Innovation Capital and Firm Performance: To Explore the Deferral Effect and the Revisited Measurement

Mu Shun Wang
Unversity of Kainan, Taiwan, ROC

This paper analyzes the relationship, from 2000 to 2009, between corporate governance, innovation capital, and management performance in Taiwanese companies containing research and development (R & D) departments. For the analysis, panel data regression was used, which incorporated the random effect, while two-stage regressions were used to test the relationship. As is known, innovation capital is related to management performance and has a deferral effect. In this study, a new variable was chosen to express the concept of innovation capital and take advantage of the instrument variables of corporate governance, thereby supporting our hypothesis. Similar results are also obtained using a two-stage regression, which also incorporated the instrument variables of corporate governance. The results demonstrate that innovation capital has different outcomes, especially because independent directors have an influence on both innovation capital and management performance. Thus, through cross-sectional analysis, we suggest a new variable to estimate market performance, with measures of structural capital requiring redesign. Organizational capital was also found to have an influence on performance.

INTRODUCTION

The effect of intellectual capital generally requires a two-dimensional analysis of both micro and macro factors. After World Bank (1998) laid much emphasis on the importance of national intellectual capital, Lin and Lin (2008) found that, it was not hidden assets, but national intellectual capital that underpinned and fuelled a country's growth. Lin and Edvinsson (2009) developed an index to measure intellectual capital consisting of a sharp depicting the changeable time horizon. The paper argues that intellectual capital is the main function in empowering productivity and increasing earnings to sustain a competitive advantage. Currently, studies quantifying the effect of intellectual capital are conducted through questionnaires or discussions on the value of intangible assets. However, since there is still no consistent definition of intellectual capital, the line between what does and does not fall into this category is still quite blurry. After Choong (2008) classified intellectual capital as customer related capital, human resource capital, and structural capital, Kamath (2008) quantified the financial data and helped initiate further studies on the quantification of intellectual capital.

Aside from intellectual capital, innovation capital arriving from R & D provides much of an advantage for a corporation. Innovation is a dynamic competence; the competence to create, extend or modify its resource base for inter-organizational sharing (Helfat et al. 2006). Strategy literature, derived from resource-based theory, states that innovation capital has accumulated intangible assets including patents and reputation such that this intellectual capital can influence operating performance (Hope and

Hope, 1997). "Innovation capital", however, is quite an abstract and difficult measure to define. Saenz et al. (2009), as a hypothesis, argued that knowledge sharing occurred, which helped explain that the production of innovation capital was intensively communicated between parties, leading to new knowledge and subsequent innovation. Wang et al. (2008), using large sample data, demonstrated that business type, through the formulation of strategies affecting innovation development, influences the creation of firm value. However, from past observations of cross-sectional data, innovation capital is positively correlated to operating performance. To bind the mixed results, we further explore the time-series and cross-sectional samples collected. This paper develops a new measure to estimate innovation capital and sets the instrument variables of corporate governance for use in the two-stage least squares method. Further, special ownership structure, usually apparent in listed high-tech Taiwanese companies, is discussed. Taiwanese subsidiaries often develop new technology in the labs of the parent. Upon receipt of new patents, the parents invest in the new subsidiary to earn profit through the pyramid-holding. This paper has a large academic contribution because past studies have only discussed the influence between innovation capital and past performance. These studies have estimated innovation capital but neglected the inconsistency of time to impact on accumulation of innovation capital. Needless to say, competition depletes innovation capital, a fact that will be reflected in a lower stock price. In addition, to show the change in time horizon, we use proxy variables for total production and return on asset growth rates.

The rest of this paper is organized as follows: in the next section, we go into details about innovation capital and measuring method. Section 3 presents the methodology adopted in this study, including panel data regression and two stage least square method. Section 4 presents sample selection and descriptive statistics, followed by analysis of empirical results; finally, section 5 concludes the paper with some implications and limitations.

LITERATURE REVIEW

Innovation Capital

An important component of intangible assets is its triggers of organizational reform. Innovation capital is often granted by the creation of value from the positive effect on deferred performance (Souginnis, 1994; Lev and Sougiannis, 1996). There are a number of papers that measure patent and R & D expenditure; Wang et al. (2008) use R & D expenditure to sales as a proxy for innovation capital. Wang and Chang (2004) inferred that innovation capital was created through employees. Their estimation was constructed through a questionnaire and survey, and the creation of multiple scales to measure which included productivity of R & D, the proposition of R & D staff to all crew, patent and expenditure to members of the R & D department etc. Since their method involves equation modelling, our study cannot use their variables due to co-linearity problems. Chen et al. (2008) examine the relation of the total risk of returns with R & D intensity and find the two to be nearly positively correlated. However, their method only used R & D expense to test cross-sectional variation. Hall (1999), Hall et al. (2000), Gambardella and Torrisi (200) use the perpetual inventory formula to develop a measure for the skill of innovation capital. To calculate innovation capital, Zhang (2003) design a model of R & D percentage, which incorporates the total, lagged two periods and 15% amortization.

In this study, we consider these methods regardless of intellectual capital and either split the intangible asset (Wang et al. 2008) or complicate to calculate the expenditure (Zhang, 2003). We calculate intellectual capital, and get the results of the value added coefficient of intellectual capital (VAIC) found by Public (2000). This VAIC was divided by the R & D percentage to proxy for innovation capital. In calculating VAHU (Value added coefficient of Human Resources) and using the random effect of panel data to capture the time effect, our measurement is consistent with Public (2000). We assume that innovation capital is positively related with firm performance.

