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Article

Are over-paid Chief Executive Officers better innovators?

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ABSTRACT

This paper focuses on the pay level of the highest paid executive directors, which we label as "Executive Director's Organizational Level" (henceforth EDOL), to raise the question if highest paid CEOs invest heavily in innovative projects. Two-stage least squares (2SLS) regressions show that over-paid CEOs are more likely to invest in R&D projects. They highlight, moreover, both from a "statutory" and an "activist" perspective, that CEOs' intends to invest in value-enhancing innovations are contingent upon compensation committee independence and investor protection level. Check tests reveal that the pay-performance "*innovation*" effect for option-based compensation is higher than that for stock-based compensation. Within the options (stocks) rewards, unvested options (restricted stocks) are the most effective. However, we find that over-paid CEOs of low-growth firms achieve less innovation compared to those of high-growth firms. Throughout, we reveal that the effect of CEOs performance-pay on innovation is mainly relevant among overconfident managers than non-overconfident ones.

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¿Los directores mejor remunerados son más innovadores?

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RESUMEN

El presente artículo se basa en el nivel salarial de los directores generales que más cobran, y hemos denominado "Nivel Organizativo de Director General" (en adelante, NODG) a fin de responder si los directores generales mejor remunerados invierten más en proyectos de innovación. Las regresiones de mínimos cuadrados en dos fases demuestran que los directores generales mejor remunerados son más proclives a invertir en proyectos de I y D. Dichas regresiones destacan, tanto desde una perspectiva "reglamentaria" como desde una "activista", que la intención de los directores generales de invertir en innovaciones con valor añadido están supeditadas a la independencia del comité de compensación y al nivel de protección del inversor. Las pruebas de control revelan que el efecto "*innovación*" en el sueldo-rendimiento para la remuneración con base en acciones es superior al de la remuneración con base en opciones. Dentro de los incentivos en acciones, aquellas sin derecho de posesión (acciones restringidas) son las más efectivas. No obstante, observamos que los directores generales mejor pagados en las empresas de bajo crecimiento consiguen menos innovación que aquellos de las empresas con un mayor crecimiento. En todo momento, hemos observado que el efecto sueldo-rendimiento de los directores generales sobre la innovación es mucho más marcado entre los jefes con gran confianza en sí mismos.

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1. Introduction

The underling goal of tying managers' compensation to the firm's performance is the division of management and shareholder functions caused by the separation of control and ownership. CEOs performance-based compensation is therefore considered as the most powerful tool to reward both managers and shareholders. There are several reasons for this consideration. First, within the publicly traded corporations executive pay is a large debated issue. Second, pay-to-performance policies have significant outcomes (i.e, shareholders and managers interests' alignment, talent CEOs' retention, risk-taking encouragement, cash scarcity, accounting and tax treatment). Third, equity-based incentive instruments aim the long term firm's value maximization rather than the short-term earnings amplification. Compensation paid is a widely investigated area of research by both academic scholars and practitioners. Nevertheless, some CEOs incentives' outcomes are still inconclusive such as their intended purpose of enhancing managerial risk preferences and therefore firm innovation. Except of few studies (Sheikh, 2012; Wu & Tu, 2007), little is known about the effects of incentive rewards on the CEO's risk-taking behavior. In this study, we aim to fill this gap. Our baseline hypothesis is the well-established argument by agency theorists that CEOs who receive stock option compensation are more likely to make riskier decisions since they participate in the upside potential of these decisions but not in their downside. This "paradigm" in considering the strategic expenses' implications of CEOs equity compensation is to investigate whether CEO is really motivated to incur R&D expenses. Our sensibility analyses go beyond this paradigm by examining if CEOs of high R&D intensive firms are really rewarded for the induced firm's profitability. We consider firm innovation characteristics (R&D expenditures, patents and citations to patents) to proxy for managerial strategic decision making.

