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Institutional ownership and information transparency: Role of technology intensities and industries

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ABSTRACT

Information disclosure is a necessary activity in corporate governance; information transparency plays a unique role in corporate governance in the era of knowledge-based economy. Lack of transparency can lead to confusion, misinformation, and distrust. With this in mind, we examine the factors that influence corporate information transparency in terms of two dimensions: technology intensity and institutional ownership. Drawing on data from a 2005–2012 cross-section sample of 1391 public firms evaluated by the official ‘information disclosure and transparency ranking system’ (IDTRS), we find that increases in domestic institutional ownership for firms in high-tech industries, relative to foreign institutional ownership, lead to a current-year upgrade in information transparency, but not for firms in other industries. We also find that firms with increased foreign institutional ownership and high-tech firms with both increased governmental institutional or corporate ownership and high R&D intensity can sustain a longer-run upgrade in corporate transparency. Pushing further we also investigate whether corporate transparency in high-tech industries is negatively affected if governmental institutional or corporate shareholders are involved in corporate governance, but cannot find strong evidence for such a tendency. Our results suggest that institutional shareholders promote good corporate governance practices which gradually improve at the pace of high technology development.

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1. Introduction

A good corporate governance framework should ensure that timely and accurate disclosure is made on all material matters regarding the corporation, including the financial situation, performance, ownership, and governance of the company (OECD, 2004¹). With an eye towards corporate governance framework and technological knowledge characteristics we investigate the

joint effects of research and development (R&D) intensity and the four categories of institutional ownership on corporate information transparency for the three tiers of industries (i.e., high-tech, medium-high-tech and traditional) and the three categories of firms (i.e., government-involved, group-affiliated and manager-governed) over a sample period from 2005 to 2012.

Proponents of ‘Asian value’ argue that companies led by governmental institutions have better performance in terms of influencing the course of economic development and income distribution, especially in knowledge-based innovative services and industries (Lee, 2003). Asian countries have a long tradition of governments exerting a lot of authority in various matters. Do governmental institutions intervening in business affairs of high-tech firms influence corporate transparency? By contrast, following the democratization of Taiwan and Korea, universalism claims that the Asian experience is not exceptional at all. Stock markets in Taiwan are ‘plate-form’ markets that are significantly influenced by the international contagion effect. The stock price fluctuations are seen to exhibit signs of increasing foreign

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¹ In conjunction with national governments, other relevant international organizations and the private sector, the Organization for Economic Cooperation and Development (OECD) has developed a set of corporate governance standards and guidelines, ‘The OECD Principles of Corporate Governance’. We quote the foreword of its principle V: ‘Disclosure and Transparency’, one of the six main principles, as our writing motivation.

investments acting as a critical factor in swaying capital markets. Does foreign institutional ownership have significant influence on disclosure quality of firms in the plate-form stock markets? Prior studies have provided inconsistent explanations for the mixed evidence on the influence of institutional ownership. Since every category of institutional ownership has its different competing effects on information asymmetry, it is unclear whether it is practicable to generalize the results of prior studies to other institutional shareholders.

Using the IDTRS evaluation from 2005 to 2012, we investigate the direct causal relations between institutional ownership and corporate transparency in Taiwan, where national policies are seen as serving as a hub for the technology industries. Based on the different characteristics in diversified industries, we correct standard errors for industry-level clustering because information transparency is likely to be correlated within an industry since some industry-specific attributes are mandated by accounting and disclosure rules (De Franco, Kothari, & Verdi, 2011). For instance, the accounting standards regarding R&D expenditures, intangible assets, and impairment of assets are highly correlated with technology-oriented industries. We preliminarily find that firms and industries operating at a higher technology level tend to have higher R&D intensity and information transparency. We also find that domestic institutional ownership is positively correlated with corporate transparency. However, in pursuit of their maximum interest, the dual roles of stakeholder and shareholder may eventually conflict by controlling managers' decisions that are in conflicts with shareholders' interests including transparent information. We find the correlation coefficient of institutional ultimate controlling ownership is significantly negative, suggesting that a possible role duality conflict may affect the ownership–transparency relationship.

R&D intensity is more characteristic of industrial technology firms than other indicators (Hsu, Lai, & Li, 2015). We use both R&D-based industry classification and a firm's R&D intensity as the technology factors to moderate the linkages between institutional ownership and corporate transparency. We further implement multivariate changes regressions to examine the effect of ownership on transparency at the level of both industry and firm. Our regression analysis of the above relationship leads to four findings. First, we find that technology industry classification is, in general, more indicative than technology intensity magnitude. Second, increases in domestic institutional ownership help high-tech firms increase their current-year information transparency, while the positive effects of increases in foreign institutional ownership on corporate transparency are deferred to the following year. Third, firms with a higher R&D intensity which are experiencing increased governmental institutional or corporate ownership tend to continuously improve their information transparency in the following year. Finally, by comparing changes in the controlling ownership of government-involved firms and group-affiliated firms with manager-governed firms, we cannot find a negative effect of increased controlling institutional ownership on corporate transparency.

The contributions which this research makes to the field are summarized in the following. First, we integrate the IDTRS evaluation and the OECD industry classification (OECD, 2011) into our research; this includes fairly new data in the literature on corporate governance. Second, this is the first paper that uses industry-level and firm-level technology intensity together to determine the moderating effect of various institutional ownership on information transparency. Third, though related research is abundant, in this paper we perform an analysis through a multivariate changes regression model to provide a deeper insight into the causal relation between institutional ownership and corporate transparency.

We believe that our focus on official data and standards, direct causality relationship, and counterevidence can provide more convincing results than previous research has managed to achieve. Research background and hypotheses development are explained in the next section; data and methodology in the third section; empirical research findings in the fourth section; and the conclusion in the final section.

2. Background and hypotheses

2.1. Background description

In this paper, institutional shareholders are operationally defined as the shareholders of domestic institutions which are governed by the Taiwan Securities Exchange Act,² and foreign institutions and funds.³ Depending upon their backgrounds, trading tendencies and regulatory restrictions, various economic consequences can be caused by institutional ownership (Choi, Lam, Sami, & Zhou, 2013). Shareholders who focus on a firm's short-term performance tend to be concerned with market-price volatility but not the firm's prospects and management, and therefore, no positive impact of their shareholdings on corporate governance is expected. Inversely, expectations regarding a firm's future development, long-term institutional shareholders will have a greater influence on firms. They use different means to monitor the firm's decision-making. Transparent accounting information facilitates institutional shareholder monitoring and the effective exercise of shareholder rights under existing securities laws (Bushman & Smith, 2003).

According to Black (1991), institutional shareholders can be categorized into 'Institutional voice' and 'Institutional control'. The former does not participate in management but can pressure and challenge firm managers. By contrast, the latter participates in the firm's business by holding key positions, such as directors or managers. Many prior studies (i.e., Chen, Harford, & Li, 2007; Ferreira & Matos, 2008; Aggarwal, Erel, Ferreira, & Matos, 2011) classify institutional investors according to the potential for business ties to a firm, referring to those with strong ties as "grey institutions"⁴ and those with weak ties as "independent institutions".