Public (1998, 2000) use *VAIC* to measure the intellectual capital of companies. The abbreviations adopted in the *VAIC* approach are defined as follows:

Output = Gross income, (1)
Input = Operating expenses (Excluding personal costs), (2)
VA = Output – input, (3)
CE = capital employed = book value of a firm's net asset, (4)
VACE = *VA*/*CE* = total *VA* divided by the total amount of *CE*, (5)
VA of human capital (*VAHU*) = *VA*/*HU*; *HU* = total salary and wage cost, (6)
VA intellectual capital (*VAIC*) = *VAHU* + *VACE*. (7)

VAIC approach is now commonly used to explore the relationship between financial performance with intellectual capital (Chen et al., 2005; Shiu, 2006; Kujansivu and Lonnqvist, 2007; Tan et al., 2007; Yalama and Coskun, 2007; Chan, 2009).we also use the process capital to control the variation. Process capital is calculated by VA to administrative expense.

Corporate Governance and Performance

We hypothesize that the corporate governance variables are relevant to innovation capital. To represent the governance mechanism, institutional shareholder activism to control conflicts between managers and shareholders is used. Institutional shareholders focus on performance, profits and the development of inventions, despite the efforts of management. Gillan and Starks (2000) argued that the large shareholders who simultaneously hold debt and/or equity positions in a company are active participants in a company's strategic direction. If we consider small, high-tech companies with a higher R & D intensity and exploration stage suitable for latent customers, they welcome more funds to assist their growth but are also concerned that underperformance will damage their outlook with top management.

Filatotchev and Toms (2003) examines the influences of organizational diversity, ownership structure and board characteristics on strategic response to industrial decline in firms from the UK textile industry, and argued that the surviving companies tended to have a higher level of organizational diversity in their institutional ownership and more diverse boards. Black (2001) reported a powerful correlation between the market value and corporate governance of Russian firms. Abeysekera (2010) examine the effect of board size on firms disclosing more, rather than less, strategic and tactical intellectual capital resources using the top 26 of the 52 firms ranked by the Nairobi Stock Exchange for market capitalization in 2002 and in 2003. Keenan and Aggestam (2001) argue that responsibility for the prudent investment of intellectual capital resides with corporate governance, and that, depending on the firm's characteristics and orientation, the corporate governance may need to develop new structures and processes in annual reports about the value created for stakeholders through the firm's intellectual capital.

Dittmar and Mahrt-Smith (2007) found that firms with both high excess cash and poor governance subsequently experience particularly low operating performance. If the firm has poor corporate governance, the return on assets displays a decrease in growth and damages their large excess cash reserves. On the other hand, the influence of corporate governance on discretion, company enhanced the corporate governance may reduce manager's discretion and hurt the future value of the company.

Many papers have argued that corporate governance is positively related to management performance (Joh, 2003), with management performance found to be positively related to intellectual capital. It is common knowledge that many countries require domestic companies to maintain an appropriate corporate governance structure in order to protect shareholders, while companies also seek intellectual capital in order to develop their competitive advantage. We posit that corporate governance and intellectual capital is positively related to management performance, while management performance is positively related to intellectual capital.

As proxies for corporate governance, we use variables of pyramid, duality, independent directors and foreign shareholders. Duality means that the CEO also has a duty to ensure directors take care of the company. This usually enhances the power to lead subordinates towards achieving their goal and is a symbol for poor corporate governance in Taiwan. However, if the directors of the board have more talent

to develop patents and new technologies, they reduce the intervention of others and the seizing of their achievement. High performance is conversely faced with the corporate governance mechanism. Secondly, independent directors also play a vital role in monitoring and advising business activity. Independent directors are positively related to performance through their innovation activities.

Innovation Capital and Firm Performance

Company need sustain competitive advantage and earn more money to cater for stakeholders; they should focus on new product and new skill to develop, if we need the proposition did, the innovation capital is the successful factor key to assist managers to strength their core competence. As we know, innovation capital usually consist of the research and develop expense, these expenditures can't be recognized by "capital" in front of commercialization. Wang et al. (2008) design a model which was supposed of the deferral effect to test the relationship between R & D fee with operating performance, and the conclusion to explain a feedback effect that innovation capital are positive related to operating performance, and the effect will feedback for R & D activities. Most of the papers with regarded as the innovation capital to discuss the relevant is significant at their collecting of samples. We suppose that the innovation capital are positive related to total production with ROA growth rate. One of the reason is the innovation capital not only help satisfied for benefits of stakeholders, but also improve the environment of workers of organization and promote network to smoothly flow.

We also believe that the R & D fee has random effect to match the challenge and the change from external factors. This effect of the innovation activity is not easy in the foreseeable future after many of the apparent. However, As long as the fake from the fraud, will be able to improve operational efficiency and improve corporate performance, somehow company prone to attain the mission to benefit for human, they certainly increase the return of asset either invest more asset or reduce avoidable waste (cost). Our hypotheses can simple state as follow:

H1: Innovation capital is positively related to total production.
H2: Innovation capital is positively related to ROA growth rate.

RESEARCH DESIGN

Panel Data Model of Fix Effect

There are two common assumptions made about the individual specific effect, the random and fixed effects assumption. The former (made in a random effects model) assumes that the individual specific effects are uncorrelated with the independent variables; the latter assumes that the individual specific effect is correlated with the independent variables. If the random effects assumption holds, the random effects model is more suitable than the fixed effects model.