Our paper contributes to previous research in the area in two aspects. First, in response to Wu & Tu (2007)'s call for additional research to investigate separately the impacts of share-based and stock option-based compensation on R&D expenses, we have demonstrated that stock options encourage investment in value-increasing innovations better than stock rewards.[1] Second, this study is the first to highlight, both from a "statutory" and an "activist" perspective (Bebchuck, Cohen & Ferrell, 2009), whether CEOs' intends to invest in value-enhancing innovations are contingent upon compensation committee independence and investor protection level.

The rest of the paper proceeds as follow. The next section provides the literature review and develops the hypotheses. Section 3 describes the data, variables and empirical methodology. Results, implications and robustness tests are reported in section 4. The last section concludes.

2. Related literature and hypothesis development

2.1. Prior literature

Corporate governance theorists applaud the issue of CEOs performance-based compensation because they suggest that management incentive rewards yield immediate alignment of managers' interests with those of shareholders', which helps mitigate potential managerial opportunism and enhance firm value creation (Jensen & Meckling, 1976). Under this assumption, accounting and stock measures of performance are widely used in compensation contracts to interest the manager (agent) to maximize the owner's (principal) utility.[2] Shares and stock-options compensation plans can serve as a screening device to avoid adverse selection and moral hazard problems and hence, enhance firm value (Banker, Byzalov & Xian, 2011). Firm innovation is an important channel through which managers may increase firm value. Firm's innovation strategy can be characterized by different proxies such as patent counts (innovation magnitude), patent citations (innovation quality), technology class concentration, R&D expenditures, etc.

The empirical literature on the relationship between innovation and managerial incentives is limited. There is moreover, no consensus among researchers that performance-based incentives motivate managerial risk-taking and help to attract innovator agents.

On the one hand, by considering the behavioral agency approach, which draws upon agency and prospect theories, Wu and Tu (2007) and Bahaji (2011) have taken a contingent view toward pay-to-performance incentive effects. They report that, when rewarded for performance, managers become more risk-averse as a large lump of their personal wealth (financial and human capital) is directly dependent upon firm performance. Their models predict that managers may overestimate the values of their equity holdings in-excess of their risk-neutral value.

On the other hand, Cheng (2004) and Fernando and Xu (2012) dissert that CEOs may manage downward all possible expenses to provide a short-term boost to return at the expense of the firm's long-term profitability. Hence, CEOs' myopic behavior may occur when executives focus disproportionately on current earnings. However, using information on all patents granted in the US from 1976 to 2005, Sanyal and Luban (2010) find that innovation magnitude, quality and R&D quality have an inverted U-shape relationship with pay-performance sensitivity. Lerner and Wulf (2007) conclude that the log-term incentive compensation of corporate R&D managers is positively associated with patent citations, patent originality and patent awards. Aghion, Van Reenen & Zingales (2009) also find a strong link between CEOs (R&D managers) incentives and innovation (technology class concentration).

Banker et al. (2011) proceed differently. They examine the mediating effect of R&D intensity on the weights on signals of ability and financial performance measures in executive rewards. Their conclusions share with Cassiman and Veugelers (2006) in showing that, in optimal incentive contracts, proxies for managerial ability (work experience and relevant education) as well as the proportions of equity-based pay should increase with R&D intensity. Masli, Sanchez & Smith (2009) find that information technology (IT) expenses are associated with higher ratios of equity compensation. Their results are consistent with the notion that by tying CEO compensation to future outcomes, board of directors understand the uncertainty and risk profile of IT spending and place, consequently, greater weight on equity compensation. Xue (2007) studies whether the choice of performance measures used in executive compensation contracts can affect managers' choice between the in-house R&D and the licensing or external acquisition innovation strategies of obtaining new technology.[3] Using data from U.S. high-tech industries, they find that accounting-based cash compensation encourages managers to pursue the ''buy'' strategy instead of the ''make'' strategy, while stock-based pay encourages managers to adopt the ''make'' strategy. Onishi (2012) reports that the introduction of a revenue-based compensation plan for employee inventions that is linked to the patent's contribution to the firm's sales, profit, or license royalties significantly lead to an increase in

1. Moreover, we have shown that unvested options are more effective than vested options and that restricted stocks have better effects on innovation than unrestricted stocks.