Corporate shareholders have a strong underlying purpose for building business ties to a corporation. Their tight business and monitoring capability can result in efficient monitoring or strategic alignment (Pound, 1988). The shareholdings of governmental institutions usually can represent governmental policy objectives and implementation. In the same vein, financial institutional shareholders may play a role like governmental institutions, or may be able to make direct fund transfers to firms just as corporate shareholders and grey institutions are able to.

² In this paper, our domestic institutions comprise all institutions other than foreign ones. The composition of institutional shareholders is different according to the country's related law. According to the trading proportion statistics of shareholder categories of the Taiwan 'Securities Exchange Act', the institutional shareholders in a broad sense are the category relative to human shareholders. However, in a narrow sense, the Act also categorizes financial institutions, investment and trust companies and some specific funds as the 'professional institutional shareholders'.

³ The qualified foreign institutional shareholders (QFII) in this paper include all institutional shareholders who are not domiciled in Taiwan, including foreign institutions, foreign mutual funds, and foreign corporate shareholders and other institutions.

⁴ Grey institutions refer to those investors who have, whether actual or only potential, business relationships with firms in which they invest. The ownership is mainly the percentage of shares held by bank trust departments, insurance companies, and other institutions (e.g., pension funds, endowments).

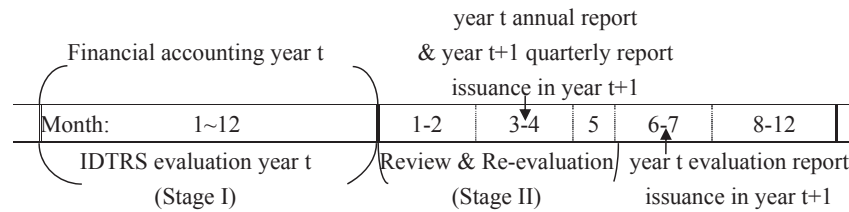


Fig. 1. Timeline of annual reports and IDTRS implementation in Taiwan.

Domestic mutual fund and foreign institutional shareholders have independent institutional ownership, because they are more likely to collect corporate information and are subject to fewer regulatory restrictions. They have the highest shareholder sophistication but fewer potential business relationships with the corporations. Based on their greater independence, these two groups are more involved in monitoring corporate management. However, foreign institutional shareholders seldom participate in local firm's operations because of greater restrictions, fewer information channels and unfavorable environmental factors.⁵ They know that excessive intervention in invested firms can negatively influence firm's operation and stock price, and may cause a loss for independent shareholders (Palmiter, 2002).

Isolating two distinct factors, Bushman, Piotroski, and Smith (2004) find that the governance transparency factors are primarily related to a country's legal/judicial regime, whereas the financial transparency factors are primarily related to political economy. Hence, we argue that the official evaluation is a direct measure of information transparency since the systematic review is based on definite evaluation metrics at the class and method level.⁶ It provides another type of comparable data for transparency, relative to the measures based on market reactions (e.g., Choi & Seo, 2008; Liu, Hsu, & Li, 2014).

In 2002, the Taiwan Securities & Futures Institute (SFI) established an independent council for professional evaluation and launched the IDTRS, through which a two-stage screening process is conducted. First, all information provided is given a preliminary screening by the SFI's in-house ranking team based on each disclosure item in an evaluation year. Second, all companies are entitled to review the preliminary results via the internet and respond directly to SFI regarding ambiguous issues in the following year. Upon receiving the different opinions expressed by companies, the ranking committee assesses the correspondences, makes adjustments if needed; and the consulting committee decides the final ranking results. About half of the indicators are concerned with financial statement information, and about forty percent are designed for voluntary disclosure (including R&D-related information). The latter causes the major differences in ratings. The IDTRS thus help all stakeholders monitor corporate governance.

In Fig. 1 we can see that two subsequent events are scheduled for the following year. The first is the procedure of review and re-evaluation. It is possible for evaluated firms to change the first-

stage results by improving their website disclosure and financial forecasts. The second is the year t annual and the year t + 1 quarterly reports issuance. However, we find that both the two financial reports are evaluated through the year t + 1 IDTRS (their issuance year) and only impact the year t + 1 evaluation result.

2.2. Hypothesis development

Relative to retail shareholders, large external shareholders, block owners, and institutional shareholders have strong incentives to monitor domestic public firms (Allen, Bernardo, & Welch, 2000; El-Gazzar, 1998; Hotchkiss & Strickland, 2003; Shleifer & Vishny, 1986). Prior studies have found that monitoring by large external shareholders reduces the agency costs of equities by effectively controlling managers' decisions when they are in conflicts with shareholders' interests. Thus, firms with long-term supervision have better prospects for long-term earnings growth and increases in value. However, some studies (e.g., Porter, 1992; Bushee, 2001) claim that institutional ownership with short investment horizons will maximize short-term results at the expense of long-term equity value or firm value in expected near term earnings.

In the present work we analyze the influence of various external shareholders on corporate transparency. Governmental institutions are concerned with governmental institutional service and policy implementation. In Taiwan, Chen, Chen, and Chen (2005) indicate that firms with a higher percentage of ownership by the government, financial institutions, and foreign institutions have superior long-term supervision and better disclosure. Ku (2013) asserts that a larger board and higher proportion of institutional ownership will strengthen the information transfer effect. The so-called 'three legal entities'⁷ in Taiwan's stock markets have significant influence on firm's market price, which is why both firm managers and securities analysts keep a close eye on their trading tendency. Based on the influence of domestic mutual funds on the trading in secondary markets, firms concerned about the effect of the three legal entities on market prices may manage to promote their information transparency.

Based on the higher economic value of high technology, the benefits accruing from the firm's increased value serve as an important driving force for institutional shareholders to enhance their influence for self-interest. Bearing greater cost and risk in their investments, institutional shareholders will select firms with high information transparency and require the firms to disclose more information relevant to financial analysis, risk evaluation and operational plans. Hence, we postulate that institutional shareholders also have a higher investment preference for information about firm's technology level, especially in high-tech industries.

⁵ In the US, institutional control shareholders of investment firms and funds are also rare, due to the Investment Company Act of 1940 No.17. In Taiwan, few internal positions are held by representatives of foreign institutions due to compliance with laws enacted to protect national defense, national communication security, local industries, local culture, public interests, market price, etc.

⁶ The IDTRS broadly identifies 109 disclosure items regarding regulation compliance, disclosure timeliness, financial forecast publication, and annual reports as evaluation criteria and gauges the level of corporate transparency by searching public information disclosed in various ways. For full ranking results, please visit website: <http://www.sfi.org.tw>.

⁷ They are the professional institutional shareholders including securities investment companies (dealers), domestic investment trust funds, and foreign institutions and funds.

Consistent with the monitoring argument (Shleifer & Vishny, 1986, 1997), we establish our hypothesis as follows:

Hypothesis 1. *High-tech firms experiencing increases in institutional shareholdings have a higher possibility of increasing their information transparency.*

By splitting the sample into high-tech and low-tech companies, Czarnitzki and Thorwarth (2012) find a large premium of R&D for firms in high-tech industries, but no premium in low-tech sectors. This suggests that rational institutional shareholders want more relevant information disclosed, especially about high-tech firm's R&D activities and capital-intensive projects, which concern virtually all of the firm's operational results (Bushee, 1998). On the contrary, too much technology-originated information disclosed will impair the vested interests of insiders. A firm's insiders will conservatively disclose information to decrease information transparency. Owing to the firm-specific risks of high-tech industries, we expect that corporate transparency will be affected by the percentage ownership of external institutional shareholders.

