.78)	(4.36)		(7.29)	(4.80)	(4.78)	(4.36)
SLS	0.130 ***	0.128 ***	0.128 ***	0.122 ***	SLS	0.130 ***	0.128 ***	0.128 ***	0.122 ***

	(7.67)	(5.88)	(5.88)	(5.55)		(7.67)	(5.88)	(5.88)	(5.55)
SID	0.152 ***	0.152 ***	0.152 ***	0.149 ***	SID	0.152 ***	0.152 ***	0.152 ***	0.149 ***
	(14.82)	(14.71)	(14.70)	(14.41)		(14.80)	(14.70)	(14.69)	(14.40)
TFS		0.003	0.002	0.018	TFS		0.003	0.002	0.018
		(0.16)	(0.15)	(1.01)			(0.16)	(0.15)	(1.01)
TFC			-0.001	0.000	TFC			-0.001	0.000
			(-0.07)	(0.03)				(-0.07)	(0.03)
TFV				-3.174 ***	TFV				-3.173 ***
				(-2.24)					(-2.24)
Industry Dummy	YES	YES	YES	YES	Industry Dummy	YES	YES	YES	YES
Year Dummy	YES	YES	YES	YES	Year Dummy	YES	YES	YES	YES
Adj R^2	0.50	0.50	0.50	0.51	Adj R^2	0.51	0.51	0.51	0.51
N	6,906	6,906	6,906	6,906	N	6,906	6,906	6,906	6,906

Panel B The change of leverage and the change of information ratings

	Model 1	Model 2	Model 3	Model 4		Model 5	Model 6	Model 7	Model 8
Intercept	2.459	2.411	2.418	2.425	Intercept	2.459	2.410	2.417	2.424
	(0.83)	(0.81)	(0.81)	(0.82)		(0.83)	(0.81)	(0.81)	(0.82)
△IR	-0.282 ***	-0.279 ***	-0.277 ***	-0.277 ***	△IRS	-0.353 ***	-0.348 ***	-0.346 ***	-0.345 ***
	(-2.39)	(-2.36)	(-2.34)	(-2.34)		(-2.60)	(-2.56)	(-2.55)	(-2.55)
△TANG	5.879 ***	5.895 ***	5.907 ***	5.911 ***	△TANG	5.888 ***	5.903 ***	5.915 ***	5.919 ***
	(2.72)	(2.73)	(2.73)	(2.74)		(2.72)	(2.73)	(2.74)	(2.74)
△QRATIO	-0.029 ***	-0.029 ***	-0.029 ***	-0.029 ***	△QRATIO	-0.029 ***	-0.029 ***	-0.029 ***	-0.029 ***
	(-16.48)	(-16.44)	(-16.46)	(-16.46)		(-16.49)	(-16.45)	(-16.47)	(-16.46)
△SIZE	1.838 ***	1.820 ***	1.825 ***	1.824 ***	△SIZE	1.839 ***	1.821 ***	1.826 ***	1.825 ***
	(6.60)	(6.53)	(6.55)	(6.54)		(6.60)	(6.54)	(6.55)	(6.55)
△PF	-0.261 ***	-0.262 ***	-0.262 ***	-0.262 ***	△PF	-0.261 ***	-0.262 ***	-0.262 ***	-0.262 ***
	(-19.75)	(-19.83)	(-19.79)	(-19.79)		(-19.75)	(-19.83)	(-19.79)	(-19.79)
△SDS	0.035	-0.005	-0.003	-0.003	△SDS	0.035	-0.005	-0.003	-0.003
	(1.52)	(-0.17)	(-0.10)	(-0.10)		(1.51)	(-0.17)	(-0.10)	(-0.10)
△SLS	0.025	-0.003	-0.003	-0.003	△SLS	0.025	-0.003	-0.003	-0.003
	(1.39)	(-0.14)	(-0.15)	(-0.15)		(1.40)	(-0.13)	(-0.14)	(-0.15)
△SID	0.045 ***	0.043 ***	0.042 ***	0.042 ***	△SID	0.045 ***	0.043 ***	0.043 ***	0.042 ***
	(3.07)	(2.89)	(2.88)	(2.87)		(3.08)	(2.90)	(2.88)	(2.88)
△TFS		0.068 ***	0.068 ***	0.068 ***	△TFS		0.067 ***	0.067 ***	0.068 ***
		(2.77)	(2.78)	(2.75)			(2.76)	(2.77)	(2.74)
△TFC			-0.025	-0.025	△TFC			-0.025	-0.025