2. In the extent that stock price is efficient and reflects currently market's expectations of firm's future cash flows.

3. Which the authors label respectively us "make" and "by" strategies.

the number of highly cited patents while these compensation plans do not lead to an increase in the number of Japanese and U.S. patents. Based on arguments from labor market and social comparison researches, Fong (2010) examines whether CEO underpayment relative to the labor market affects R&D spending. He suggest that relative CEO underpayment is associated with reductions in R&D spending in low R&D intensive industries and increases in R&D spending in high R&D intensive industries. Erkens (2011) find a positive interactive effect of secrecy on executives' unvested equity holdings and R&D-intensity. Moreover, he concludes that the interactive effect is more pronounced for executives who are more likely to have the required skills and knowledge to exploit information about R&D investments. Using a sample of firms from the knowledge-intensive biotechnology industry, Levitas, Barker III & Ahsan (2011) have found a positive relationship between R&D spending and managerial incentive plans.

Consistent with these empirical researches, we state our first hypothesis as follows:

H1: *A firm's innovation intensity and quality is positively associated with the EDOL.*

2.2. Moderator effects of contextual features

Empirical literature on the relation between incentives and innovation generally omit the mediating effects of some contextual and specific features on such relation. Board oversight effectiveness and investors' rights protection level were, for example, considered by numerous studies as strong determinants of both firm's compensation and innovation strategies.

On the one hand, Liu (2008) reports evidence that remuneration committee of R&D intensive firms reduce the use of accounting relative performance evaluation rewards to prevent the management's myopic behavior patterns. Hermanson, Tompkins, Veliyath & Ye (2012) finds that the interaction between the percentage of outside directors on boards and the level of their stock-option compensation is positively related to firms' R&D intensity. Henry et al. (2011) dissert that maintaining an effective internal control system imposes greater costs on (and requires higher levels of effort from) the manager and the firm must therefore grant higher levels of executive compensation to properly incentivize effort-averse managers. They conclude that the explained (unexplained) component of compensation is positively (not) related to the probability of effective internal control. Morse, Nanda & Seru (2011) argue that, when a board is relatively weak, powerful CEOs get paid more. Firth, Fung & Rui (2007) support the prediction that CEOs facing less monitoring form firm owner may be encouraged to behave opportunistically towards R&D spending. Fernando and Xu (2012) show that of three corporate governance attributes (CEO/chair duality, board independence, compensation committee independence), only an independent compensation committee rewards the CEO for incurring R&D expenses. Gabais and Landier (2008) find moreover, that boards exhibiting best practice arrangement –those chaired and dominated by non-executives at the full board and compensation committee levels– are no more adept at enforcing CEO pay-for-performance than are executive dominated boards.

On the other hand, Jouber and Fakhfakh (2012) and Bryan, Nash and Patel (2010, 2011) have shown that equity mix is high and pay-performance sensitivity is low under stronger shareholder rights. Georgen and Renneboog (2011) argue that shareholder activism such us proxy proposals and the threat of disciplinary takeover may result in too less pay sensitivity and too much risk taking. Bryan, Hwang & Lilien (2000) conclude that equity-based compensation varied between 35% and 50% for companies with low anti-self-dealing index, while it was at or below 10% in countries with high anti-self-dealing index. Chakraborty and Sheikh's (2010) results indicate that managers who face a lower threat of takeover invest less in R&D, reduce capital expenditures, receive higher levels of compensation, and exhibit equity-based compensation that is less sensitive to firm performance. Hence, they reveal that the adoption of antitakeover amendments exacerbates agency problems by restricting shareholder rights and increasing managerial entrenchment. Lhuillery (2006) and Fahlenbrach (2009) dissert that firms with governance practices that are shaped to defend shareholders' rights are more R&D intensive. Agrawal and Knoeber (1998), while exploring the role of executive compensation in corporate governance, report that the effect of takeover threat on CEO compensation is unclear and can be broken into two opposing parts.[4]