Pindado, Queiroz, and Torre (2015) find that effective corporate governance allows the market to better assess a firm's R&D investments because effective control mechanisms reinforce the positive effect of R&D on a firm's market value. Using order backlog as a predictor, Jiambalvo, Rajgopal, and Venkatachalam (2002) assert that institutional investors may be attracted to firms in richer information environments where stock prices tend to lead earnings. Using R&D expenses as a proxy for forward-looking information, Chen and Wang (2006) find that institutional investors can incorporate R&D information that reflects future earnings, especially for group-affiliated firms. Hence, we know that larger institutional shareholders are better able to use enhanced corporate transparency to acquire relevant information. This leads to the following hypothesis:

Hypothesis 2. *As their R&D intensity increases, high-tech firms experiencing increases in institutional shareholdings have a higher possibility of increasing their information transparency.*

However, the associations between corporate characteristics and disclosures level are moderated by differences in disclosure index construction, differences in definition of the explanatory variables, and differences in research settings (Ahmed & Courtis, 1999). There are alternative views which are diametrically opposed to our above two hypotheses. First, Fan and Wong (2002) argue that, in a region of high-developed knowledge economics, the holding percentage and voting right enforcement of governmental institutions indicate strategic economic purposes. Morck, Shleifer, and Vishny (1988) claim that institutional shareholders place too much emphasis on firm's technological capacity and leadership will increasingly push firm managers to seek value-maximization over all other goals. As a result, in compliance with institutional shareholder's expectations, firms tend to overlook the importance of disclosure quality and information transparency.

Second, others argue that the frequent trading and short-term focus of institutional shareholders encourages managers to engage in myopic investment behavior. Firm managers may take advantage of transient institutional shareholders such that they make decisions (including accounting/reporting decisions) so as to maximize their own self-interest. As the level of institutional ownership increases, firm managers' opportunistic behavior is likely to increase even as their firm's disclosure level decreases (Laverty, 1996).

Third, Lambert (1986) indicates that the conflict of interest between the executive and the principal may lead to different selections in risky projects. Forker (1992) shows a model of optimal disclosure decision which is presented in terms of managerial incentives and the impact of corporate governance structures. He argues that a threat to monitoring quality exists where the roles of chief executive and chairman are combined. Choi and Seo (2008) indicate that risk-averse managers may have incentives to reduce the firm-specific risks of firms' activities, including reduction of information transparency, and such incentives of managers are in conflicts with the incentives of external shareholders owning controlling ownership or having intimate business relationship.

In addition, Graves (1988) argues for the detrimental effect of institutional stock ownership on corporate R&D spending in the computer industry, whereas Baysinger, Kosnik, and Turk (1992) argue the exact opposite, claiming to find that high insider representation on a board and concentration of equity among institutional shareholders positively affects corporate R&D spending. Thus the institutional shareholders can influence or even determine the R&D spending when they have significant influence on firms.

Taken together, an increase in the firms' institutional shareholdings has a detrimental effect on corporate transparency because of conflicts of interest, especially for high-tech firms and firms with high R&D intensity. Accordingly, Hypothesis 3 is proposed as follows:

Hypothesis 3. *As their R&D intensity increases, high-tech firms whose institutional shareholdings are becoming larger will have greater role duality conflicts and therefore decrease their information transparency.*

3. Data and methodology

3.1. Sample collection

We obtain our information transparency data from the IDTRS annual evaluation reports; our institutional percentage ownership and financial information data come from the Taiwan Economic Journal database (TEJ). We use the variable term, *Institutions*, to represent four individual institutional ownership and total institutional shareholdings, generally based upon data we gather from official information websites. These shareholding combinations include: (1) *Govt*: denotes the shareholdings of governmental and financial institutions in Taiwan; (2) *Corp*: denotes the shareholdings of domestic business corporations; (3) *Fund*: denotes the shareholdings of domestic mutual funds; (4) *Foreign*: denotes the shareholdings of foreign institutions and funds; and (5) *Inst*: denotes shareholdings of all above institutional shareholders.

We collect a sample of 9200 firm-year evaluated observations. After 219 financial institutions (due to odd variables or a lack of R&D data) and 144 inappropriate observations (those with unusual and/or irregular conditions) are deleted, our sample is reduced to 8837 firm-year observations (including 1391 evaluated firms) from 2005 (the year scaling to rank was first used) to 2012 (the year before the International Financial Reporting Standards (IFRS) was first adopted in Taiwan). As shown in Table 1 about half of the evaluated firm-years are classified as high-tech firms, whose R&D intensity is higher, relatively, than those in the other two industries. The mean and correlation coefficient of R&D intensity with high-tech industries tend to be higher, suggesting that R&D intensity can characterize the industry-specific technology level.

Table 1
Sample distributions by industry, transparency grade, and institutional ownership.

Grade	C ⁻	C	B	A	A ⁺	Best voluntary disclosure
Score range	<45	45–49	50–59	60–79	80–100	
Median interval scale	40 ^a	47	54.5	69.5	90	
<i>Hightech</i>	33	481	2494	1404	124	280 (49.5%)
In percentage (100%=)	.7%	+10.6%	+55.0%	+31.0%	+2.7%	
<i>Medium</i>	25	286	777	475	9	80 (14.1%)
In percentage (100%=)	1.6%	+18.2%	+49.4%	+30.2%	+0.6%	
<i>Traditional</i>	92	587	1207	779	64	206 (36.4%)
In percentage (100%=)	3.4%	+21.5%	+44.2%	+28.6%	+2.3%	
Total	150	1354	4478	2658	197	566 (100%)
In percentage (100%=)	1.7%	+15.3%	+50.7%	+30.1%	+2.2%	

	Sample size	Mean of Institutions (%)					R&D	
		Govt	Corp	Fund	Foreign	Inst (Total)	Mean (%)	Correlation
<i>Hightech</i>	4536 (51.33%)	2.41	19.60	2.02	8.37	32.40	5.243	.184**
<i>Medium</i>	1572 (17.79%)	1.66	22.36	1.18	7.47	32.67	3.472	-.002
<i>Traditional</i>	2729 (30.88%)	2.81	29.72	1.14	7.98	41.65	.661	-.197**
Total	8837 (100.00%)	2.40	23.21	1.62	8.09	35.32	3.513	

** Significant at the 1 percent level.

^a The number is calculated based on the weighted average of the other four grade intervals.

In order to mitigate the influence of outliers, we winsorize all of the scaled financial independent variables (e.g., *R&D*, *Turnover*, *RET*, *RETVar*, *Leverage*, *Profit*) at the top and bottom .1% of their respective distributions. After deleting the inadequate observations (i.e., missing-variables, without prior-year data) and those with no changes in transparency grade, we are left with 2154 firm-years in our test sample. Matching the TEJ with the OECD industry classification codes,⁸ we set three industry dummy variables, *Hightech*, *Medium* and *Traditional*, for high-tech, medium-high-tech and traditional industries, respectively, in our regressions.

