

Full Length Research Paper

The effect of profit incentive of ICT industry on the relationship between ownership and corporate performance

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ICT industry dominated the global economic development in recent years, and Taiwan ICT industry was an important center for the global ICT development. This study analyzed the relationship between the ownership structure and performance of ICT firms in Taiwan. The subjects in the study were 199 ICT firms from 1994~2004. The empirical results showed that the effect of profit incentive on directors and managers was distinct in ICT industry. Directorial ownership had a positive effect on performance and performance also had a positive effect on directorial ownership; they were consistent with the convergence-of-interest hypothesis. However, managerial ownership had a negative effect on performance, and it was consistent with the entrenchment hypothesis. On the other hand, performance had no significant effect on managerial ownership. That was because the stock bonus ratio was low, and managers were free to sell off shares anytime, and managerial ownership kept low percentage all the time.

Key words: Corporate governance, performance, ownership structure, ICT Industry.

INTRODUCTION

There is no doubt that ICT (Information and communications technology) plays an important role in pushing ahead with global economic development in the past ten years. In globalization, ICT even accelerates the advent of the era, "The World Is Flat". On account of IT foundation, technology application, and productivity, Taiwan becomes a world-famous country as an ICT producer. The definition of ICT enterprise in OECD includes those enterprises, which engage in electronics, information, and communication businesses. According to the report, OECD Information Technology Outlook (2008), based on the comparison of turnover in 2006, Taiwan accounted for 19 companies in the world's top 250 ICT companies,

ranking third in the world after the U.S. and Japan. From MIC statistics, the output value in Taiwan's ICT industry reached 114,097 million US dollars in 2007, 122,667 million US dollars in 2008 and 118,668 million US dollars in 2009. The worldwide market share of more than ten products is ranked first from the analysis of ICT products and ICT production value (Table 1); so Taiwan's ICT industry can be said to be a major force affecting global technology development.

Compared to other non-ICT industries, ICT firms are relatively young. The major capital sources of ICT companies are mainly from bank loan, venture capital, joint venture, government fund or public financing. Most

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Table 1. Worldwide leading market share of ICT products made by Taiwan in 2009.

| Product | Worldwide market share No. 1 |
|----------------------------|------------------------------|
| NB PC | 95.3% |
| Motherboard | 93.5% |
| Cable CPE | 93% |
| WLAN NIC | 90.8% |
| Netbook | 90.7% |
| Server(system and pure MB) | 88.7% |
| LCD monitor | 71.8% |
| DSL CPE | 65% |
| CDT monitor | 59.2% |
| IP Phone | 54.0% |

Source: Market Intelligence Center (2010), Outlook for the Taiwanese ICT Industry. Taiwan: Chang Chi. [online] Available from: MIC, Institute for Information <<http://proj3.moeaidb.gov.tw/nmipo/edm/Event/20100527/2.pdf>> [20 September, 2010].

capital of ICT companies is not invested by a major family, and the ownership structure is very different from the one of non-ICT firms or traditional firms, which are family-controlled. The shares in ICT industry are more dispersed, and are not concentrated in the hand of a few large shareholders, so the proportion of ownership structure is also quite different. On the other hand, there is a common reward system of stock bonus to employees in ICT industry, and managers, including other employees, can obtain certain stock bonuses according to the performance of the company every year; so ownership structure could be affected by the performance of ICT company and the policy of stock bonus.

The managers in ICT industry are very different from the ones in traditional industry. Those managers in ICT industry are usually with at least college education background or above, highly knowledge orientation, and most of those managers often focus on management, and seldom have a concurrent post as a director; so the ratio of their holdings is usually low. Because of the reason, there could be a balance effect between managers and directors—management level vs. supervision level—in ICT industry, and the situation is different from traditional industry, in which family members play the two roles, a manager and a director, at the same time (Lo, 2009).

Relative to traditional family enterprises, which control most ownership and management, ownership and management in ICT industry are separate. Directors are chosen by shareholders, and the board of directors gives authorization to professional managers for management. Owing to this, agency problems may happen because of information asymmetry or uneven benefit between managers and shareholders, and the situation could affect the performance of company. Therefore, the study only focuses on the analysis between ownership structure—in terms of directorial ownership and managerial

ownership—and performance, and there is no detailed treatment about the relationship of related persons. However, in the treatment between ownership structure and performance in Taiwan in the past, there was still no detailed research about the agency problem in ICT companies.

The study is based on the research between ownership structure—in terms of directorial ownership and managerial ownership—and performance to realize whether the effect of agency problem exists or not. Can the performance in ICT enterprises lead directors to increase holdings? Does the increase of directors' holdings have positive effect on the development of ICT performance? Under the reward system of stock bonus, if managers' holdings increase, will it have a positive or negative effect on the performance of the company? Will a positive performance of the company affect managers' willingness to increase holdings? The above questions will be treated separately. Hopefully, the results in the study can be used as references to enhance the efficiency of governance in ICT companies and to make investors have an assessment based on the investment of ICT companies.

LITERATURE REVIEW

With the extension of company, a family-oriented management style changes to a manager-oriented management style. Due to the authorization and agency problem among shareholders, directors and managers, there is a separation of ownership and management. The corporate governance issue was firstly proposed by Berle and Means (1932). Berle and Means (1932) reported that ownership structure could influence corporate performance. As the ownership of an enterprise becomes more dispersed, managerial ownership decreases and

information asymmetry arises. The degree of control that shareholders are able to exert over firm's managers is reduced and as a result, the interests of managers and shareholders do not coincide; there is no certainty that managers may utilize the companies' resources in such a way to maximize profits, and that may damage the stockholders' equity.