Given the above arguments, we state our second hypothesis as follows:

H2: *A firm's innovation intensity and quality-EDOL link is strong under effective compensation committee control and high shareholders' rights protection level.*

3. Data, sample construction and empirical methodology

3.1. Data and sample selection

To test the effect (s) of the EDOL in firm's innovation features, we compile a sample of 205 American firms included in the S&P 500 from five high-tech industries. These five industries are defined on the basis of Standard Industrial Classification (SIC) codes and include biotech ($n = 43$), computer equipment ($n = 41$), electronics ($n = 41$), communications ($n = 40$) and aerospace ($n = 40$). We combine data from different archival data sources. Data on CEO pay were downloaded from the EQUILAR database. Shareholders' protection indexes are collected from the World Bank doing business reports. R&D spending, firms' economic and corporate governance data are gathered from firm's proxy statements (DEF14-A) obtained from RDGARSCAN website files. Patents and patent citations data came from the National Bureau of Economic Research (NBER) website. All data span the period 2000-2004. Nevertheless, Sheikh (2012) disserts that NBER's patent data suffer from truncation problem. We use the author's methodology to correct truncation in patent counts. He asserts (p. 37):

> [...]The method involves in calculating weight factors based on the application-grant distribution of patents in the sample and then multiplying number of patent counts by the respective weight factors. [...]The following formula is used to correct for the truncation in patent counts:
>
> $\text{Ptent}_t = Ptent_t / \sum^{2004-t}_{k=0} weight_k$; $2004 \leq t \geq 2000$

3.2. Empirical methodology

Researchers have recognized how CEO compensation affects firm's innovation and how investment in innovation influences pay-for-performance sensitivity (Coles, Daniel & Naveen, 2006; Sheikh, 2012). They dissert that both compensation and investment in innovation policies are determined simultaneously. To extent that compensation and innovation are endogenously determined, modeling compensation as an exogenous determinant of innovation is problematic. Hence, OLS approach may results in biased estimators. To mitigate endogeneity problems, our empirical methodology

4. Labeled as the "competition effect" and the "risk effect". The competition effect predicts lower compensation when the takeover threat is higher. The risk effect predicts higher compensation when the takeover threat is higher to compensate the manager for the risk of losing his or her firm-specific human capital.

Table 1
Variables description.

Variable	Label	Description
Dependent variables		
R&D intensity	R&D	Research and development expenditures
Patents	PAT	Number of patents applied for during the year
Patent citations	PATCIT	Total number of citations summed across all patents applied for during the year.
Executive Director's Organizational Level	EDOL	Total compensation of the highest paid executive director
Independent variables (firm and CEO characteristics)		
Firm size	LnTA	Log of total assets
Growth opportunity	Tobin's Q	(market value of equity + book value of assets – book value of common equity and deferred taxes) / book value of assets
Firm risk	RISQ	Annualized stock return volatility calculated over 60 months
CEO age	AGE	Age of the highest paid CEO in year
CEO tenure	TEN	Number of years the highest paid CEO has been in office
Overconfidence	OVE	Indicator variable equals 1 for all years after a CEO holds options that are at least 67% in the money, and 0 otherwise (Gervais, Heaton & Odean, 2011)
Independent variables (contextual features)		
Compensation committee independence	COMM	% of outside independent directors in the compensation committee
Shareholders' rights protection	SRP	Shareholders' rights protection level

EDOL, Executive Director's Organizational Level.

Table 2
Means, standard deviations and Pearson correlations.