Because the fixed effects model relies on within-group action, we require repeated observations for each group, and a reasonable amount of variation of our key X variables within each group. One potentially significant limitation of the fixed effects model is that we cannot assess the effect of variables that have little within-group variation. The mean values of the variables in the observations on a given individual.

This is known as the within-groups regression model as it explains the variations in relation to the mean of the dependent variable in terms of the variations about the means of the explanatory variables for the group of observations relating to a given individual. The possibility of tackling unobserved heterogeneity bias in this way is a major attraction of panel data for researchers, which are calculated and subtracted from the data for that individual. Finally, they will produce between-group regression. Subtracting this from (8), one obtains (9) and the unobserved effect disappears.

$$\hat{Y} = \hat{X}_{st}\,\beta + \beta_0 + \varepsilon.. \tag{8}$$

$$\hat{Y} = \frac{\sum_t Y_{it}}{T} \qquad \hat{X} = \frac{\sum_t x_{it}}{T} \qquad \hat{\varepsilon} = \frac{\sum_t \varepsilon_{it}}{T} \tag{9}$$

If we define a new dummy variable dj, where dj is equal to 1 in the case of an observation relating to individual j and 0 otherwise, the model can be rewritten as Eq. [10]:

$$performance_{st} = \alpha_1 d_{1jt} + \alpha_2 d_{2jt} + ... + \hat{\beta} X_{st} + \varepsilon_{st} \tag{10}$$

Formally, the unobserved effect is treated as the coefficient of the individual-specific dummy variable, the $\alpha_j d_j$ term representing α fixed effect on the dependent variable performance$_{st}$ for individual i (accounting for the name given to the fixed effects approach). Having re-specified the model in this way, it is suitable to use the OLS approach, being well-known as the least squares dummy variable (LSDV) regression model

Panel Data Model of Random Effect

In statistics, a random effect(s) model, also called a variance components model, is a kind of hierarchical linear model. It assumes that the dataset being analyzed consists of a hierarchy of different populations whose differences relate to that hierarchy. In econometrics, the random effects models are used in the analysis of hierarchical or panel data.

The decision over the use of random effects is based on two methods, being the Lagrange Multiplier Test proposed by Breusch and Pagan (1980) and the Hausman Test. Various tests have been developed to detect the presence of random effects. Among them, the most commonly adopted is the Breusch – Pagan Lagrange multiplier test, the test statistic having a chi-squared distribution with one degree of freedom under the null hypothesis of no random effects, as shown in Eq. [11]:

$$LM = \frac{NT}{2(T-1)}\left[1 - \frac{u'(In \otimes JT)u}{u'u}\right]$$
$$LM = \frac{NT}{2(T-1)}\left[1 - \frac{u'(In \otimes JT)u}{u'u}\right] \tag{11}$$

Where N is the tested number of markets; T is the research period; and u is the residual item of OLS. If the test results do not reject the null hypothesis, the ordinary least squares method will be adopted. If the test results reject the null hypothesis, a random effects model is applied.

The Hausman test equation is expressed in Eq. [12]:

$$H = \left(\hat{\delta}_{FE} - \hat{\delta}_{RE}\right)\left[\hat{AVAR}\left(\hat{\delta}_{FE}\right) - \hat{AVAR}\left(\hat{\delta}_{RE}\right)\right]^{-1}\left(\hat{\delta}_{FE} - \hat{\delta}_{RE}\right) \tag{12}$$

where $\hat{\delta}_{FE}$ is the estimation equation of fixed effects, $\hat{\delta}_{RE}$ is the estimation equation of random effects, and the critical difference between FE and RE was that FE allowed for correlation between the unobserved effect and the explanatory variables, whereas RE requires these to be uncorrelated. In general, we assume that the unobserved effect is correlated with the explanatory variables, which is a more conservative approach. However, if the unobserved effect is uncorrelated with the explanatory variables, the RE estimator is more efficient than the FE estimator and hence we prefer it instead.

A Hausman test consists of two estimators. Under the null hypothesis, both are consistent, although one is more efficient. Under the alternative, the former one is more efficient and becomes inconsistent, while the formerly less efficient remains consistent. Thus, if the null is accepted, the two estimators

should be similar, and divergence indicates rejection of the null.

Normality Test

As a rule, the panel data needs to be tested for their normality. This study used the methods of Doomik-Hamsen to test the normality of single variables and multivariate, respectively. Doornik-Hamsen's multivariate normality test is suitable for fat tail situations. If the Chi-square distribution reaches 144 or the above, the test result strongly rejects the null hypothesis of normality. D = max {D^{+}, D^{-}} , then: D^{+} = max_{i = 1,..., n}{i/n - p_{(i)}}, D^{-} = max_{i = 1,..., n}{p_{(i)} - (i-1)/n}Where $p\{(i)\} = Phi([x\_\{(i)\} - overline\{x\}]/s)$. Therefore, *Phi* is always used as the cumulating distribution function of the standard normal distribution.All results are presented in Table 1. As shown, all null hypotheses of normal distribution were rejected.