While managers hold a low percentage of stock of a company, performance of the company will not attract managers' interests; so they will not maximize the company's profits, instead, they only consider their own benefits. Therefore, Jensen and Meckling (1976) proposed convergence-of-interest hypothesis, which means an increase in managerial ownership and helping to create company's value. When managers hold a significant percentage of the company's stocks, they tend to make decisions that maximize shareholders' profits since they will benefit directly from such decisions themselves. As the level of managerial ownership rises, the interests of managers and shareholders converge, leading to a positive impact on corporate performance. However, Jensen and Ruback (1983) also found that when managerial ownership ascends to the point where managers gain a control right in the company, entrenchment effects or conflicts of interest appear (Carrillo, 2007), which brings about a negative impact on the company's performance (Sundaramurthy et al., 2005). If managers think the utility of authority is much more than money rewards, they will not seek to maximize the effective utility of company (Demsetz, 1983). When managerial ownership exceeds a certain level, managers may start to exhibit anti-takeover measures or reject share acquisition to secure their positions in the firm. For this reason, high levels of managerial ownership decrease in corporate value (Barnhart and Rosenstein, 1998). When managerial ownership is high, managers often seek to thwart takeovers, and that would be advantageous to the firm in order to protect their own interests (Stulz, 1988). This tendency results in a lower success rate for takeover attempts, leaving a negative impact on corporate value.

Directors on behalf of shareholders have the responsibility to supervise managers. Morck et al. (1988) observed that the relationship between Tobin's Q and ownership is positive when directorial shareholding falls between 0 ~ 5%; negative between 5 ~ 25%; and a continually increasing positive when greater than 25%. Directorial ownership influences corporate performance. McConnell and Servaes (1990) also found that the percentage of insider ownership has invert-U shape relation with performance. Insider ownership maximizes Tobin's Q, and it was 49.4% in 1976 and 37.6% in 1986. However, the optimal percentage of insider ownership decreases within the ten-year period as a firm moves to a different stage in the corporate life cycle. The results also indicate that a more concentrated ownership structure benefits performance, but over time, ownership needs to become more dispersed in order to maintain optimal

performance.

Performance influences the change of ownership structure because of the stock bonus system, which has been adopted in ICT industry for a long time. ICT companies usually give employees stocks as reward according to annual corporate performance. Compared to direct cash payment to employees, stock bonuses are not taxable. And, employees do not need to pay extra income tax after they even sell the stocks to earn the premium. For the reason, the percentage of managerial ownership will alter due to the stock bonuses from performance. Further, as information asymmetry exists, managers can obtain the information of expected performance to adjust the shareholdings. Ownership structure changes accordingly, too. Directors, who grasp the actual operation of company, are also insiders, and can acquire first-hand data. When the expected performance is better, those directors increase shareholdings; when the expected performance is worse, they decrease shareholdings first, too.

The changes in the ownership structure reflect the degree that directors or managers are able to exert over corporate governance, and reflect whether the firm's decision-making is oriented towards maximizing profits. At the same time, the impact of the firm's performance on directors' and managers' ownership reflects the level of confidence that directors and managers have with respect to the firm's operations. Kole (1996) proposed a formula for expressing the relationship between ownership structure and corporate value, which treats corporate value as one of the factors influencing ownership structure. If the ownership structure is treated only as an exogenous variable of performance, it results in an inconsistent parameter estimation of OLS, generating a misinterpretation of regression results and possibly leading to inappropriate decisions made by the firm (Cho, 1998).

Ownership structure should also be treated as an endogenous variable in modeling the relation between ownership structure and corporate performance. To identify the endogenous characteristics of ownership structure, we deploy the simultaneous equation models to explore the relationship between ownership structure and performance. The Two-Stage Least Squares (2SLS) approach is used to find the fitted model for panel data.

As agency problems are taken into consideration, the study of relationship between ownership and performance classifies ownership into two types: shares held by directors and shares held by managers. These two are mutually exclusive. The shares held by managers do not include the shares held by the directors who also have a concurrent position as a manager.

The paper proposes the following hypotheses (Figure 1).

Based on the entrenchment hypothesis, the shareholdings in managers' hand are relatively low in ICT industry, and managers can only get limited benefits from

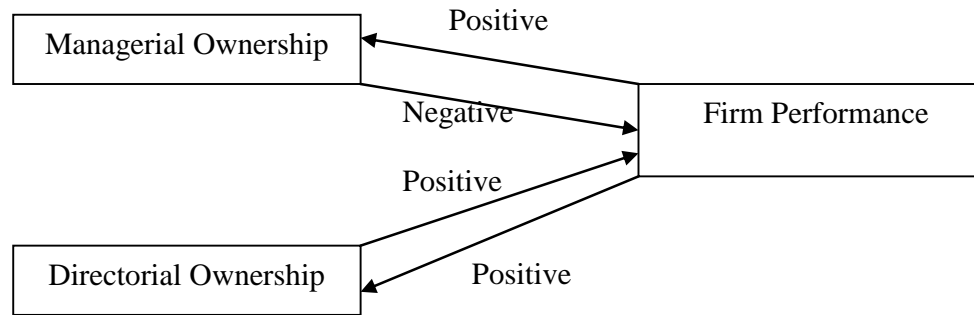


Figure 1. Framework of hypotheses: the relationship between ownership and performance.

stock bonuses, so they could possibly employ their authority to do something advantageous for themselves but disadvantageous for the company. Therefore, managerial ownership has negative effect on performance.