Because the TEJ database categorizes four different types of ultimate ownership, we regroup the evaluated firms into three categories: (1) Government-involved (labeled as GA firms⁹): 1197 firm-years directly or indirectly controlled by central, local authorities, their peripheral organizations, or cooperative governance; (2) Group-affiliated (also called 'family business'; labeled as FA firms): 5523 firm-years held by a single group consisting of an individual and his or her family members; (3) Manager-governed (labeled as MG firms), 2117 firm-years governed by professional executives or managers.

3.2. The measure of variables

In compliance with the measures used in prior literature (e.g., Agrawal & Mandelker, 1990), the ownership of a substantial stake in a firm by an institution is expressed as a percentage of the firm's

⁸ Because the cut-off points of OECD industry classification for distinction between the medium-low- and low-technology groups are not clear, we regroup these two industries as traditional industries.

⁹ The method of identifying the ultimate owners is similar to the one used in La Porta, Lopez-de-Silanes, and Shleifer (1999). Our variables for the different types of ultimate institutional owners are compliant with the codes of the TEJ database.

¹⁰ The IDRTS reports explain that every grade has its clear score range. For univariate statistics analysis, we transfer each grade into its median interval scale for variable *Grade* as stated in Table 1. Based on a five-rank scheme, changes in transparency grade, $\Delta Grade$, denote a change in information transparency based on the median score of individual observation. We develop two logistic regression models and use *Upgrade* to replace $\Delta Grade$, to emphasize the relative effect on information transparency, upgrade or downgrade.

year-end outstanding shares. We test the relation between changes in institutional shareholdings, $\Delta Institutions$, and changes in transparency grade, *Upgrade*¹⁰, in an attempt to examine the relationship between shareholders' intention and corporate transparency. The dependent variable, *Upgrade*, is equal to one if the yearly change in *Grade* indicates an improvement in information transparency, and zero otherwise. The other test variable, *R&D*, is formed by creating a ratio of annual R&D expense to annual reported net operating income.¹¹

We then estimate equation (1) for individual industries and whole industries. We directly compare the coefficients on $\Delta Institutions$ across industries and institutional ownership. We express the following control variables in terms of changes, including: (1) *MVE*: equal to the natural logarithm of market value of equity at the beginning of the sample year; (2) *Nanalyst*: equal to the number of analysts following the firm at year-end. (3) *Turnover*: equal to the annual share of trading volume divided by shares outstanding; (4) *RET*: equal to stock returns over the fiscal year; (5) *RETVar*: equal to volatility of stock return equal to annual stock returns rate variance; (6) *Leverage*: equal to ratio of total liabilities to total assets; (7) *Profit*: equal to ratio of prior-three-year average net profit margin from sales; (8) *SGrowth*: equal to ratio of incremental sales to prior-year sales; (9) *Grade*: equal to the lagged level of transparency and used as a regressor to account for situations in which changes are limited, and to capture any changes in response to existing levels; and (10) *DYear*: a dummy variable capturing year fixed-effect. To solve the omitted-variables problem, we also include firm fixed-effects with standard errors adjusted for firm-level clustering in our regressions to control for unobserved sources of firm heterogeneity.

We also use $\Delta Institutions$ to interact with *R&D* and regress *Upgrade* on the interaction term, $R\&D \times \Delta Institutions$, to observe whether the level of R&D intensity strengthens the effect of

¹¹ Our R&D intensity is a common-practice measure which is different from the OECD's R&D indicator of the cut-off points. The OECD methodology uses two indicators of technology intensity reflecting, to different degrees, 'technology-producer' and 'technology-user' aspects: (i) R&D expenditures divided by value added; (ii) R&D expenditures divided by production.

ownership on transparency. Therefore, we run our first regression as equation (1)¹²:

$$\begin{aligned} Upgrade_{t/t+1} = & \beta_0 + \beta_1(R\&D_t) + \beta_2(\Delta Institutions_t) + \beta_3(R\&D_t) \\ & \times (\Delta Institutions_t) + \beta_4(\Delta MVE_t) \\ & + \beta_5(\Delta Analyst_t) + \beta_6(\Delta Turnover_t) \\ & + \beta_7(\Delta RET_t) + \beta_8(\Delta RETVar_t) \\ & + \beta_9(\Delta Leverage_t) + \beta_{10}(\Delta Profit_t) \\ & + \beta_{11}(\Delta SGrowth_t) + \beta_{12}(Grade_t) \\ & + \sum_{k=1}^7 \gamma_k(DYear_t) + \varepsilon... \end{aligned} \quad (1)$$

An important concern is that institutional ownership is endogenously determined. However, our study has some distinguishing features relative to other research. First, as discussed in the background description, the IDTRS score reflects any likely increased disclosure regime and legal/regulation regime. In turn, unlike other corporate governance indexes, the score is a composite index which is co-determined by 'corporate governance' and 'governmental supervision'. Second, as illustrated in Fig. 1, our data substantially presents a half-year lag between year-end institutional ownership and annual IDTRS evaluation results. Third, as explained in our model, all independent variables are lagged relative to the dependent variable, *Upgrade*. We also extend our primary findings to examine lead-lag relations between changes in institutional ownership and changes in corporate transparency in an attempt to provide some insight into their causal relation. Finally, Aggarwal et al. (2011) provide clear evidence showing that changes in institutional ownership affects subsequent changes in corporate governance, but the opposite is not true. Similarly, no reverse effect between the IDTRS evaluation and institutional ownership has been found so far. Based on above, our data and methodology can reduce concerns regarding this.

Further, we use the regrouped sample to regress changes in transparency grade on changes in insider institutional shareholding percentage and levels of R&D intensities. We include changes in all the firm-level control variables and add additional three control variables: (1) *CV*¹³: a dummy variable capturing if the firm exhibits a divergence between the controlling owner's cash flow rights and voting rights; (2) *Collateral*¹⁴: an aggregate stock collateral percentage of board of directors and supervisors, which also denotes potential agency conflicts between controlling owners and outside shareholders; (3) *Internal*¹⁵: the number of internal positions held by the inside controlling group, and duality of board chairman and CEO or general manager.

We use the TEJ code to create indicator variables (*GA*, *FA*, and *MG*) for the three categories (Government-involved, Group-affiliated, and Manager-governed) and for testing whether the counter-effect as discussed in Hypothesis 3 exists in two relative categories. To test whether our first results are sufficiently robust in comparison to the alternative specification which situates the role

duality conflict between internal and external institutional shareholders, we run a hypothesis regression using changes in institutional internal ownership of two relative categories of firms. Our equation (2) is formulated as follows:

$$\begin{aligned} Upgrade_{t/t+1} = & \beta_0 + \beta_1(R\&D_t) + \beta_2(\Delta Govt_t/\Delta Corp_t) \\ & + \beta_3(R\&D_t) \times (\Delta Govt_t/\Delta Corp_t) + \beta_4(GA_t/FA_t) \\ & + \beta_5(GA_t/FA_t) \times (R\&D_t) + \beta_6(GA_t/FA_t) \\ & \times (\Delta Govt_t/\Delta Corp_t) + \beta_7(GA_t/FA_t) \times (R\&D_t) \\ & \times (\Delta Govt_t/\Delta Corp_t) + \beta_8(\Delta MEV_t) \\ & + \beta_9(\Delta Analyst_t) + \beta_{10}(\Delta Turnover_t) \\ & + \beta_{11}(\Delta RET_t) + \beta_{12}(\Delta RETVar_t) \\ & + \beta_{13}(\Delta Leverage_t) + \beta_{14}(\Delta Profit_t) \\ & + \beta_{15}(\Delta SGrowth_t) + \beta_{16}(\Delta CV_t) \\ & + \beta_{17}(\Delta Collateral_t) + \beta_{18}(\Delta Internal_t) \\ & + \beta_{19}(Grade_t) + \sum_{k=1}^7 \gamma_k(DYear_t) + \varepsilon... \end{aligned} \quad (2)$$