Two Stage Least Square Method of Panel Data

To examine the association between level of intellectual capital and management performance, we construct different scale to proxy for performance on a self-constructed measure of intellectual capital and corporate governance variables. First, the regress indicators are using the OLS to observe their relationship and check the collinearity.

$$y = \beta_0 + \beta_1 Pyramid + \beta_2 Dual + \beta_3 IndDir + \beta_4 Forinst + \beta_5 INOVA + \beta_6 AgCost + \beta_7 Persale + \beta_8 FrmSize + \beta_9 D\% + \varepsilon \quad (13)$$

Y= ATO, ROAg

Second, when faced with the problem of unobserved heterogeneity, we have thus far seen two approaches: ignore the unobserved heterogeneity and suffer the potential consequences of biased and inconsistent estimators. Assume that the unobserved heterogeneity is constant over time and use either first differencing or fixed effects estimation. Two stages least squares can also be used in models with more than one endogenous explanatory variable. For example, consider the model Eq. (13), where E(ε)= 0, andε1 is uncorrelated with corporate governance variables. The variables y2 and y3 are endogenous explanatory variables: each may be correlated withε1. To estimate Eq(13). By TSLS, we need at least two exogenous variables that do not appear in Eq. (13) but that are correlated with y2 and y3. Suppose we have two excluded exogenous variables, say z1 and z2. Then, from our analysis of a single endogenous explanatory variable, we need either z1 or z2 to appear in the reduced forms of y2 and y3.

Consider the simple regression model: Since cov(x,u)≠0 contradicts one of our assumptions for OLS, the OLS estimator will be biased and inconsistent.

$$y = \beta_0 + \beta_1 x + u; \operatorname{cov}(x,u) \neq 0 \quad (14)$$

To obtain consistent estimators of both β0and β1 (recall, it is not just the coefficient for x that will be inconsistent) we need more information. Suppose we had an additional variable z that satisfied properties:

$$\operatorname{cov}(z,u) = 0; \operatorname{cov}(z,x) \neq 0 \quad (15)$$

Then we call z an instrumental variable for x. The variable z is often referred to as an exogenous variable. This means that z should have no partial effect on y(once x and the omitted variables in u are controlled for) and z should not be correlated with the unobserved factors that affect y.

It is a good idea to compute OLS and 2SLS to see if the estimates are practically different. To determine whether the differences are statistically significant, it is easier to use a regression test.

Weak Instrument

It is common to find that potential instrumental variables are only weakly correlated with the endogenous variable. This introduces three problems: (1) Estimates will have large standard errors. (2)The IV estimator can have a large asymptotic bias (i.e., inconsistency) even if z and u are only modestly correlated when z and x are weakly correlated. (3)In finite samples, IV estimates are biased in the same direction as OLS estimates. The magnitude of the bias becomes closer to that for OLS as the R2 between the instruments and the endogenous variable approach 0. A finite-sample bias arises because we do not know the first-stage coefficients and instead must estimate them.

The magnitude of the bias depends on both the sample size (the bias decreases as the sample increases) and the multiple correlation between the instruments and the endogenous variable (as R2x,z increases the bias of the IV estimator decreases).

If we only looked at the OLS and IV regression results we might conclude that the OLS estimate was biased downwards. The standard error on the IV estimate is very large, meaning that we cannot conclude that the estimate is statistically different from 0 (or from the OLS estimate).

The F-test conducted to examine the strength of the instruments is for the null hypothesis that only the parameters on the instruments are 0(a good rule of thumb is that the F-statistic should be at least 10). The null hypothesis is NOT that all parameters in the reduced form regression are equal to 0.

Testing Over-Identification Restrictions

If we have more than one instrumental variable, we can effectively test whether some of them are uncorrelated with the structural error. Given the IV estimates, we can compute the residuals, because Θ4 is not used at all in the estimation, we can check whether Θ4 and $\hat{u}1$ are correlated in the sample. If they are, Θ4 is not a valid IV for y2. Of course, this tells us nothing about whetherΘ3 and$\hat{u}1$ is correlated; in fact, for this to be a useful test, we must assume that z3 and u1 are uncorrelated. Nevertheless, ifΘ3 and Θ4 are chosen using the same logic—such as mother's education and father's education—finding thatΘ4 is correlated with u1 casts doubt on usingΘ3 as an IV. Because the roles ofΘ3 andΘ4 can be reversed, we can also test whetherΘ3 is correlated with u1, providedΘ4 and u1 are assumed to be uncorrelated. Which test should we use? It turns out that our test choice does not matter. We must assume that at least one IV is exogenous. Then, we can test the over-identifying restrictions that are used in TSLS.

OPERATION DEFINITION

Corporate Governance Variables

IndDir = 1 if the independent directors had been hold a seat at the board,; 0 if otherwise

DUAL = 1 if the roles of chairman and CEO are held by the same person; 0 if otherwise

Forinst=the shareholders is belong to foreign institutional investors. We check on the proportion of real share ratio.

Pyramid= 1 if the ownership structure is belong to multi-level holding; 0 if otherwise.

The AgCosts acts as the proxy variable for agency problem reduction, in order to measure the operating expense divided to operating cost. Percapc is proxy variable for organizational performance to assist in focusing on business activity, with this measurement defined as employee salary divided by the total expenses of marketing and operating activities.

Measurement of Performance

According to Stewart (1997), the selection of independent variables is based on performance measurement. Economic Value Added is used as the variables for capital budgeting, financial planning, goal setting, performance measurement, shareholder communication, and incentive compensation to determine corporate value. Sveiby (2002) suggested that different measurement methods have different advantages, and the financial methods for valuation such as ATO and ROAg, are useful for stock market valuations.

