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CONTENTS

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DOES EXECUTIVES COMPENSATION STIMULUS FIRM INNOVATION? THE CASE OF TAIWAN

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ABSTRACT

This paper investigates the relationship between executives compensation and innovation capability of publicly traded firms in Taiwan. Our dataset contains 1,968 non-financial companies from 2005 to 2015. Executive compensation is divided into two components: short-term (total salary and bonus) and long-term (the value restricted stock granted, value of current stock granted). We use R&D expenses to measure innovation capacity and some financial ratios are also included as control variables. Using quantile regression, we find that high salary and bonus play a significant and negative role in stimulating R&D spending. However, the relationship between long-term incentive and R&D expenses is non-linear. For low and medium innovating firms, R&D expenditure is increasing with long-term incentive whereas it is decreasing with long-term incentive in high innovating firms.

JEL CODES
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KEYWORDS
innovation, executive compensation.

1. INTRODUCTION

Innovation plays a key role not only for firm survival but also for economic growth. Innovation is understood as the explorations and developments the products or processes to help firms gain and remain competitive advantages then ultimately increase profits. However, as a high-risk investment, innovation is not prospective based on managerial perspective (Manso, 2007). The asymmetric information of innovation may lead agency problem occurs more seriously. The risk aversions, a problem of agency theory, discourage managers to invest in long-term periods and high rates of failures like innovation. Moreover, managers tend to purse their self-interests and prefer short-run return projects to secure their own wealth, which is attached tightly to firm value (Hunton and Rose, 2008). Therefore, shareholders need to offer manager strong incentives to assure the long-term commitments as well as the protections from failure (Holmstrom, 1989 and Manso, 2007). Consequently, manager compensation contracts are designed to solve the conflict problems by creating appropriate incentives for managers (Bebchuk and Fried, 2003). Numerous empirical literatures have demonstrated the association between compensation and innovation. Balkin et al.(2000) report that CEO compensation is aligned with R&D in high innovative firms rather than low innovative firms. Makri et al. (2006) document that CEO total pay has strong impacts on innovation performance for high-technology firms.

This study takes the initial step by addressing the gap of an emerging market as Taiwan. We investigate whether there is an association between incentive compensation for executives and R&D expenses in Taiwanese public listed companies. Regarding to Aboody and Lev (2000), CEOs should have better understanding of optimal R&D spending, they may make an adequate reduction in R&D expense or relocate funds for their other preferable investments; hence CEOs's incentives should have influence on innovation capabilities. Since R&D expenses is seen as investments in innovation, we follow Aghion, Reenen and Zingales (2009) to treat R&D as the measurement for innovation input. We split compensation into two components: long-term (the value restricted stock granted, value of current stock granted) and short-term (salary and bonus). We test the different compensation structure for managers and R&D using a large sample of Taiwanese firms during 2005 and 2015. Using quantile regression, our findings support that compensation of CEOs is significantly correlated with innovation but the relationship is distinct between two compensation components. The results suggest that short-term incentive reduces the expenses in R&D. However, the relationship between long-term incentive and innovation is non-linear; long-term incentive fosters innovation for low and medium innovating firms but destroys innovation for high innovating firms.

Though there are numerous of the studies work on it, the results are controversial. Most principally, Dechow and Sloan (1991) and Holthausen, Larcker and Sloan (1995) find the evidence that for firms offer their CEOs a higher proportion of long-term incentive in total compensation, those firms are seem to be more innovative. Recently, most of the researches agree that long-term incentive such as stock options promote innovation since they provide CEOs long-term commitments (Barros and Lazzaarini, 2012; Bereskin and Hsu, 2014). In contrast to these findings, based on crowding out theory, Lotfi and Rost (2014) suggest that both short and long-term incentives have negative impacts on radical innovation activities within US firms. Therefore, firstly, our study contributes to the extant controversial literature by providing empirical evidence on an emerging country. Secondly, instead of focusing only on CEO's payments (Francis et al, 2011), we also concern both the compensations of CEOs and top managers. Though CEOs is the decision-maker, we concern top executives as Chief Financial Executives (CFOs), Chief Operating Officer (COOs) since they are also the influential people within firms and their reactions should lead to any consequences for innovation strategy. Thirdly, we use the quantile regression to present the explanations for the inconsistent findings provide by conventional OLS. Finally, our study provides the suggestions for investors and corporate governances to increase their values.