			(-1.26)	(-1.25)				(-1.26)	(-1.26)
△TFV				-0.338	△TFV				-0.337
				(-0.15)					(-0.15)
$Leverage_{t-1}$	-0.132 ***	-0.132 ***	-0.132 ***	-0.132 ***	$Leverage_{t-1}$	-0.132 ***	-0.132 ***	-0.132 ***	-0.132 ***
	(-21.00)	(-20.94)	(-20.93)	(-20.93)		(-21.00)	(-20.93)	(-20.93)	(-20.93)
Industry Dummy	YES	YES	YES	YES	Industry Dummy	YES	YES	YES	YES
Year Dummy	YES	YES	YES	YES	Year Dummy	YES	YES	YES	YES
Adj R^2	0.56	0.56	0.56	0.56	Adj R^2	0.56	0.56	0.56	0.56
N	6,904	6,904	6,904	6,904	N	6,904	6,904	6,904	6,904

*, **, *** denote statistical significance at 1%, 5%, and 10%, respectively.

Appendix A Information disclosure and transparency measures

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 from A++ to C- based on these questions.

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?
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 two months of accounting year-end? (This item receives extra bonus point)
25	Whether company reports annual report within three 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 one 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 one 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?
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?
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)
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?

Appendix B Measurements of information rating based on five different dimensions

This appendix categorizes the 114 items used to evaluate a firm's information rating in each of the five dimensions of information disclosure. Total items are the number of items in each dimension. Percentage of total items represented is the number of total items in each dimension divided by total items in the sample (114). Items with extra rewards are those items encouraged by the government regulator.

Dimension		Item range	Total items	Percentage of total items represented	Items with extra rewards
(1)	Regulatory compliance	1-12	12	11%	None
(2)	Timeliness of information disclosure	13-39	27	23%	9 items
(3)	Disclosure of financial forecast	40-44	5	4%	5 items
(4)	Disclosure of annual report	45-94	50	44%	4 items
(5)	Disclosure of firm website	95-114	20	18%	20 items
	Total			100%	38 items

Data sources: SFI database

Appendix C Information ratings and their corresponding scores from 2006 to 2012

This appendix shows the corresponding information rating score for each information rating ranging from A++ to C-.

Information rating (IR)	2006	2007	2008	2009	2010	2011	2012
A++						7	7
A+	5	5	5	5	5	6	6
A	4	4	4	4	4	5	5
A-						4	4
B	3	3	3	3	3	3	3
C	2	2	2	2	2	2	2
C-	1	1	1	1	1	1	1

Data source: SFI database, Taiwan

Appendix D Variable definitions

This appendix provides the definition of each dependent and independent variable used in the empirical analysis.

Variable	Explanation
	Firm Characteristics
LEVERAGE	The ratio of debt to market value of assets.
IR	The score of information rating ranging from 1 (the lowest) to 7 (the highest).
IRS	The standardized information rating score, the difference between IR for firm *i* at time *t* and the average IR, scaled by the firm's IR standard deviation.
TANG	The ratio of fixed to total assets.
QRATIO	[(Book equity + market equity) / Total Assets]*100%.
SIZE	Natural log of net sales.
PF	Profitability = (EBITDA / Total Assets)*100%.
Agency-based measurements	
SDS	Percentage of total outstanding shares owned by directors and supervisors.
SLS	Percentage of total outstanding shares owned by largest shareholder.
SID	Percentage of shareholdings by individual investors.
TFS	Percentage of total outstanding shares owned by family members.
TFC	Times of family shareholdings to cash flow rights = family ownership / cash flow rights, where cash flow rights percentage is based on the percentage of cash flow rights for the ultimate control by the largest shareholder (La Porta et al. (2002), Claessens et al. (2002)).
TFV	Times of family shareholdings to voting rights = family ownership / voting rights, where voting right percentage is the percentage of voting rights for the ultimate control by the largest shareholder (La Porta et al. (1999)).