3.3. Descriptive statistics and correlation analysis

Table 2 reports descriptive statistics and Table 3 provides correlation analysis. In Table 2 the mean transparency grade is only 58, the median 55 (all equal to *Grade B*), and the standard deviation 8.93, which shows a narrowly dispersed but low information transparency among the evaluated firms. The mean (median) R&D intensity is 3.51% (1.21%), and its standard deviation is 9.67%, that is, highly dispersed. The maximum of institutional ultimate ownership is 97.72%, while its mean, 16.10%, equals 53.81% of controlling ownership, 29.92% (obtained from the TEJ), suggesting that institutional ultimate ownership has a controlling power on corporate policies. The average of the governmental institutional holding, 2.4% is low, but the highest shareholding is 72.02% because some firms are in the process of public business privatization. The mean (median) of corporate ownership, domestic mutual fund, and foreign institutional ownership is 23.21% (18.30%), 1.62% (0) and 8.09% (2.67%), respectively, representing the differing importance these variations have on a firms' equity structure.

Corporate shareholdings are the largest among institutional shareholders. Although foreign institutional shareholders do not have the highest percentage of ownership, they have the highest mean change (.24%) and its standard deviation (3.88%), suggesting that they have a higher transient ownership and short-term informational demand. The means changes and their standard deviations of domestic mutual fund and governmental institutional ownership are much smaller (−.06% and .04%).

In Panel A of Table 3 the data and variables used in correlation analysis are for the same period. We find that larger-sized firms or firms with more analyst coverage have higher transparency when they have higher market returns or profitability. Also, market return volatility is, as expected, negatively correlated with information transparency. But unexpectedly, sales growth and turnover have negative coefficients. We check prior studies and find that the directions of these variable coefficients are not identical in different types of analysis.

Panel B of Table 3 indicates that governmental institutional and domestic mutual fund ownership are most closely related with high-tech industries (.064 and .149), whereas corporate ownership invest more in traditional industries (.221); foreign ownership is positively correlated with high-tech industries (.014) compared with the other industries (−.003 and −.012). *Hightech* has a significantly positive correlation with *Grade*, consistent with that the information presented in Table 1, its coefficient of .088 is much

¹² For simplicity of notation, subscript denoting firm 'i' is omitted from variable notations throughout this paper; subscript denoting '/' represents 'or' and 'Δ' represents 'change amount'.

¹³ Fan and Wong (2002) use *CV* to measure the level of shareholder's right divergence. The measure of *CV* is a ratio of cash-flow holding percentage to controlling ownership by the firm's ultimate owners.

¹⁴ The collateral of personal holdings is deducted from total shareholdings. Therefore, we set collateral holdings for equity collateral as variable *Collateral*.

¹⁵ Following the TEJ database, we define the internal positions as chairman of the board of directors, supervisors, chief executive officers (CEO), and chief financial officers (CFO).

Table 2
Descriptive statistics on firm-specific variables.

	(1) Levels (n = 8837)					(2) Changes (n = 2154)				
	Mean	S.D. ^a	Medi.	Mini.	Maxi.	Mean	S.D.	Medi.	Mini.	Maxi.
<i>Grade</i>	B (58)	8.93	B (55)	C ⁻ (40)	A ⁺ (90)					
<i>R&D (%)</i>	3.51	9.67	1.21	0	192.0					
<i>MVE</i>	8.11	1.45	7.96	4.65	14.74	0	.61	-.01	-1.31	6.97
<i>Nanalyst</i>	3.17	4.83	1.00	0	34.00	-.061	1.90	0	-7.00	11.00
<i>Turnover (%)</i>	1.96	1.79	1.40	.05	8.34	-.20	1.69	-.11	-4.96	6.00
<i>RET (%)</i>	6.93	13.82	7.47	-42.20	41.23	-1.00	11.96	-.93	-40.99	43.51
<i>RETVar (%)</i>	12.36	5.81	11.31	3.07	32.41	-.12	6.56	-.33	-18.06	24.91
<i>Leverage (%)</i>	.41	.17	.42	.07	.79	0	.07	0	-.20	.62
<i>Profit (%)</i>	1.72	5.39	1.75	-27.47	14.97	-.16	3.93	-.10	-21.35	12.41
<i>SGrowth (%)</i>	6.97	29.90	3.76	-56.15	135.51	0	.41	0	-1.92	1.00
<i>CV</i>	.38	.48	0	0	1.00	0	.20	0	-1.00	1.00
<i>Collateral (%)</i>	8.40	16.42	0	0	79.31	.23	8.71	0	-31.07	50.10
<i>Internal</i>	2.25	1.15	2.00	0	5.00	0	.55	0	-2.00	4.00
<i>Ultimate (%)</i>	16.10	17.48	10.53	0	97.72	.27	4.33	0	-26.70	60.25
<i>Inst (%)</i>	35.32	21.92	14.51	0	100.00	.11	7.62	0	-31.94	47.73
<i>Govt (%)</i>	2.40	5.24	.11	0	72.02	.04	1.95	0	-6.63	10.47
<i>Corp (%)</i>	23.21	18.53	18.30	0	98.02	-.06	3.50	0	-11.83	18.26
<i>Fund (%)</i>	1.62	3.41	0	0	17.44	-.06	2.47	0	-9.00	11.61
<i>Foreign (%)</i>	8.09	12.78	2.67	0	88.09	.24	3.88	0	-12.80	34.54

^a S.D. denotes standard deviation.

Table 3
Pearson correlation coefficients among firm-specific variables.