Hypothesis 1: Managerial ownership has negative effect on performance

When performance is better, more stock bonuses can be released by the company, and it makes the shareholdings in managers' hand increase. Therefore, performance has positive effect on managerial ownership.

Hypothesis 2: Performance has positive effect on managerial ownership.

As directors have higher proportion of shareholdings, the company's performance will have a direct effect on their benefits. For that reason, directors will actively participate in major corporate decision-making to ensure the performance. Therefore, directorial ownership has positive effect on performance.

Hypothesis 3: Directorial ownership has positive effect on performance.

When the performance is positive, directors will increase shareholdings due to expected benefits, like allotment of shares or stock bonuses. Therefore, performance has positive effect on directorial ownership.

Hypothesis 4: Performance has positive effect on directorial ownership.

METHODOLOGY

ICT definition and data

Information and communications technology (ICT) sector is defined by the OECD in terms of the ISIC Rev. 4. The current version of ISIC (ISIC Rev.4) was approved by the United Nations Statistics Commission (UNSC) in 2006. ISIC is the United Nations International Standard Industrial Classification of All Economic Activities. This classification is the international standard for the classification of productive economic activities. Directorate General of Budget of Accounting and Statistics in Taiwan classified Taiwan's ICT industries by comparing a four-digit code from international standard industrial classification system of the Republic of China (Rev.8, 2006) with OECD classification (Table 2). The missing data and outlier are omitted. By selecting firms which are ICT firms listed

in the Taiwan Stock Exchange, the unbalanced panel data consist of 199 ICT firms with 1,053 firm-year observations of database from *Taiwan Economic Journal (TEJ)* covering the period of eleven years (1994 to 2004).

Explanation of variables

Our study investigates the relationship between ownership structure – in terms of directorial and managerial ownership – and performance. Tobin's Q approximates a firm's future value, thus approximate Tobin's Q is used as a proxy variable for performance. Approximate Tobin's Q is defined as (market value of C/E)/(book value of C/E) and can be used as a proxy variable for firm's performance (Li and Chan, 2008) (Table 3). We input independent variables that represent firm-specific characteristics into the model with Tobin's Q as an endogenous variable. Independent variables include the natural logarithm of assets, dividend yield and debt ratio. The natural logarithm of assets is the variable used to measure enterprise size, and also has a negative relationship with Tobin's Q (Chen et al., 2003; Demsetz and Villalonga, 2001). Larger firms tend to have increasingly serious agency problems in addition to demonstrating less flexibility when the market environment changes. However, improved performance in larger firms may be attributed to having economies of scale (Wei and Varela, 2003). Since dividend yield represents corporate value, it might have a positive impact on Tobin's Q under certain circumstances. However, high dividends might also reduce the amount of capital available to the firm during the growth stage, thereby having a negative impact on Tobin's Q (Chen et al., 2003). The impact of the debt ratio on corporate value may vary, having a positive impact (McConnell and Servaes, 1990), a negative impact (Demsetz and Villalonga, 2001; Morck et al., 1988), or no impact at all (Wei and Varela, 2003). Under circumstances of high growth, debt may reduce the amount of working capital available, forcing managers to abandon investment plans. In a low-growth situation, there are fewer investment opportunities, so debt reduction may prevent the emergence of a situation where managers invest in projects with a negative return in order to expand the firm's scale of operations to their own benefit. To the long-term detriment of the firm under these circumstances, there is a positive correlation between debt and performance (McConnell and Servaes, 1995).

With directorial and managerial ownership as endogenous variables, we add Tobin's Q and independent variables including the standard deviation of stock returns, the natural logarithm of the market value of equity, dividend yield, and debt ratio into the model. The standard deviation of stock returns represent the risk that the firm bears (Chen et al., 2003; Demsetz and Villalonga, 2001; Denis and Sarin, 1999), which affects managerial and directorial ownership; the higher the risk is, the higher the degree of managerial

Table 2. OECD and Taiwan's ICT four-digit code industry classification.