ATO is the proxy variable for management efficiency in measurement, as the total revenue is divided by equity. ROAg is the proxy variables for information asymmetry reduction, and the measurement is defined as the return on asset growth rate (being the next ROA minus current ROA), and the amount to divide the current ROA.

RESULTS AND FINDING

Descriptive Statistics

Data was collected from the Taiwan Economic Journal Data base (TEJ). A total of 227 items of missing data were deleted, leaving 112,370 items of final testable data. The period of 2000 to 2009 was used for balanced panel data regression for the listed companies of the Taiwan. There were 312 firm samples in each year of operation, as summarized in Table 1.

Observing the descriptive statistics in Table 1, we first look at the proxy variables of management performance. ATO, ranging from a minimum value of 1.385 to a maximum value of 2.206, indicating any firm have R & D expenditure whose innovation is approach to average value. The return on asset growth rate averaged 1.7381%, but the minimum is negative value which showing that most of the sampled companies need to work harder to improve their profit margin. In addition, Table 1 also shows that average of Agency cost was 0.1238, minimum 0.0055, and maximum value 0.6867, indicating the returns of assets of listed companies varied greatly, The panel data need long horizon and can find their information from TEJ database every time. If the company had been go private at any time and lack of their financial report, we deleted all relevant data.

Both innovation capital and process capital had more deviations, as shown in Table 1. One of the defects of the adoption of value-added calculation approach is that, when the net loss of a company is large, its market value becomes negative, regardless of the actual amount of resources possessed by the company. However, the average falls positively in value, which implies a positive relationship between a company's intellectual capital and its daily operating activities. We found that the proposition of foreigner institutional investor have large variation and the range from 0 to 74.68%. the number implicit that the foreigner institutional investor are inclined to search for having-innovation capital to do. And if the company has no performance to devote on the creative activity, they will decrease their holding to leave this equity. We guess the corporate governance variables can influence on the firm performance.

TABLE 1
DESCRIPT STATISTIC

	Mini.	Max.	Average	Standard deviation	skewness	Kurtosis	Normal test
ATO Total production	1.385	2.206	1.641	1.377	3.562	18.962	5894.8
ROAg ROA growth %	-32.38	79.40	1.7381	6.62923	2.051	14.490	734.3
AgCosts Agency costs	0.0055	0.6867	0.123893	0.0884519	2.111	6.567	2032.08
Persale Personnel sales contribution	-1348	29049	1157.66	1933.392	5.959	53.186	16429.6
Pyramid Pyramid ownership	0	1	0.22	.417	1.329	-.235	9460.89
Duality Straddle two positions bothe CEO and directors	0	1	0.93	.248	-3.501	10.263	44435.9
IndDir Independent directors	0	1	.49	.500	.059	-1.998	3322.22
Forei Foreigner institutional investor	0	0.7462	0.098	0.136	1.978	3.777	3517.56
Innovation capital	1.623	7.8040	4.32	1.25	28.516	886.641	1.09
Process caital	0	1.39	8.59	8.69	5.089	49.869	5428.5
Frmsize Firm size	1.27	2.029	1.556	1.28	1.050	1.416	497.389
D% Debt ratio	.0460	0.79	0.35	0.143	0.208	-0.504	58.84

ATO is total production, measured as the total revenue divided by equity. ROAg is defined as the return on asset t year ROA subtract t-1 year ROA and the results was divided to t-1 year ROA, Pyramid= the owner structure is pyramid through multi-level investing to control subordinate units. Duality is defined as the positions being straddled across the board and CEO, IndDir =independent directors dummy variable, and a value of one indicates independent directorship, otherwise, zero, Forinst= quality of foreign institutional investors. Innovation capital is defined as the VA/R & D %, Skewness means inclined to right when value over zero or inclined to left when value under zero. Ex. kurtosis point the distribution is high and narrow tail when the value over 3, and the distribution is low and fat tail when the value under 3. Normal test is use the Doornik-Hansen test，there p-value all are equal and under zero.

Pearson Correlation Test

Pearson correlation test is used to help explore changes in the direction of any two variables, AgCost, Persal, Pyramid, IndDir, FrmSize and D% are highly correlated with the ATO, while AgCost and ROAg insignificantly at our samples. The higher the Forinst, ATO and ROAg the better, and the agency problem can be reduced, indicating institutional investors on corporate governance to be effective. InnoVA correlations with ATO are insignificant. The correlation coefficients are positively related between innovative capital and ROAg, but display a positive relationship with personal contribution, and significant positive correlated with pyramid. Process capital and AgCost, and the pyramid is significantly negatively correlated and means that the Group-based listed company will assist the process of capital increase, while the family-type or shadow director does not assist the increase in process capital. Process capital and the personal contribution are positive; firm size has significant correlation with any variables except for ROAg, it is explained that the ROA have limit at the mercy of firm value. Some company have more grow opportunities but actually carve out or spinoff their asset to restructuring. Forinst are positive

correlated with Persal and Pyramid, DUAL are no any correlated with none variales, but only negative correlated with IndDir, It is very interest that they are conversely role to exercise in the board, DUAL may be said as a bad governance effect however, IndDir is one of the proxy variables for corporate governance.