Panel A: Statistics on innovation, compensation, firm, CEO and contextual characteristics

Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
R&D[b]	4.41	5.06	1.00											
PAT[b]	0.62	0.71	0.81*	1.00										
PATCIT[b]	0.67	0.87	0.7*	0.82*	1.00									
EDOL[b]	7.81	8.19	0.27	0.21*	0.32	1.00								
LnTA	13.07	13.59	0.41	0.3	0.27*	0.41	1.00							
Tobin's Q[a]	2.13	2.07	0.09	0.04	0.11	0.09*	*	1.00						
RISQ[b]	43.19	43.67	−0.69*	−0.39*	−0.24	0.17	−0.10	−0.06	1.00					
AGE[b]	1.73	1.77	0.18	0.1	0.10*	−0.22	0.05	0.01	0.03	1.00				
TEN[b]	0.89	1.01	0.11	0.12	0.08	−0.11	0.07	0.00	0.03	0.18	1.00			
OVE	3	4	0.1*	0.09*	0.09*	0.05	0.01	0.01	−0.11	−0.07	0.09	1.00		
COM[a]	0.47	0.51	0.37*	0.17	0.29	−0.18	0.12	0.1	0.07	−0.10	0.27	0.01	1.00	
SRP[b]	0.78	0.83	0.44*	0.38*	0.27*	−0.21	0.11	0.2*	0.07	−0.08	−0.24	0.01	*0.3	1.00

Panel B: Statistics on the composition of the highest paid CEO's total compensation

Variable	Mean	Median	SD	25th percentile	50th percentile	75th percentile
Salary[c]	1337.26	1378.39	1505.22	306.77	1285.24	1395.24
Bonus[c]	789.2	793.53	805.37	129.37	750.45	808.65
Options[c]	1916.15	1974.2	2003.45	492.51	1948.15	1955.25
Vested options[c]	665.9	673.41	689.53	85.55	673.92	715.35
Unvested options[c]	1250.25	1269.47	1307.02	247.27	1266.75	1295.58
Stocks[c]	11405	11447	11491	505	11475	11517
Restricted[c]	5300.45	5385.59	5404.33	1005.95	5322.45	5347.45
Unrestricted[c]	6104.55	6188.25	6205.29	2015.35	6130.50	6150.05

EDOL, Executive Director's Organizational Level; SD, standard deviation.
* $p<0.05$; [a] (%); [b] (in Log); [c] ($000s units).

closely follows Coles et al. (2006) and Sheikh (2012). We use 2SLS approach to estimate the effect (s) of the EDOL in firm's innovation attributes (R&D expenditures, patents and patents citations). The complete model that we estimate uses the following specification of the innovation and compensation models:

$$INNOVATION_{i,t+1} = \alpha_1 EDOL_{i,t} + \beta_1 CONTROL_{i,t} + \gamma_1 COMM_{i,t} + \delta_1 SRP_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$EDOL_{i,t} = \alpha_2 INNOVATION_{i,t+1} + \beta_2 CONTROL_{i,t} + \gamma_2 COMM_{i,t} + \delta_2 SRP_{i,t} + \zeta_{i,t} \quad (2)$$

Where:

- $INNOVATION_{i,t+1}$ represents innovation intensity (R&D expenditures) and innovation outputs (patents and patents citations) of firm i at time t+1[5];
- $EDOL_{i,t}$ is the total compensation of the highest paid CEO in firm i at time t ;
- $CONTROL_{i,t}$ is a set of control variables (firm and CEO characteristics) at time t;
- $COMM_{i,t}$ and $SRP_{i,t}$ are the corresponding contextual factors at time t;
- $\varepsilon_{i,t}$ and $\zeta_{i,t}$ are the residuals.

The detailed descriptions and measures of firm's innovation and CEO's compensation determinants are shown in Table 1.