| ICT industry classification based on OECD definition (the 4 th edition of the United Nations) | | Taiwan's ICT industry classification (the 8 th edition of ISIC of Directorate - General of Budget, Accounting and Statistics, Executive Yuan) | |
|--|---|--|--|
| Four-digit codes | Description | Four-digit codes | Description |
| 2610 | Manufacture of electronic components | 2611 | Integrated Circuits Manufacturing |
| | | 2612 | Discrete Devices Manufacturing |
| | | 2613 | Semi-conductors Packaging and Testing |
| | | 2620 | Electronic Passive Devices Manufacturing |
| | | 2630 | Bare Printed Circuit Boards Manufacturing |
| | | 2641 | Liquid Crystal Panel and Components Manufacturing |
| | | 2649 | Other Optoelectronic Materials and Components Manufacturing |
| | | 2691 | Printed Circuit Assembly Manufacturing |
| | | 2692 | Electronic Tubes Manufacturing |
| | | 2699 | Other Electronic Parts and Components Manufacturing Not Elsewhere Classified |
| 2620 | Manufacture of computers and peripheral equipment | 2711 | Computers Manufacturing |
| | | 2712 | Monitors and Terminals Manufacturing |
| | | 2719 | Other Computer Peripheral Equipment Manufacturing |
| 2630 | Manufacture of communication equipment | 2721 | Telephones and Cellular Phones Manufacturing |
| | | 2729 | Other Communication Equipment Manufacturing |
| 2640 | Manufacture of consumer electronics | 2730 | Audio and Video Electronic Products Manufacturing |
| 2680 | Manufacture of magnetic and optical media | 2740 | Data Storage Media Units Manufacturing |
| 4651 | Wholesale of computers, computer peripheral equipment and software | 4641 | Wholesale of Computers and Peripheral Equipment and Software |
| 4652 | Wholesale of electronic and telecommunication equipment and parts | 4642 | Wholesale of Electronic and Telecommunications Equipment and parts |
| 5820 | Software publishing | 5820 | Software Publishing |
| 6110 | Wired telecommunications activities | 6100 | Telecommunications |
| 6120 | Wireless telecommunications activities | | |
| 6130 | Satellite telecommunications activities | | |
| 6190 | Other telecommunications activities | | |
| 6201 | Computer programming activities | 6201 | Software Design Services |
| 6202 | Information technology consultancy activities and computer facilities management activities | 6202 | Computer Integration Systems Services |
| 6209 | Other information technology and computer service activities | 6209 | Other Computer Systems Design Services |
| 6311 | Data processing, hosting and related activities | 6312 | Data Processing, Hosting and Related Services |
| 6312 | Web portals | 6311 | Web Portals |
| 9511 | Repair of computers and peripheral equipment | 9521 | Repair of Computers and Peripheral Equipment |
| 9512 | Repair of communication equipment | 9522 | Repair of Communication Equipment |

Sources: 1. National Statistics, Standard industrial classification system of The Republic of China (Rev.8, 2006), [online] Available from: Directorate General of Budget, Accounting and Statistics, Executive Yuan <<http://eng.stat.gov.tw/public/Attachment/812415415971.xls>> [13 August 2010]. 2. Organisation for Economic Co-operation and Development (OECD), Alternative aggregation for the information economy (2006), [online] Available from: United Nations Statistics Division, United Nations <http://unstats.un.org/unsd/cr/registry/docs/i4_information_economy.pdf> [13 August 2010]

ownership for effective governance will be. Market value has a negative relationship with insider ownership (Chen et al., 2003; Denis and Sarin, 1999); if the firm's market value is high, insiders are more likely to be encouraged to have cash in their holdings within the company. Dividend yield represents corporate benefit, generally having a positive effect on insider shareholders. On the

other hand, Chen *et al.* (2003) propose that excessively high dividend payment reduces the amount of cash flow available to the firm and the agency problem arises from it, which is assumed to have a negative impact. The debt ratio has a negative impact on managers' ownership (Chen et al., 2003; Demsetz and Villalonga, 2001; Denis and Sarin, 1999), because debt increases risk, leading

Table 3. Explanation of variables.

| Variable | Description |
|-------------------------------------|--|
| Tobin's Q | =replacement value of assets/book value of assets = (Market value of C/E)/(Book value of C/E) |
| Directorial ownership (%) | Common shares held by the board of directors divided by total common shares outstanding |
| Managerial ownership (%) | Common shares held by the managers' divided by total common shares outstanding |
| Standard deviation of stock returns | Standard deviation of stock returns by day |
| Dividend yield | Annual dividend per share divided by price per share |
| Debt ratio | Total debt divided by total assets |
| Natural logarithm of total assets | Natural logarithm of total assets which in a balance sheet item representing what a firm owns. |
| Natural logarithm of market value | Natural logarithm of the market capitalization plus the market value of debt |

to increased external supervision. Debt reduces the disposable funds available to managers, thereby reducing agency costs. Stulz (1990) assumes that managers always want to use available funds to expand the firm's scale of operations, resulting in over-investment. Debt reduces the disposable funds available to managers, thereby reducing agency costs.

Formulation of the model

Simultaneous equation models for the relationship between ownership structure and performance

Taking the endogenous characteristics of ownership structure and performance into account, we set up simultaneous equation models. The models are described as below:

Model I: Simultaneous Equation Model of Directorial Ownership and Tobin's Q

$$\begin{aligned} \text{Directorial Ownership}_{it} = & \alpha + \beta_0(\text{Tobin's } Q_{it}) + \lambda_0(\text{Standard Deviation of Stock Returns}_{it}) \\ & + \lambda_1(\text{Dividend Yield}_{it}) + \lambda_2(\text{Debt Ratio}_{it}) \\ & + \lambda_3(\text{Natural Logarithm of Market Value}_{it}) + v_{it} \end{aligned} \quad (i)$$

$$\begin{aligned} \text{Tobin's } Q_{it} = & \alpha + \beta_0(\text{Directorial Ownership}_{it}) + \lambda_0(\text{Natural Logarithm of Total Assets}_{it}) \\ & + \lambda_1(\text{Dividend Yield}_{it}) + \lambda_2(\text{Debt Ratio}_{it}) + \pi_{it} \end{aligned} \quad (ii)$$