TABLE 2
PEARSON CORRELATION COEFFICIENT TEST

	AgCosts	*Persal*	*ROAg*	*Pyramid*	*Forinst*	*DUAL*	*IndDir*	*InnoVA*	*Proc.CA*	*FrmSize*	*D%*
ATO	-0.369	0.11	0.031	-0.055*	0.031	0.02	0.14	0.03	0.03	0.113	0.536
	0.000	0.000	0.154	0.011	0.153	0.34	0.000	0.156	0.156	0.000	0.000
AgCosts		-0.172	-0.083	-0.085	-0.105	0.011	-0.056	-0.057	-0.208	-0.292	-0.266
		0.000	0.000	0.000	0.000	0.62	0.009	0.008	0.000	0.000	0.000
Persal			0.206	0.047	0.199	0.022	0.042	0.29	0.406	0.282	-0.134
			0.000	0.029	0.000	0.311	0.052	0.000	0.000	0.000	0.000
ROAg				-0.021	-0.009	0.009	0.07	0.07	0.271	-0.021	0.014
				0.325	0.658	0.673	0.001	0.001	0.000	0.333	0.515
Pyramid					0.125	-0.017	-0.22	0.077	-0.017	0.283	0.054
					0.000	0.429	0.000	0.000	0.416	0.000	0.012
Forinst						0.014	-0.01	-0.018	0.057	0.545	-0.07
						0.507	0.654	0.411	0.008	0.000	0.001
DUAL							-0.063	0.011	0.011	0.004	-0.067
							0.003	0.609	0.609	0.855	0.002
IndDir								0.032	-0.02	-0.126	-0.009
								0.135	0.344	0.000	0.684
InnoVA									0.057	0.15	0.05
									0.008	0.000	0.019
Proc.CA										0.36	-0.145
										0.000	0.000
FrmSize											0.138
											0.000

The first column is stead of the Beta value, second column is p-value. 0.00 mean very significant. The distribution is two tail and the p-value is significant under2.5%.

Empirical Conclusions

This paper examines the relationship between management performance and innovation capital. At first, we suppose that management performance is subject to both corporate governance and innovation capital in the development process of the company. Management performance is visible in the aspects of total production (product effectiveness) and the increase of return on sales (ROA growth ratio). If we can determine the significance, the confidence with which the subject variables tested involves process capital, agency cost and personal contribution increases. In Table 3, the results are explained as to the holding of shares of pyramid types and its significance with management performance. Pyramid is negatively related to ATO and the coefficient is -0.234 we support the hypothesis that an emphasis on the pyramid-holding of shares exist internal capital market and usually called as “dark hole” to increase the agency problem.

Table 3 shows that there is a significantly positively related for Innovation capital with ATO and ROAg. The relationship between AgCosts with ATO and ROAg is significantly negative. This result supports hypothesis. However, there is a significant correlation with personnel contribution, with positive effects from ATO and ROAg. This shows that the higher the personal contribution expenditure, the higher the management efficiency and the higher the ROA grow up. It is concluded that many Taiwanese companies focus on innovation and invention to endeavor for increase effectiveness and performance.

Firm size is negative related to performance which means the more the innovation capital, the less the scale of the firm is inclined to niche market.

TABLE 3
INNOVATION CAPITAL WITH PERFORMANCE

Item	ATO			ROAg		
	Fixed effect	Random effect	TSLS	Fixed effect	Random effect	TSLS
Constant	0.021 1.62	1.29*** 4.05	6.172*** 14.25	7.41*** 3.23	9.173*** 4.89	-3.01*** -4.52
Pyramid	-0.234*** -3.96			0.05 0.14		
Duality	0.333*** 3.561			0.331 0.594		
IndDir	0.303*** 6.29			0.634** 2.21		
Forinst	0.513** 2.472			-0.613 -0.494		
INNOVA	4.85e-05** 2.465	5.31e-05*** 2.685	0.001*** 3.357	0.00034*** 2.874	0.00032*** 2.74	0.0006*** 3.96
Agcosts	-3.37*** -11.794	-3.51*** -12.124	-29.61*** -10.01	-4.289*** -2.52	-4.663*** -2.75	15.24*** 3.62
Persale	0.00011*** 8.4	0.000122*** 9.02	-0.0002 -1.169	0.00085*** 10.692	0.00086*** 7.94e-05	0.0014*** 4.88
Frmsize	-0.058** -2.39	-0.069*** -3.46		-0.48*** -3.316	-0.554*** -4.73	
D%	5.015*** 28.75	4.91*** 27.99	-0.06* -1.94	2.25** 2.162	2.25*** -2.74	0.152** 2.551
R-square	0.392		0.0795	0.0643		0.00576
Adj-R2	0.387		0.0778	0.0579		0.056
Log-likelihood	-3255.975	-3299.6		-7156.8	-7162.47	
Akaik criterion	6543.95	6611.21		14345.6	14336.94	
Schwarz criterion	6634.97	6645.34		14436.63	14371.1	
Hannan-Quinn	6577.223	6623.684		14378.88	14349.42	
Dubin-Watson	1.039			1.746		
LM test		2.85 0.091			0.0676 0.795	
Hausman test		0.656 0.985	759.355 4.88e-16		5.94 0.31235	113.833 1.64e-024
Sargan over identification			LM=9.7 0.0213			LM=291 6.69e-06
Weak instrument			21.45			21.44