Panel A: Coefficients on firm's characteristics variables									
	<i>MVE</i>	<i>Nanalyst</i>	<i>Turnover</i>	<i>Leverage</i>	<i>RET</i>	<i>RETVar</i>	<i>Profit</i>	<i>R&D</i>	<i>SGrowth</i>
<i>Grade</i>	.266** (.000)	.147** (.000)	-.016 (.144)	.015 (.173)	.109** (.000)	-.092** (.000)	.078** (.000)	.024* (.024)	-.023* (.028)
<i>MVE</i>		.640** (.000)	.138** (.000)	-.050** (.000)	.387** (.000)	-.111** (.000)	.257** (.000)	-.034** (.002)	.014 (.181)
<i>Nanalyst</i>			.223** (.000)	-.054** (.000)	.349** (.000)	-.015 (.149)	.224** (.000)	.011 (.300)	.044** (.000)
<i>Turnover</i>				-.030** (.004)	.149** (.000)	.362** (.000)	.071** (.000)	.036** (.001)	.016 (.139)
<i>Leverage</i>					-.063** (.000)	.036** (.001)	-.118** (.000)	.159** (.000)	-.068** (.000)
<i>RET</i>						-.145** (.000)	.607** (.000)	-.101** (.000)	.048** (.000)
<i>RETVar</i>							-.154** (.000)	.089** (.000)	-.012 (.244)
<i>Profit</i>								-.173** (.000)	.097** (.000)
<i>R&D</i>									-.002 (.857)

Panel B: Coefficients on firm's institutional ownership and industry dummy variables									
	<i>Govt</i>	<i>Corp</i>	<i>Fund</i>	<i>Foreign</i>	<i>Inst</i>	<i>Ultimate</i>	<i>Hightech</i>	<i>Medium</i>	<i>Traditional</i>
<i>Grade</i>	.089** (.000)	.040** (.000)	.058** (.000)	-.001 (.889)	.058** (.000)	-.039** (.000)	.088** (.000)	-.034** (.001)	-.067** (.000)
<i>Govt</i>		-.049** (.000)	.206** (.000)	-.019 (.075)	.540** (.000)	-.115** (.000)	.064** (.000)	-.033** (.002)	-.042** (.000)
<i>Corp</i>			-.111** (.000)	-.007 (.531)	-.207** (.000)	.729** (.000)	-.207** (.000)	.003 (.749)	.221** (.000)
<i>Fund</i>				-.009 (.511)	.139** (.000)	-.157** (.000)	.149** (.000)	-.062** (.000)	-.108** (.000)
<i>Foreign</i>					.617** (.000)	-.001 (.896)	.014 (.198)	-.003 (.780)	-.012 (.246)
<i>Inst</i>						-.175** (.000)	.083** (.000)	-.005 (.729)	-.086** (.000)
<i>Ultimate</i>							-.289** (.000)	.089** (.000)	.238** (.000)
<i>Hightech</i>								-.478** (.000)	-.686** (.000)
<i>Medium</i>									-.311** (.000)

*, ** Significant at the 5 percent and 1 percent level, respectively.

greater than that of medium-high-tech and traditional industries, $-.034$ and $-.067$, respectively. All of the coefficients for domestic institutional ownership are positively associated with *Grade*. However, the coefficient on ultimate ownership is significantly negative, suggesting a possible conflict of interest and role duality. In regard to foreign ownership, the coefficient is insignificant $-.001$, which suggests there are possible high information environmental restrictions and self-selection bias.

4. Empirical results

4.1. The regression of current- and next-period information transparency on institutional ownership

To clearly observe differences among institutional ownership at different levels, we partition our sample by industry and institutional ownership to form a matrix of twenty individual regressions, where R&D intensity is contrasted with increases in institutional ownership.¹⁶ In Panel A of Table 4 the bottom section of the column (4) shows that the coefficient on $\Delta Inst_t$ is significantly positive .17, suggesting that increases in institutional ownership can effectively promote corporate transparency. Column (1) shows that, except for the foreign institutions section, the effects of increases in institutional ownership on increases in transparency are all significantly positive. This result indicates that firms in high-tech industries are affected more by increased institutional shareholding than firms in other industries. It is reasonable to think that these institutional shareholders can effectively compel high-tech firm managers to increase corporate transparency. However, increased foreign institutional ownership has no significant association with increases in information transparency. The possible reasons are lack of positive intention and effective policy instruments, information channels and sufficient ownership influence. Hence, Hypothesis 1 holds for domestic institutional ownership, but not for foreign institutional ownership.

In column (1) of Table 4 the coefficients of $R\&D \times \Delta Institutions$ are all negative. Hence, Hypothesis 2 is not supported for the current-year relation. Our conjecture is that group-affiliated firms in Taiwan are primarily controlled by institutional insider owners who will conserve their R&D-related information. This will be further examined in a hypothesis regression we will look at later. An alternative explanation is that higher corporate ownership may create a perception of operational competition relations which can prompt firm managers to reduce corporate information transparency to a lower level.

We can also observe the effect which increases in institutional ownership have on increases in the following year's information transparency because when a firm announces a governance change (e.g., disclosure policy) in year t , it will be formally adopted, and hence can be evaluated, in year $t+1$. Interestingly, Panel B of Table 4 shows that all the coefficients of the institutional ownership in high-tech industries and their interaction terms move in the opposite direction to those in Panel A. The results suggest that the positive effects of increased domestic institutional ownership are partially captured in the current year (year t) and partially captured by the firms with high R&D intensity in the following year (year $t+1$). In contrast, we find that significantly positive effects of institutional ownership only exist in the rows of foreign institutions of high-tech industries, suggesting that the positive effect of

increased foreign institutional ownership is mainly captured in the following year (year $t+1$). This may be because the issuance of annual reports in year $t+1$ defers their positive effect on increases in corporate transparency.

The accounting-based R&D valuation model (Sougiannis, 1994) indicates that investors place a high value on a firm's R&D investments. In our regression analysis, the association between increased ownership and increased transparency before and after the issuance of financial statements is compared. Our results show that the incremental increases in information transparency represent a positive response to increased governmental institutional and corporate ownership of high-tech firms with higher R&D intensity. Our approach also eliminates the impact of time-invariant unobservable firm characteristics on corporate transparency. Our results also indicate that changes in foreign ownership positively affect subsequent changes in transparency of firms in high-tech and medium-high-tech industries. These findings are consistent with the results of Aggarwal et al. (2011), who assert that increases in institutional ownership over time drive subsequent increases in firm-level governance.

4.2. Additional lead-lag regression analyses

To further substantiate the above findings on how changes in institutional ownership affect current and future changes in transparency, using our sample of high-tech firms, we regress year t changes in the transparency on year t and $t-1$ changes in institutional ownership. Panel A of Table 5 shows that, except for domestic and foreign mutual funds with a marginally positive coefficient on $\Delta Inst_t$, changes in governmental institutional and corporate ownership drive changes in transparency, which is consistent with the findings displayed in Panel A of Table 4. In comparing coefficients on the interaction term, we find that the effect of increased foreign institutional ownership in the previous year (year $t-1$ is .008) on increases in transparency is much greater than the effect in recent year (year t is $-.012$). These results highlight that when R&D intensity is high, increased foreign institutional ownership tends to cause an increase in corporate transparency following year. These two results qualitatively accord with our earlier findings, as presented in Table 4.

Furthermore, we perform a long-run change regression analysis which specifically addresses the notion that institutional shareholders may simply invest in anticipation of future improvements on information transparency. To investigate this, we run a regression to observe changes in information transparency over 2009–2012 in relationship to changes in institutional ownership over the earlier period, 2005–2008. We would expect to see changes in institutional ownership in the earlier period associated with changes in corporate transparency in the more recent period. Although Panel B of Table 5 shows that all of the coefficients of $\Delta Inst_t$ are insignificant, the coefficient of $\Delta Inst_t$ for foreign institutions (.028) with the lowest p-value (.171) indicates a more positive effect on corporate transparency in a long run, relative to the other forms of institutional ownership in local markets.