Model II: Simultaneous Equation Model of Managerial Ownership and Tobin's Q

$$\begin{aligned} \text{Managerial Ownership}_{it} = & \alpha + \beta_0(\text{Tobin's } Q_{it}) + \lambda_0(\text{Standard Deviation of Stock Returns}_{it}) \\ & + \lambda_1(\text{Dividend Yield}_{it}) + \lambda_2(\text{Debt Ratio}_{it}) \\ & + \lambda_3(\text{Natural Logarithm of Market Value}_{it}) + \gamma_{it} \end{aligned} \quad (iii)$$

$$\begin{aligned} \text{Tobin's } Q_{it} = & \alpha + \beta_0(\text{Managerial Ownership}_{it}) + \lambda_0(\text{Natural Logarithm of Total Assets}_{it}) \\ & + \lambda_1(\text{Dividend Yield}_{it}) + \lambda_2(\text{Debt Ratio}_{it}) + \tau_{it} \end{aligned} \quad (iv)$$

Estimation of panel data

In order to obtain better estimated coefficients from firms' unobserved and observed characteristics, we use unbalanced panel data that combine time-series data and cross-sectional data across firms. Its usage has several advantages such as providing additional sample characteristics from the increased sample size, more useful added information, and more efficient estimations, while reducing multicollinearity and increasing degrees of freedom. The use of panel data assumes that individual firms are not necessarily homogenous, making it possible to bring out the heterogeneity of individual firms; it is also well suited for analyzing the dynamics of adjustments (Baltagi, 2001).

We apply the Two-Stage Least Squares (2SLS) method to the panel data to investigate the relationship between ownership structure and performance. The best model might be OLS, fixed effect model or random effect model. Using the OLS estimation

directly for panel data might lead to significant heterogeneity bias and inconsistent results; the use of a random effects model or fixed effects model can avoid these problems.

The fixed effects model assumes that the individual effects of firm and explanatory variables are related, meaning that the intercept for each individual firm is related to the explanatory variables, and the intercept varies between firms. With the random effects model, the opposite is true. The fixed effects model assumes that there is no difference between individuals in the time-series data, but in the cross-sectional data, which is reflected in the intercept. By contrast, the random effects model assumes differences exhibited in both of the cross-sectional and time-series data. The difference is randomly generated and shows up in the residual.

The fixed effects model assumes heterogeneity of individual firms (the individual effect), which is related to explanatory variables. The intercept varies between firms, and dummy variables must be used for estimation expecting to a significant reduction in the degrees of freedom. In the random effects model, emphasis is placed on the overall relationship between the data, rather than on individual differences. To overcome the shortcomings of the fixed effects model, the random effects model assumes that individual firms are heterogeneous and that this heterogeneity is randomly generated and unrelated to the explanatory variables; rather, it is related to the residuals of the cross-sectional and time-series data.

The first stage of Two-Stage Least Squares (2SLS) method is to decide the best estimation model. To use LM test decides whether OLS or the random effect model is better, then F-test is used to test whether OLS or the fixed effect model is better. In this study, the use of the Hausman Test helps us decide whether a random effects model or fixed effect model should be adopted for panel data. Then, using the random effect model or fixed effect model in the second stage tests the coefficient of best fitted model. If the Hausman Test results reject the hypothesis that the intercepts representing the heterogeneous individual effect are not correlated with the explanatory variables, then it is more appropriate to use the fixed effects model for the simultaneous model.

Descriptive statistics

We use a sample comprising 1,053 firm-year observations from the 199 listed Taiwanese ICT companies covering the eleven-year period from 1994 to 2004, and combine the sample with unbalanced panel data analysis. The mean value for Tobin's Q is found to be 1.74, which is higher than the mean of 1.24 reported by Chen et al. (2003) using Japanese data and the value of 0.85 reported by Morck et al. (1988) using the United States' data. This means ICT firms in Taiwan have better performance than in Japan and America.

The mean value for directorial ownership is 21.51% and the highest is 81.85%. The mean value for managerial ownership is

Table 4. Descriptive statistics.

| Variable | Number of firm-year observations | Mean | Standard deviation | Minimum | Maximum |
|-------------------------------------|----------------------------------|-------|--------------------|---------|---------|
| Tobin's Q | 1053 | 1.74 | 0.86 | 0.45 | 4.91 |
| Directorial ownership (%) | 1053 | 21.51 | 0.12 | 1.10 | 81.85 |
| Managerial ownership (%) | 1053 | 0.42 | 0.65 | 0.00 | 3.13 |
| Standard deviation of stock returns | 1053 | 6.06 | 6.25 | 0.38 | 96.50 |
| Dividend yield | 1053 | 0.18 | 3.99 | 0.00 | 128.46 |
| Debt ratio | 1053 | 34.42 | 21.49 | 0.00 | 90.35 |
| Natural logarithm of total assets | 1053 | 15.83 | 1.29 | 12.98 | 20.00 |
| Natural logarithm of market value | 1053 | 9.00 | 1.51 | 5.19 | 15.28 |

Table 5. Test for random effect model or fixed effect model.

| Independent variable | Directorial ownership | Tobin's Q | Managerial ownership | Tobin's Q |
|----------------------|-----------------------|----------------------|----------------------|---------------------|
| Test | Equation (i) | Equation (ii) | Equation (iii) | Equation (iv) |
| F-Test | 1.87 | 11.34 ^a | 5.02 ^a | 0.68 |
| LM-Test | 232.43 ^b | 1316.82 ^b | 261.27 ^b | 206.63 ^b |
| Hausman Test | 2.41 | 7.95 | 5.43 | 0.48 |

Note: 1. ^a denotes statistical significance at 0.1% level. Equation (ii) and (iii) reject the H_0 by F-test which means fixed effect model is better than OLS model. In Equation (i) and (iv), the fixed effect model is not significant, which does not reject the null hypothesis, and OLS may be better fitted to these equations. 2. ^b denotes statistical significance at 0.1% level. In LM test, all models are significant in favor of random effect model rather than OLS model. 3. In order to identify the random effect model or fixed effect model, Hausman test shows that Equation (i), (ii), (iii) and (iv) do not reject the null hypothesis of random effect model by Hausman Test.