ATO is total production to measure as the total revenue was divided to equity. Pyramid= the owner structure is pyramid through multi-level investing to control subordinate units. Duality is defined as the positions were straddled across board and CEO, IndDir =independent directors which dummy variable, if have, given one, otherwise, given zero, Forinst= quality foreign institutional investors. Fix effect assumes that the individual specific effect is correlated with the independent variables. This is known as the within-groups regression model as it explains the variations in relation to the mean of the dependent variable in terms of the variations about the means of the explanatory variables for the group of observations relating to a given individual. The possibility of tackling unobserved heterogeneity bias in this way is a major attraction of panel data for researchers, which are calculated and subtracted from the data for that individual. To compare the OLS and TSLS and whether consistency is to be used, the Hausman test is applied. If we reject H0, this show that they are different to OLS and TSLS, and the results depict the endogenous variables from predicators rather than data, suggesting using 2SLS to replace OLS. If we do not reject H0, we suggest using the OLS method because the two have consistency. We do not reject H0 to show that the model is unstable. Sargan over-identification tests as higher as fine tune the variables. We use weak instrument test to observe the design of instrument variables, and if the F-statistic is over 10.3, the null hypothesis is rejected, and is proof that the instrument variables are correlated to endogenous variables.

The first test condition shown in Table 3 is that the Hausman test results did not reject the null hypothesis. If the test results reject the null hypothesis, it is not necessary to test for random effects. Thus, Table 3 lists the Hausman test results that do not reject the null hypothesis. As shown, the test results on AgCost are the same as the fixed effects. This result supports the agency theory that the QFII has a vital role in helping companies increase the corporate governance effect and strengthening intellectual capital. However, innovation capital has a significantly positive effect on ROAg, indicating that given the instant intercepts (i.e., without consideration for the base period), innovation capital has a significant effect on corporate performance. Firms often adopt the strategy of downsizing during economic recessions. In addition, the independent directors have a positive effect on ATO and ROAg. Because of the limited freedom such that all corporate governance variables cannot be put into the subject together, we found that the results support hypothesis.

TABLE 4
INNOVATION CAPITAL INVOLVES 3 LAGGED WITH PERFORMANCE

	ATO		ROAg	
Constant	-0.885***	1.71***	1.344***	1.344***
	-2.868	38.1	5	5
Innovation capital	3.62e06	3.91e-05*	-0.00034***	-0.00034***
	0.18	1.65	-2.865	-2.895
Innovation capital(-1)	2.23e-05	-1.745e-05	-1.36e-05	-1.363e-05
	1.12	-0.734	-0.122	-0.122
Innovation capital(-2)	3.924***	-1.767e-05	0.000185*	0.000186*
	1.969	-0.75	1.666	1.666
Process capital		-0.0025		0.23***
		-0.711		13.74
pyramid		-0.188***		
		-2.612		
Forinst				-4.43***
				-4.239
AgCost			-3.71**	
			-2.315	
Persale			0.00075***	
			9.776	
FrmSize	0.047**			
	2.344			
D%	5.156***			
	29.2			
Breusch Pagan test	2.689	2.917	0.149	
	0.1	0.088	0.7	
Hausman test	0.53	0.512	5.2374	
	0.991	0.992	0.388	

One of the interesting factors is that the independent directors have a positive effect to ROAg and innovation capital has a significant effect to ROAg at the fixed effect. On the other hand, ROAg are positively related to both personnel contribution and innovation capital due to the random effect. This finding explains that the ROA growth % is not only representative of corporate governance, but independent directors incline to sustain the competition advantage to maintain the company's long- term trend. These values caught my curiosity, so I will corporate governance variables set to instrumental variables and to explore the relationship between innovation capitals with management performance by using the two stage regression model. It was supposed that the predicted variable of innovation capital has a higher explanatory power to management performance including that of ATO, and ROA growth %.

We repeatedly test to screen the fitted variable in Table 3. The hypothesis is regarded as the corporate

governance variables having an effect on intangible assets to enhance the competitive adva－ntage for a company. Innovation capital can increase performance such as production efficiency, and feedback on the return on asset growth. The instrumental variable is set to corporate governance, and corporate governance variables are used by the investors as a good indicator of trust. Good corporate governance can be said that the reputation of the company to investors is more important than profitability. We used the weak instrument test to determine all models over 10.3 and reject the hypothesis of the weak instrument. That is to say, the corporate governance variables are strong instrument variables when compared to the endogenous variables of intellectual capital.

Innovation capital and process capital has a positive effect on management performance which all displays a significant positive relationship on the column in Table 3. The R-square is too low, leading to shortcomings with this conclusion.

We also use the Hausman test to explore regression robustness. If the p-value is insignificant and rejects H0, the Hausman test suggests that OLS are different from 2SLS, and the results depict that the endogenous variables are from predicators rather than the data, suggesting the use of 2SLS to replace OLS. If H0 is not rejected, we suggest using the OLS method due to the consistency. Most of the parts use the 2STS model except for ATO. However, the four endogenous variables have significant effects on ATO.

In Wang et al. (2008) study, investigate the relationship between intangible assets and performance, with the effect of lagged effects. Innovation have no effect on the ROAg, caused possible related with the time lag. Han and Lin (2008) designed three indicators of intellectual capital to discuss the analysis of human resource capital, the proposed method to further combine these with time series of lagged phenomenon. Another phenomenon is worth discussing the performance of structural capital of the company response is not significant. In the different control variables, we could find the effect is different from innovation capital. Our results also are different from Wang et al. (2008). Generally speaking, Innovation capital has deferred effect to management performance.