The paper is structured as follows. The next section is the review of previous literature. Section 3 presents the data as well as describes the methodology and variables. We report the results in section 4 and conclude in section 5.

2. LITERATURE REVIEW

The idea of CEO compensation might have influence on the funding of R&D is based on the theory of agency problem (Jensen and Murphy, 1990). CEOs are believed as the main decision makers in guiding firms to an optimal level of innovation to fulfill their ultimate task and maximize shareholder wealth (Francis, 2011). However, the nature of innovation is high-risky while CEOs are averse to risk. It indicates that managers should offer incentives as well as rewards to motivate CEOs pursuit innovation investments. An early research of Jensen and Meckling (1976) point out that the particular compensation contracts might lessen the conflicts of interest and encourage managers to pursuit the shareholder benefits. Specifically, Holmstrom (1989) suggests, not only compensation but also the design of compensation is essential to innovation.

Salary is the fixed payment to CEOs regarded to their individual performance so it is the least expected compensation and it does not motivate CEOs' efforts. Meanwhile, bonus is the payoff based on accounting measures to reward CEOs' short-term performance. Though it enhances the tie between CEOs and shareholder interest, it is just based on short-term results. Hence, CEOs is only focus on short-term performance rather than long-term value creation as innovation investments (Werner, 2015). The CEOs risk-aversion is more serious when the cutting bonus for poor performance is higher than the rising bonus for good performance (Murphy and Jensen, 2011). Therefore, salary and bonus, which is short-term payoff, is likely to discourage CEOs in pursuing risky and long-term results like innovation.

In contrast to short-term payoff, long-term payoff is advantageous in align the interests between CEOs and shareholders (Hall and Liebman, 1998). By offering CEOs stock options, CEOs wealth ties more solid with shareholders wealth, which encourages CEOs to stay with their firms then prevents them to taking short-run investments (Kole, 1997). The empirical early relevant to our study of Francis and Smith (1995) suggest that stock options might create incentives for innovation for diffusely-held firms. Similarly, Eng and Shackell (2001) find the weal evidence that when the divisional CEOs get high proportion of long-term compensation, their divisions obtain high ratio of patents awards to sales. Lerner and Wulf (2007) analyze the sample of 300 US firms and indicate that stock options as compensation for R&D executives is positively related to innovation quality, measured by patent citations. Francis et al. (2001) find that the relationship holds for the use of total portfolio of long-term incentives in the form of options as CEOs compensation. Recently, Chang et al. (2015) point out that if all employees receive more stock options, firms are more innovative.

Other study (Lotfi and Rost, 2014) examines the effect of long-term incentives on incremental and radical innovation. They show that short and long-term incentives discourage CEOs to allocate fund to radical innovation but only short-term payoff encourages executives to engage in incremental innovation activities like rising R&D expenditure.

3. DATA AND METHODOLOGY

3.1 DATA

Our data is constructed from Taiwan Economic Journal database (TEJ) from 2005 to 2015. TEJ provides the financial data of Taiwanese firms as well as manager's compensation data. Starting with 1,168 non-financial firms, after deleting an un-creditable data, we obtain 9,248 year-firm observations of an effective sample.

3.2. METHODOLOGY

Our quantile regression is specified as follow:

$$\log RD_{it} = \beta_0 + \beta_1 LONG\_PAY_{it} + \beta_2 SHORT\_PAY_{it} + \beta_3 \log TA_{it} + \beta_4 LEVERAGE_{it} +$$
$$\beta_5 TANGIBILITY_{it} + \beta_6 \log WC_{it} + \beta_7 \log SALES_{it} + \beta_8 CASH\_R_{it} + \varepsilon_{it}$$

The measurement of innovation is R&D expenditures as in prior literature. These studies suggest that R&D is required to pursue innovation. In a competitive market, allocating funds into R&D is a crucial instrument for enhancing innovation (Kor, 2006). Accordingly, we measure innovation by the natural logarithm of R&D expenditures (logRD).