0.42%, which is lower than 2.01% reported by Chen et al. (2003). To compare with directorial ownership, managerial ownership has much lower percentage of shareholding. The highest managerial ownership is 3.13%. The agency problem may arise because of the huge difference of ownership structure (Table 4).

RESULTS

Panel data model

The Two-Stage Least Squares (2SLS) method is used to examine the panel data model of our study. The results are presented in Table 5. The models of this study are all fitted for random effect model.

Ownership structure and performance

Simultaneous Equation Model I presents the relationship between directorial ownership and performance. Simultaneous Equation Model II presents the relationship between managerial ownership and performance. Omitting the missing and outlier data, the number of annual firm-year observations that can be applied to the study is 1,053 firm-year observations from 199 ICT firms. The empirical results are shown in Table 6.

The relation between directorial ownership and performance

The average shareholdings for directors, on behalf of shareholders, reach 21.75%; so the performances in ICT companies are closely related to directors' benefits. Owing to this, directors will concentrate more on participating in corporate decision making in business operation to supervise managers and to avoid any wrong decision made by managers. Directorial ownership has a significant positive impact on performance; see the coefficients in Table 6. When directorial ownership is high, more internal controls can be strengthened and agency problems can be relatively alleviated. This also helps the firm to perform better, leading to a positive relationship between the percentage of directorial ownership and corporate performance. This is in conformity with the convergence-of-interest hypothesis (Jensen and Meckling, 1976).

Model I: Simultaneous Equation Model of Directorial Ownership and Tobin's Q

$$\text{Directorial Ownership}_{it} = \alpha + \beta_0(\text{Tobin's Q}_{it}) + \lambda_0(\text{Standard Deviation of Stock Returns}_{it}) + \lambda_1(\text{Dividend Yield}_{it}) + \lambda_2(\text{Debt Ratio}_{it}) + \lambda_3(\text{Natural Logarithm of Market Value}_{it}) + v_{it} \quad (i)$$

Table 6. Simultaneous equation model.

| Independent variable | Model I | | Model II | |
|-------------------------------------|-----------------------|---------------|----------------------|---------------|
| | Directorial ownership | Tobin's Q | Managerial ownership | Tobin's Q |
| Dependent variable | Equation (i) | Equation (ii) | Equation (iii) | Equation (iv) |
| Directorial ownership | | 0.207 *** | | |
| Managerial ownership | | | | -4.726 *** |
| Tobin's Q | 9.326 *** | | -0.075 | |
| Dividend yield | -0.074 | 0.009 | 0.000 | -0.001 |
| Debt ratio | 0.040 * | -0.003 | 0.000 | -0.002 |
| Standard deviation of stock returns | -0.112 * | | -0.008 * | |
| Natural logarithm of market value | -1.246 *** | | -0.005 | |
| Natural logarithm of total assets | | 0.540 *** | | -0.177 |

Note:*** denotes statistical significance at 0.1% level. ** denotes statistical significance at 1% level. * denotes statistical significance at 5% level.

$$\begin{aligned} \text{Tobin's } Q_{it} = & \alpha + \beta_0(\text{Directorial Ownership}_{it}) + \beta_1(\text{Directorial ownership}^2_{it}) \\ & + \lambda_0(\text{Natural Logarithm of Total Assets}_{it}) + \lambda_1(\text{Dividend Yield}_{it}) \\ & + \lambda_2(\text{Debt Ratio}_{it}) + \pi_{it} \end{aligned} \quad (ii)$$

Model II: Simultaneous Equation Model of Managerial Ownership and Tobin's Q

$$\begin{aligned} \text{Managerial Ownership}_{it} = & \alpha + \beta_0(\text{Tobin's } Q_{it}) + \lambda_0(\text{Standard Deviation of Stock Returns}_{it}) \\ & + \lambda_1(\text{Dividend Yield}_{it}) + \lambda_2(\text{Debt Ratio}_{it}) \\ & + \lambda_3(\text{Natural Logarithm of Market Value}_{it}) + \gamma_{it} \end{aligned} \quad (iii)$$

$$\begin{aligned} \text{Tobin's } Q_{it} = & \alpha + \beta_0(\text{Managerial Ownership}_{it}) + \beta_1(\text{Managerial ownership}^2_{it}) \\ & + \lambda_0(\text{Natural Logarithm of Total Assets}_{it}) + \lambda_1(\text{Dividend Yield}_{it}) \\ & + \lambda_2(\text{Debt Ratio}_{it}) + \tau_{it} \end{aligned} \quad (iv)$$

A higher level of directorial ownership indicates a higher level of internal control; active supervision by directors can ensure that the policies adopted by managers are oriented towards benefitting shareholders, thereby helping to improve the firm's performance. When the level of directorial ownership is high, directors can provide a higher level of supervision and this may lead to improved performance. Directors can hold a large amount of shares and be in a position to influence corporate policy-making. A high concentration of ownership in the hands of directors is beneficial to a firm's performance.