4.3. The regression on institutional ownership with role duality conflicts

In an attempt to corroborate Hypothesis 3 our sample is further partitioned into three categories of firms, GA, FA and MG firms, as defined in the Section 3.1. First, using full sample, we compare the GA and FA firms in high-tech industries with the MG firms in column (1) of Table 6. Then, using only samples of high-tech firms, we compare the GA and FA firms with the MG firms in

¹⁶ An alternative approach to the above research design is to include both R&D intensity and an R&D-based industry dummy in a single regression and interact these terms with changes in institutional ownership. When we run this regression, however, we find serious multicollinearity problems with the model.

Table 4
Logistic regression of changes in information transparency on current- and next-period changes in institutional ownership.^a

Industries:	(1) <i>Hightech</i>		(2) <i>Medium</i>		(3) <i>Traditional</i>		(4) <i>Whole</i>	
	Coeff.	p-Value	Coeff.	p-Value	Coeff.	p-Value	Coeff.	p-Value
Panel A: Effects of changes in institutional ownership in period t on changes in information transparency in period t								
Governmental institution:								
$R\&D_t$	.005	.642	-.056*	.079	-.062	.700	.000	.985
$\Delta Govt_t$	.135**	.014	-.016	.887	.008	.903	.085**	.022
$R\&D_t \times \Delta Govt_t$	-.007	.162	.032	.402	.073	.448	-.002	.588
Pseudo R ²	.477		.518		.507		.473	
Corporation:								
$R\&D_t$	.003	.777	-.059*	.083	-.051	.752	-.001	.930
$\Delta Corp_t$	.090***	.004	-.029	.655	.029	.541	.050**	.020
$R\&D_t \times \Delta Corp_t$	-.006*	.067	.006	.369	.027	.673	-.002	.392
Pseudo R ²	.478		.518		.507		.473	
Domestic mutual fund:								
$R\&D_t$	.000	.987	-.057*	.089	-.075	.641	-.002	.867
$\Delta Fund_t$	.085**	.050	-.092	.369	.033	.673	.031	.300
$R\&D_t \times \Delta Fund_t$	-.007	.170	.007	.334	-.026	.807	-.002	.481
Pseudo R ²	.476		.518		.507		.472	
Foreign institution:								
$R\&D_t$	-.001	.937	-.058*	.061	-.070	.664	-.002	.852
$\Delta Foreign_t$	-.009	.768	.072	.299	-.021	.678	-.015	.483
$R\&D_t \times \Delta Foreign_t$	-.007	.201	-.002	.765	.078	.205	-.002	.447
Pseudo R ²	.476		.518		.508		.472	
Total institutions:								
$R\&D_t$	.004	.779	-.056	.101	-.047	.771	.017	.928
$\Delta Inst_t$	.034**	.021	-.001	.970	.007	.760	.017*	.097
$R\&D_t \times \Delta Inst_t$	-.004**	.034	.004	.360	.020	.478	-.001	.270
Pseudo R ²	.477		.519		.507		.472	
Control variables	Yes		Yes		Yes		Yes	
Observations	1109		399		646		2154	
Panel B: Effects of changes in institutional ownership in period t on changes in information transparency in period t + 1								
Governmental institution:								
$R\&D_t$	.009	.430	-.048	.316	.176	.374	.005	.619
$\Delta Govt_t$	-.097	.131	.018	.864	.029	.704	-.032	.423
$R\&D_t \times \Delta Govt_t$	.021**	.045	-.039*	.070	.029	.708	.008	.290
Pseudo R ²	.414		.463		.432		.389	
Corporation:								
$R\&D_t$	.012	.339	-.024	.596	.100	.620	.007	.524
$\Delta Corp_t$	-.042	.210	-.016	.789	.019	.690	-.026	.261
$R\&D_t \times \Delta Corp_t$	.009*	.084	-.013	.324	-.023	.642	.005	.166
Pseudo R ²	.414		.458		.431		.401	
Domestic mutual fund:								
$R\&D_t$	.011	.379	-.008	.852	.101	.590	.007	.554
$\Delta Fund_t$	-.048	.292	-.095	.350	.054	.430	-.028	.384
$R\&D_t \times \Delta Fund_t$	.008	.209	.015	.407	-.074	.328	.006	.252
Pseudo R ²	.413		.457		.432		.401	
Foreign institution:								
$R\&D_t$	.008	.640	.021	.660	.188	.330	.003	.692
$\Delta Foreign_t$	.047*	.088	.235***	.002	.004	.930	.053***	.007
$R\&D_t \times \Delta Foreign_t$	.000	.908	-.033***	.005	.046	.310	-.004	.223
Pseudo R ²	.414		.476		.433		.403	
Total institutions:								
$R\&D_t$	.013	.317	-.017	.703	.166	.419	.006	.592
$\Delta Inst_t$	-.005	.744	.030	.288	.013	.565	.005	.623
$R\&D_t \times \Delta Inst_t$	.004	.114	-.011**	.041	.003	.896	.001	.522
Pseudo R ²	.414		.462		.432		.401	
Control variables	Yes		Yes		Yes		Yes	
Observations	920		332		562		1814	

*, **, *** Significant at the 10 percent, 5 percent and 1 percent level, respectively.

^a To reserve space and focus on the variables of interest, we omit the results of all the control variables in Tables 4–6.

column (2). These two tests enable us to see whether a high conflict of interest may exist in the GA (FA) firms, relative to MG firms, with increased governmental (corporate) institutional ownership. Finally, for an in-depth insight into the effects of possible conflict of interest, we further confine $\Delta UGovt$ ($\Delta UCorp$) to the increases in shareholdings of governmental (corporate) institutional ultimate owners and implement the same two comparisons in column (3).

In Panel A of Table 6 column (1) shows that the coefficient of $GA \times Hightech \times \Delta Govt$ (β_7) is insignificant $-.267$. This result does not support Hypothesis 3 for governmental institutional ownership. The coefficients of the three-way interaction term are insignificant $-.024$ and $.065$. Thus, we find that increased governmental institutional ownership with conflict of interest cannot significantly decrease corporate transparency. In Panel B of Table 6 column (1) shows us that the coefficient of $FA \times Hightech \times \Delta Corp$ (β_7) is insignificant $.009$. This result suggests that high-tech FA

Table 5
Logistic regression of changes in information transparency on longer-run changes in institutional ownership.

Institutional shareholders:	(1) Governmental institution		(2) Corporation		(3) Domestic mutual fund		(4) Foreign institution		(5) Total institutions	
	Coeff.	p-Value	Coeff.	p-Value	Coeff.	p-Value	Coeff.	p-Value	Coeff.	p-Value
Panel A: Effects of changes in institutional ownership in period t and t–1 on changes in information transparency in period t										
$R\&D_{t-1}$	.008	.711	.011	.561	.013	.504	.011	.562	.014	.477
$R\&D_t$	–.005	.789	–.008	.690	–.010	.592	–.008	.695	–.008	.677
$\Delta Inst_{t-1}$	–.020	.703	–.015	.599	–.042	.341	–.022	.332	–.013	.297
$\Delta Inst_t$	.136**	.016	.087***	.008	.070	.123	.008	.819	.032**	.036
$R\&D_{t-1} \times \Delta Inst_{t-1}$	.006	.357	.004	.265	.006	.309	.008**	.032	.003	.112
$R\&D_t \times \Delta Inst_t$	–.007	.184	–.005	.123	–.005	.365	–.012*	.060	–.004*	.064
Pseudo R ²	.478		.479		.477		.479		.479	
Observations	1107		1107		1107		1107		1107	
Panel B: Effects of changes in institutional ownership for period from 2006 to 2008 on changes in information transparency for period from 2009 to 2012										
$R\&D$	.015	.246	.013	.292	.013	.286	.016	.234	.014	.270
$\Delta Inst$	.028	.664	–.004	.899	.020	.682	.028	.171	.013	.336
$\Delta Inst \times R\&D$	–.008	.511	.002	.733	.070	.760	–.002	.653	–.001	.825
Pseudo R ²	.237		.236		.238		.241		.239	
Observations	289		289		289		289		289	

*, **, *** Significant at the 10 percent, 5 percent and 1 percent level, respectively.