Short-term incentive (SHORT_PAY) is captured by natural logarithm of cash compensation such as salary and bonus (Hayes et al, 2012), then divide it by the natural logarithm of total compensation. Long-term incentive (LONG_PAY) is measured as the natural logarithm of sum of the value restricted stock granted, value of current stock granted and long-term incentives (Black and Scholes, 1973), then divide it by the natural logarithm of total compensation.

We also control for the effect of firm characteristics on innovation. In the early study of Schumpeter (1942), he hypotheses that firm size has a strong impact on innovation capabilities of firms. Based on these hypotheses, Kamien and Schwartz (1975) find the consistent results on the size effect and innovation. Hence, to separate the effect of compensation components, we include the logarithm of total assets (logTA). In addition, firm with more tangible assets is more likely to be innovative (Atanasov et al., 2014) so we argue that tangible assets (TANGIBILITY), captured by the ratio of fixed assets to total assets, also have impact on R&D. The other control variable is firm performance, proxied by natural logarithm of sales (logSALES), since high-performance firms may perform high effort in innovation activities (Geroski et al., 1993). As demonstrated in the study of Fang et al. (2011) that low leveraged firms are likely more innovative, we hypothesize that leverage is correlated with R&D expenditures. We also include the indicators that reflect the available liquid resources as the natural logarithm of working capital (logWC), measured by the ratio of current assets and current liabilities. Lastly, I use the cash to total assets ratio (CASH_R) with regarding the different in funding R&D.

4. RESULTS

4.1 SAMPLE DESCRIPTION

The average and median summary statistics of the whole sample are reported in Table 1. The average log of R&D expenditure is 11.457, account for 0.6% of the total assets (RD_TA). This average is far below compared to developed countries such as 10.2-16% of US firms (Ho et al. 2006; Cui and Mak, 2002) and 2.0% of Japanese firms (Yu et al., 2008). The average of LONG_PAY and SHORT_PAY are 9.8% and 78.1% scaled by total compensation, respectively. It reveals that the main compensation of Taiwanese executives is salary and bonus while in US, most of executives compensation is from long-term payoff (Lotfi and Rost, 2014). The mean of log size is 15.08 indicating the huge capitalization. Tangible assets on average are 47.3% meaning that those firms are well-equipped. Those firms have the leverage of 40.7% averagely, lower than an extremely high of 59.6% of Japanese firms (Yu and Chen, 2008), implying that the sample firms are still in healthy financial leverage. Cash ratio, on average, is 6.8%, a little lower than US firms.

4.2 QUANTILE REGRESSION ESTIMATION

Quantile regression is introduced by Koenker and Bassett (1978). It is an extension of ordinary least squared, which implies the different coefficients in different quantiles. Quantile regression aims at estimating either the conditional median or other quantiles of the response variable. Compared to the ordinary least squares regression, quantile regression estimates are more robust to non-normal errors and outliers. Hence, the bias should be more smaller if using this median based estimator.

Let ε_i is the model prediction error of the conditional median function $Q_q = (y|x)$. Quantile parameter estimates the coefficients that minimize $?_i\,|\,e_i|$ as the following equation:

$$\sum_{e_i > 0} q\,|e_i| + \sum_{e_i \leq 0} (1-q)\,|e_i|$$

That means it minimizes a sum that gives asymmetric penalties $(1-q)|e_i|$ for over-prediction and $q|e_i|$ for under-prediction. As this methodology investigate the differences among vary quantiles, in this paper, we estimate the coefficients in 50%, 75% and 95% quantiles.

4.3 RESULTS OF QUANTILE REGRESSION

Our quantile estimates are based on 20 replications bootstrapping at a vary quantiles of 50%, 75% and 95%. Table 2 reveals the results of conventional OLS and quantile regression. Colum 1 and 2 estimate the effect of explanatory variables on RD with and without control variables, respectively. In both two columns, LONG_PAY has strong effect on the R&D expenditure while SHORT_PAY is insignificant related to R&D expenditure and the sign is also contrasted to the expectation. However, the results in quantile regression in column (3)-(5) report that LONG_PAY has quantile effect on the spending on R&D. We find that for firm with high quantiles (q=50 and q=75), LONG_PAY is increasing with R&D expenses (positive coefficients of 3.338 and 2.688 at q=50 and q=75). However, for extremely high quantile (q=95), LONG_PAY is decreasing with R&D expenses as well as destroys innovation (negative coefficient of -3.648). Similarly, LEVERAGE also shows the opposite sign across q=75 and q=95. At q=75, LEVERAGE positively impacts R&D expense at the coefficient of 4.277 while LEVERAGE negatively impacts R&D

expenses at the coefficient of -2.351. These results might be explained by optimal capital structure, when firms are in heavy debt, means their risks increase; then they are not likely to fund high-risk activities like R&D.