Performance has a significant positive impact on directorial ownership. As directors can obtain the latest and realistic operation information, they are willing to increase shares when performance is much better. Furthermore, after the year-end settlement or the ex-dividend each year, profits will be distributed to investors in the form of stock dividends or cash dividends. That means the more shares you have, the more profits you can obtain. That is why directors increase their shares when performance becomes better.

The influence of other control variables on directorial ownership

Generally speaking, ICT companies are not willing to distribute stock dividends because they need to have a large input of capital in the upgrade of new equipment

and in R&D. Due to this reason, those companies usually keep a high percentage of cash surpluses to increase processing production equipment; and dividend yield has no significant effect on directorial ownership. However, the increase of debt ratio could have significant positive effect on directorial ownership. For example, ICT companies issue bonds or have more loans from bank to purchase equipment or raw materials for future operation. This means an optimistic outlook for the future performance of a company, so debt ratio can positively affect directorial ownership. Besides, debt ratio is also a good tool to see whether a company has an extra oversight mechanism. When a creditor decides to loan to a company, the operation and outlook of the company will be taken into consideration, and the external oversight mechanism is helpful to reduce agency costs, and directors will be also willing to increase shares owing to this. Corporate risks (change of stock returns) have negative effect on directorial ownership. Directors will decrease shares around 0.11% when the risk of a, ICT company's stock is relatively 1% higher than the average. Directors have professional background, and all are insiders; also participating in corporate decision making, they are very sensitive to operation risk whether in their company or the whole industry. Under the consideration of their benefits, they could reduce shares to minimize the loss caused by stocks. Market value also has negative effect on directorial ownership. Market value is the sum of equity value and credit value. When credit increases, it may slightly stimulate the increase of directorial ownership. However, when equities are expanded, directorial ownership will be diluted, and it affects the distribution of cash and stock dividends. Directors may reduce the shares on hand due to the effect of profits.

The relation between managerial ownership and performance

Performance is not significantly related to managerial

ownership. Compared to directors, managerial ownership is relatively much lower. Specifically, the mean of managerial ownership in our data is 0.42% much lower than 32.22% in Greek firms. Kapopoulos and Lazaretou (2007) suggested high performance leads to the increase of the value of stock options owned by management and would increase their share ownership, whereas managerial ownership may be too low to be affected by Tobin's Q in our study. Regarding the reward policy to managers in ICT companies, except stock bonuses, there are also cash rewards, or both. Even if performance is much better than before, it still may not increase managerial ownership directly. Although managers can acquire stock bonuses, they will adjust the shares on hand based on stock value, expected corporate performance or other factors. That is why the ownership percentage that managers declare every year does not have positive effect on performance.

Managerial ownership does negatively affect performance (Table 6). This is in conformity with the study by Jensen and Ruback (1983) and Lin and Wu (2010). The higher the managerial ownership is, the worse the performance of ICT company will be. When the level of managerial ownership increases, agency problems become worse. From the perspective of agency theory, managers in ICT companies have decision-making power on business operation, and they could employ their authority to make decisions benefit for themselves, and ignore the interests of the company and its shareholders, which just proves the entrenchment hypothesis. When ownership is more concentrated in the hands of the managers, they may choose projects that are disadvantageous to shareholders, with the aim of securing their position and furthering their own personal interests, causing corporate value to fall. Managerial ownership has negative effect on performance, and it also indicates that the lower the managerial ownership is, the better the performance will be. When managerial ownership is lower, the board of directors, creditors, and other institutions will have more power to supervise managers, and managers will not easily take the policies, which may hurt the benefit of a company.

The influence of other control variables on managerial ownership

Corporate risk (change of stock return) has negative effect on managerial ownership, and as for other control variables, they are not related to managerial ownership. The possible reason is that corporate risk (change of stock return) is out of managers' control, but those variables, like stock dividend, debt ratio, and market value, have direct relationship with managers, and in other words, the factors can be controlled by managers. Therefore, the variables have no effect on managerial ownership. Corporate risk affects managerial ownership

negatively, which suggests that managers are sensitive to corporate risk; they therefore lower their holdings to avoid bearing increasing risk. When stock risk of an ICT company is 1% higher than the average in the market, managers will reduce their holding around 0.005%. Dividend yield does not have significant impact on managerial ownership, although the distribution of dividends may decrease disposable cash for ICT firms, which will affect the amount of capital available for future investment. It means even if the outlook of performance of a company is positive, managers will not still increase holdings due to the situation. The reason is that ICT companies primarily pay out in stock bonuses, rather than stock dividends. As stock dividends are relative low, this can not become an incentive for managers to increase their own shares to obtain stock dividends. Debt ratio has no effect on managerial ownership. Although debt ratio represents the outlook of future performance, over investment also raises operation risk. Therefore, debt ratio has no effect on managerial ownership. Market value has no effect on managerial ownership. Managers have the right to decide to have a loan or not, and they have a clear understanding of internal operation of a company than creditors and shareholders. For the reason, external oversight mechanisms do not influence managers or managerial ownership.