Table 6
Logistic regression of changes in information transparency on changes in insider institutional ownership.

	(1) Institutional shareholder		(2) Institutional shareholder		(3) Institutional ultimate owner			
	Coeff.	p-Value	Coeff.	p-Value	Coeff.	p-Value		
Panel A: The relative effect on information transparency between categories of GA and MG firms								
<i>Hightech</i>	β_1	–.927	.406	<i>R&D</i>	–.001	.973	–.026	.332
$\Delta Govt$	β_2	.028	.888	$\Delta Govt$ (Note 1)	.300***	.007	.045	.108
<i>Hightech</i> \times $\Delta Govt$	β_3	.171	.436	<i>R&D</i> \times $\Delta Govt$	–.009	.172	–.009	.558
<i>GA</i>	β_4	.095	.871	<i>GA</i>	.547	.259	.636	.285
<i>GA</i> \times <i>Hightech</i>	β_5	.611	.370	<i>GA</i> \times <i>R&D</i>	.050	.475	–.001	.996
<i>GA</i> \times $\Delta Govt$	β_6	.052	.865	<i>GA</i> \times $\Delta Govt$	–.430	.179	–.332	.192
<i>GA</i> \times <i>Hightech</i> \times $\Delta Govt$	β_7	–.267	.488	<i>GA</i> \times <i>R&D</i> \times $\Delta Govt$	–.024	.696	.065	.273
Control variables	Yes			Yes			Yes	
Observations	769			491			428	
Pseudo R ²	.535			.545			.553	
Panel B: The relative effect on information transparency between categories of FA and MG firms								
<i>Hightech</i>	β_1	–.477	.367	<i>R&D</i>	–.009	.621	–.026	.223
$\Delta Corp$	β_2	–.024	.725	$\Delta Corp$ (Note 2)	.058	.211	.050	.343
<i>Hightech</i> \times $\Delta Corp$	β_3	.050	.502	<i>R&D</i> \times $\Delta Corp$	–.005	.229	.001	.850
<i>FA</i>	β_4	.342	.328	<i>FA</i>	.446	*.092	.348	.240
<i>FA</i> \times <i>Hightech</i>	β_5	.171	.670	<i>FA</i> \times <i>R&D</i>	.027	.377	.046	.193
<i>FA</i> \times $\Delta Corp$	β_6	.034	.648	<i>FA</i> \times $\Delta Corp$	.063	.339	–.067	.391
<i>FA</i> \times <i>Hightech</i> \times $\Delta Corp$	β_7	.009	.916	<i>FA</i> \times <i>R&D</i> \times $\Delta Corp$	–.005	.557	.011	.393
Control variables	Yes			Yes			Yes	
Observations	1910			971			846	
Pseudo R ²	.472			.481			.497	

*, **, *** Significant at the 10 percent, 5 percent and 1 percent level, respectively.

Note 1: In column (3) of Panel A, we use governmental institutional ultimate ownership ($\Delta UGovt$) to replace governmental institutional ownership ($\Delta Govt$).

Note 2: In column (3) of Panel B, we use corporate ultimate ownership ($\Delta UCorp$) to replace corporate ownership ($\Delta Corp$).

firms are insignificantly different from non-high-tech MG firms when corporate shareholder's shareholdings increase. Although we use R&D intensity as an effective technology factor, the coefficients of the three-way interaction term are all insignificant, –.005 in column (2) and .011 in column (3), suggesting that when R&D intensity is high, FA firms do not differ significantly from MG firms in regards to the association between increases in corporate ownership and increases in information transparency. Our Hypothesis 3 is not supported. Therefore, we cannot provide strong evidence for the hypothesis that institutional shareholders with highly possible conflict of interest are likely to manipulate disclosure quality and information transparency.

5. Conclusions

In this paper, we seek to better understand knowledge technological factors by investigating whether OECD-based industry

classification and corporate R&D intensity impact the relationship between institutional ownership and information transparency in order to explore the inconsistent inferences between extant empirical findings and arguments. We thus test whether increased institutional shareholdings can facilitate increases in corporate transparency in Taiwan's stock markets, especially in consideration of R&D intensity over time.

Consistent with the assumptions of the monitoring argument, we reach a conclusion that improvement in information transparency is significantly associated with increased institutional shareholdings in Taiwan. Our results reveal that participation of public-sectors in corporate governance is still very influential, which is consistent with the findings in East Asia (Ariff, Cahan, & Emanuel, 2014). Further, information transparency of high-tech industries or firms with high level technology is of deep concern to institutional shareholders, which is consistent with the findings in high value relevance (Hessel & Norman, 1992). In addition, we

find that firms with high R&D intensity which are experiencing increased institutional percentage ownership sustain a significantly positive association with increases in corporate transparency in the following year.

Because of the positive effect in next year (annual reports issuance), we know that foreign equity shareholders tend to strive more to enhance their informational advantage than to improve the general informational environments in local markets (Choi et al., 2013), and the participation of foreign shareholders appears to be instrumental in the transmission of information (Bae, Ozoguz, Tan, & Wirjanto, 2012). Overall, relevant information timeliness is critical for all institutional shareholders' influence on corporate transparency.

Because financial statements can help institutional shareholders improve corporate transparency, the evidence drawn from our results can serve as clues to existing IDTRS evaluation indicators for further modification. Moreover, connecting the IDTRS evaluation reports with corporate annual reports of the same year may provide institutional investors the timely information and help firms improve their governance mechanism in time. Our findings shed light on how policymakers can supervise corporate governance through the IDTRS amendment to indicators and alignment with corporate annual reports.

Some prior studies on large shareholders in East Asian firms (e.g., Scott, 1999; Fan & Wong, 2002; Claessens, Djankov, Fan, & Lang, 2002; Leuz, Nanda, & Wysocki, 2003) express some doubt about whether increased institutional ownership is less subject to discipline by the capital market, or even control shareholder benefits for self-interest. By providing some insight on the causal relation and counter-argument, our findings highlight the point that capital market participants can benefit from the increased information transparency of firms which are more closely monitored by institutional shareholders.

We should here mention some of the limitations of the IDTRS data and our technology intensity measure. First, technology intensities can also be well measured by the percentage of highly educated or experienced technical staff if there is available data on staff technological knowledge level and other technology indicators, such as added-value. Second, information regarding technology intensity is soft and discretionary, and much concern to voluntary disclosure indicators of the IDTRS. However, due to lack of accurate scores of voluntary information disclosure, effective measures on corporate transparency in the era of technology competition and adoption of IFRS are needed for future research.

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