SHORT_PAY negatively reflected R&D expenditures in all quantiles. The coefficients of SHORT_PAY do show significant relationship with lnRD while it is insignificant using conventional OLS q=50, q=75 and q=95.

LogTA and logSALES both have negative and significant effects on the amount of R&D at three quantiles, indicating that large and high-performance firms tend to spend less in innovation activities. Tangible assets and liquidity play vital role in innovation as TANGIBILITY and CASH_R affect R&D expenditures positively. The log of working capital (lnWC) also foster R&D expenses.

5. CONCLUSIONS

Using quantile regression, we find the evidences that the innovation capacity of Taiwanese firms is related to their executives' compensation compositions. Using R&D expenditure to magnitude innovation, we find that short-term incentives of top executives, which include salary and bonus, is negatively correlated with innovation. I also find a positive impact of long-term incentives on innovation for the low quantile firms but the negative relationship for the high quantile ones. We conclude that salary and bonus are likely to lower innovation capacity since they do not provide the commitments for executives to pursuit high-risk and long-term results investments like innovation. Meanwhile, long-term incentive might handle this problem by tightening the wealth of both shareholders and executives, encourage executives put more efforts to maximize firm value. However, long-term incentive is just helpful in low and medium innovative firms but for high innovative firms, long-term incentives may harm innovation. Within a high innovative firm, innovation is cover by multiple activities such as technical invention, new market entering, organizational and resources improvements, top executives need to engage with other managers then their contributions are less observable and quantifiable. While top executives are motivated to pursue innovation when they are intrinsically motivated by their work (Gilson and Madjar, 2011), engaging with many people discourages them to invest in innovation.

TABLE 1: SUMMARIZE STATISTICS

Variable	Obs	Mean	Median	Std.Dev	Min	Max
logRD	9,248	11.457	1.62	9.181	1	25.36
RD_TA	9,248	0.008	0.006	0.002	0	0.075
LONG_PAY	9,412	0.098	0.021	0.162	0	0.866
SHORT_PAY	10,117	0.781	0.906	0.234	0.134	0.9
TOTAL COMP	11,215	8.631	6.36	5.390	1.098	28.972
logTA	12,389	15.08	14.893	1.793	5.976	20.382
INTANGIBILITY	12,389	0.473	0.495	0.227	0	0.986
LEVERAGE	12,370	0.407	0.406	0.192	0	0.59
logWC	12,389	9.755	9.463	1.737	8	12.091
logSALES	12,389	14.415	14.289	2.054	3.496	20.016
CASH_R	12,389	0.068	0.046	0.074	0	0.974

TABLE 2: RESULTS OF OLS AND QUANTILE REGRESSIONS

Coefficient	(1) OLS	(2) OLS	(3) q50	(4) q75	(5) p95
LONG_PAY	13.308**	13.728**	3.338***	2.688**	-3.648***
SHORT_PAY	2.525	3.591	-0.869***	-3.553**	-1.01***
logTA		-2.639***	-1.968***	-2.759***	-3.754**
INTANGIBILITY		9.154**	0.7113*	1.605*	2.602**
LEVERAGE		1.474	0.784	4.277***	-2.351
logWC		2.593	2.374*	2.337	2.75*
logSALES		-2.951***	-1.784***	-1.929***	-4.34***
CASH_R		-3.045	6.241***	8.17***	8.44**
Constant	2.722	2.936*	4.346**	3.299*	11.61**
Obs					
Pseudo R-squared	0.007	0.007	0.002	0.004	

Standard error is parentheses, *** p<0.01, ** p<0.05, * p<0.1

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