DISCUSSION

The major contribution of this paper is to find the agency problem between directors and managers and to know how it affects performance in ICT firms. ICT firms compared to traditional industry place more importance on directors' authority and function and on their cooperation with managers. However, ownership is dispersed if directors can not execute their oversight function, managers could take disadvantageous actions to their firm or shareholders due to the increase of their ownership. Then, an agency problem happens, and it may hurt a firm's operation. Based on the 11-year panel data, simultaneous equation models among directorial ownership, managerial ownership and performance are built up to treat the effect of agency problem in ICT firms. From F-test, LM test, and Hausman Test, the panel data models in the study are applicable to the random effect model.

The study result suggests that directorial ownership has positive effect on performance. However, managerial ownership has negative effect on performance. The positive relationship between directorial ownership and performance is consistent with the convergence-of-interest hypothesis. Due to the increase of holdings, directors' interests are consistent with the interests of company, so they will pay more attention to supervision and corporate decision making to avoid managers making any disadvantageous decisions to company or directors. As managers' holding is relatively low, operation

results of a company can not bring enough incentives to them, so managers may employ their authority to take those policies harmful to the value of company, but advantageous to themselves.

After realizing the relationship among directorial ownership, managerial ownership and performance in ICT firms, investors can know that directorial ownership has positive effect on performance, and will continuously watch the change of directorial ownership. When directors increase holdings, that means performance becomes better; on the contrary, when directors decrease holdings, that means performance is not so ideal. The change of directorial ownership is helpful for investors' investment policies. On the other hand, managerial ownership has negative effect on performance, and the situation can make investors have a clear understanding that if ownership is over dispersed, not being concentrated in certain big shareholders, managers could use their authority to make decisions harmful to company but beneficial for themselves due to low managerial ownership and poor supervision. Then, an agency problem could easily happen, and it also meets the position entrenchment theory; it is similar with the results proposed by Morek et al. (1988), McConnel (1990), Helmalin and Weisbach (1991) and Himmelberg et al. (1999). Consequently, the change of managerial ownership must be given a close attention, too.

Ownership has been an important method to attract talents in ICT industry, which usually takes stocks as a reward system. But, low managerial ownership can not raise performance. Instead, managers' self-interest behavior could hurt the value of company. For the reason, in the reward system, there could be a necessity to largely adjust the policy of stock bonuses to managers. Managerial ownership should be substantially raised to make them regard the interests of a company as their interests in managing a company. Or, directors' authority can be strengthened and the supervision from external investors (such as institutions or creditors) can be enhanced to avoid managers making any decision disadvantageous to company.

Performance and debt ratio have positive effect on directorial ownership. Both of corporate risks (change of stock return) and market value have negative effect on directorial ownership, but only corporate risks (change of stock return) have significant negative effect on managerial ownership. The more supervision the creditors involve in, the better the performance will be, and the situation may attract directors to increase shares. When directorial ownership is too high, directors may easily reduce some shares due to the fluctuation of risk factors from market. While market value rises, it also means expansion of equity and debt, and directors may release some shares on account of the doubt of business operation. Managers usually have low shareholdings, and can not bear high risk from market. They easily make an adjustment of the shares in hand because of the change

of stock value. Another possibility is that the purpose of managers' shareholdings is to get the profits by transaction of stock instead of long-term holdings to join the share of profit from company.

Investors would be advised to consider the agency problem of directorial and managerial ownership before investing a company, especially managerial ownership is negatively related with performance. The outcomes of this effort may serve as effective monitoring criteria for the shareholdings of ownership structure. These results can also be helpful to investigate the relationship between ownership structure and performance in China. By aggregating the outputs of Taiwan's and China's manufacturing industries together, the "Greater China" area should provide meaningful information (Sheu and Yang, 2005). Taiwan's ICT firms are similar with China's firms in corporate governance. Taiwan originated from Chinese culture, making its organization culture such as Chinese relational society similar with China's. In addition, China's stock exchange started in 1990 and its database is not large enough to deploy longitudinal study. The results of this study provide a very helpful direction to realize China's corporate governance.

Conclusion

ICT industry dominates the global economic development in the recent years, and Taiwan ICT industry is an important center for the global ICT development. Also, the number of Taiwan's ICT firms and the proportion of those firms' production occupy a premier place in the world. This study analyzes the relationship between the ownership structure and performance of ICT firms in Taiwan. There are professional managers and a board of directors in the ICT firms in Taiwan, not like in traditional industry, where directors are also managers and most of those positions are controlled by a family. Due to the reason, the relationship between management and ownership in ICT industry specially causes people's attention. In order to study the relationship between performances and different roles---managers or directors--, there is discrimination of the shares between managers and directors in the study. Further, under the consideration of endogenous problem of ownership structure, there are separate simultaneous equation models for ownership structure and for performance. If only based on one-year data of the relationship between ownership and performance, it is not easy to find out their long-term change. Therefore, the subjects in the study are on the basis of 199 ICT firms from 1994~2004. The empirical results showed that directorial ownership has a positive effect on performance, and performance also has a positive effect on directorial ownership, and they are consistent with the convergence-of-interest hypothesis. However, managerial ownership has a negative effect on performance, and it is consistent with the entrenchment

hypothesis. That is because the stock bonus ratio is low, and managers are free to sell off shares anytime; so performance has no significant effect on managerial ownership.

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