CONCLUSION AND SUGGESTION

This paper takes samples of R & D expenditure to investigate how this innovation capital influences management performance through the instrument variables of corporate governance. All samples could not be used as some listed Taiwanese companies had no R & D expenditure. This study found that the effectiveness and deferred effect of innovation capital is positively correlated with management performance. Also, we support the hypothesis of Chen et al. (2008) and Wang et al. (2008).

However, innovation capital may have different functions at different companies. The pyramid type of ownership strives for innovation capital and is significantly related to performance. However, an area not included in this study was family groups and directorate locking, a possible direction for future research.

Innovation investment is the largest form of capital expenditure in civilized countries, especially Taiwan. High-tech people and well-educated workers set themselves apart from the group in Taiwan. However, Taiwan is generally subjected to the influence of advanced countries like the U.S.A or the EU. International buyers put suppress the profits that can be made here. Their control of the market ensures they have price determination power. This study contributes to existing literature by revisiting measurements to test innovation capital and the use of the panel data model. Our measurement of the VA was divided from R & D expense, differing to traditional proxies such as R & D divided by sales. In addition, we use panel data using lagged periods instead of the deferral effect. The results support our hypothesis of the direction of the relationship. Innovation capital improves organizational performance on the basis of good corporate governance.

ACKNOWLEDGEMENTS

The author is very grateful for the comments and suggestions received from the seminar participants at the banking and insurance conference on Kainan University. Prof. Lee Chen Fu deserves special thanks for his valuable help. In addition, the suggestions received from the conference of innovation and Management Business Practice in London are highly valued. The paper has benefited significantly from the comments of an anonymous referee and the editors. I thank the editors and referees of this journal for their very comprehensive and helpful comments on an earlier draft of this paper.

REFERENCES

Abeysekera , I. (2010) The influence of board size on intellectual capital disclosure by Kenyan listed firms, Journal of Intellectual Capital, 10,504-18.

Chan, K. H. (2009). Impact of intellectual capital on organizational performance: An empirical study of companies in the Hang Seng Index (part1). The Learning Organization, 16(1):4–21.

Chen, M. C., Cheng, S. J., & Hwang, Y. (2005). An empirical investigation of the relationship between intellectual capital and firms' market value and financial performance. Journal of Intellectual Capital, 6(2): 159–176.

Chen, D. H., C. Y. Tsai, T. W. Chen (2008), The explanatory power of R & D on cross-sectional stock return : Taiwan evidence from 1996-2005, Fu Zen Management Review, 15(3), 127-154.

Dittmar A, Mahrt-Smith J (2007), Corporate governance and the value of cash holdings, Journal of Financial Economics, 83:599-634.

Filatotchev I, Toms S (2003), Corporate governance, strategy and survival in a declining industry : A study of UK cotton textile companies, Journal of Management Studies, 40(4), 895-920.

Gillan, S., L., Laura, T., Starks (2000), Corporate governance proposals and shareholder activism: the role of institutional investors, Journal of financial economics, 57, 275-305.

Helfat, E., Finkelstein, S., Mitchell, W., Peteraf, M. A. Singh, H., Teece, D. J. and Winter , S. G. (2007), Dynamic Capabilites: Understanding Strategic Change in Organizations, Blackwell, Oxford.

Joh, Sung W (2003). Corporate governance and firm profitability: evidence from Korea before the economic crisis, Journal of Financial Economics, 68, 287-322.

Keenan, J., and Aggestam, M. (2001), Corporate Governance and Intellectual Capital: Some Conceptualisations', Corporate Governance, 9 (4): 259-275.

Kujansivu, P., & Lonnqvist, A. (2007). How do investments in intellectual capital create profits. Int. J of Learning and Intellectual Capital, 4(3): 256–275.

Lev, B. and Sougiannis, T. (1996), The capitalization, amortization, and value relevance of R & D, Journal of Accounting and Economics, 21, 107-138.

Public, A. (1998), Measuring the performance of intellectual potential in a knowledge economy. Paper presented at 2nd McMaster World Congress, available at www. Vaic-on.net

Public, A. (2000), VAIC—An accounting tool for IC management. International Journal of Technology Management, 20(5-8): 702–714.

Saenz, J., Arambura, N. O. Rivera (2009), Knowledge sharing and innovation performance: a comparison between high-tech and low-tech companies, Journal of Intellectual Capital, 10(1), 22-36.

Shiu, H. J. (2006). Application of the value added intellectual coefficient to measure corporate performance: Evidence from technological firms, International Journal of Management, June.

Sougiannis, T. (1994), The accounting based valuation of corporate R & D, the Accounting Review, 69(1), 44-68.

Stewart, T. A. (1997). Intellectual capital: the new wealth of organizations, New York, Doubleday.

Sveiby, K. E.(2002). Methods for measuring intangible assets, available at www.sveiby.com/articles/IntangibleMethods.htm

Tan, H. P., Plowman, D., & Hancock, P. (2007). Intellectual capital and financial returns of companies, Journal of Intellectual Capital, 8(1): 76–95.

Wang, W. I., Chang, C. F. (2004), the modeling of Intellectual capital impact on performance: the study on semi-conductor industry," the International Journal of Accounting Studies, 38, 89-117.

Wang, H. W., W. T., Wu, M. C. (2008), Business types and R & D activities performance, Journal of Management, 25(2), 173-193.

Yalama, A., & Coskun, M. (2007). Intellectual capital performance of quoted banks on the Istanbul stock exchange market, Journal of Intellectual capital, 8(2): 256–271.