4. Summary statistics, empirical results and robustness checks

4.1. Descriptive statistics

Panel A of Table 2 presents summary statistics of the variables included in this study. All measures of compensation and innovation are in log forms. We also use the natural logarithm of CEO

5. Following, Sheikh (2012), we assume that the effect of incentives in innovation is observed with one year lag. Thus, incentives at year t results in patents and citations in year t+1. Contemporaneous measures of incentives and innovations lead to similar results.

Table 3
Firm innovation and compensation incentives; the innovation model results.

	Model 1	Model 2	Model 3
	$R\&D_{t+1}$	$Patent_{t+1}$	$Citations_{t+1}$
Independent variables			
Intercept	1.044** (2.16)	1.115** (2.02)	0.098** (1.96)
EDOL	0.216** (2.09)	0.278*** 3.39)	0.277*** (3.13)
LnTA	0.064* (1.88)	0.137* (1.61)	0.131* (1.72)
Tobin's Q	0.13*** (3.77)	0.219*** (3.03)	0.254*** (3.99)
RISQ	−0.115 (−1.01)	−0.138 (−1.37)	−0.091 (−1.27)
AGE	−0.062 (−1.36)	−0.074 (−1.33)	−0.112 (−1.41)
TEN	0.182 (1.22)	0.115 (1.41)	0.153 (1.36)
OVE	0.221** (2.11)	0.188** (1.98)	0.213*** (3.33)
COM	0.171* (1.91)	0.214* (1.88)	0.223** (2.24)
SRP	0.22** (1.99)	0.271** (2.02)	0.216** (2.22)
Number of firm-year observations	1025	1025	1025
Adjusted R^2	0.571	0.596	0.632
Year control	Yes	Yes	Yes
F Fisher (*p-value*)	10.493*** (0.001)	10.075*** (0.001)	10.221*** (0.000)

Standard errors are shown in parentheses.
* p<0.10; ** p<0.05; *** p<0.01.

characteristics (age and tenure) as Coles et al. (2006) have done. Following Sapp (2008), we winsorise our compensation data by replacing the top and bottom 2.5% of observations with the values of the 2.5th and 97.5th percentiles to mitigate the potential impact of outliers.

As this table show, the mean number of patents (citations) is 0.62 (0.67) which is positive indicating that on average, the sampled firms are active in the innovation area. Mean R&D expenditure is 4.41. The average CEO receives a total compensation of $ 25.704,455. He has 54 years old and has been in office for 8 years on average. Managers postpone the exercise of options that are at least 67% in the money three years on average. This evidence is consistent with Malmendier and Tate (2005, 2008)'s prediction that CEO who voluntarily retains stock options after the vesting period in which exercise becomes permissible is viewed as overconfident.[6] The mean percentage number of grey directors who cite in the compensation committee is 47%. Overall, the distributions of incentive and innovation variables are comparable to Wu and Tu (2007).

Panel B of Table 2 summarizes statistics on the composition of CEOs total compensation. These statistics show that CEOs are paid largely with options. They are however awarded less with stocks. Among the "options" component, the unvested options are the larger. (in-the-money) vested options can be converted into stock at any time, are subject to vesting restrictions and their value depends directly on firm performance. (out-of-the money) unvested options protect their holders against price declines. Brisley (2006) and Sheikh (2012) argue that American firms paid more unrestricted options to their managers than stocks or vested options. When considering the "stocks" component, statistics highlight that restricted stocks have the large portion. Unrestricted stocks can be selling at any time. Nevertheless, restricted stocks can be selling only under certain performance restrictions. These restrictions may discourage managers' preferences to the unrestricted stocks. Our data share with Sapp (2008) in showing that unrestricted stocks are largely accepted by CEOs by comparison to restricted stocks.

6. We follow Hirshleifer, Low & Teoh (2012, p. 1463) in calculating the average moneyness of the CEO's option portfolio for each year. First, for each CEO-year, we calculate the average realizable value per option by dividing the total realizable value of the options by the number of options held by the CEO. The strike price is calculated as the fiscal year-end stock price minus the average realizable value. The average moneyness of the options is then calculated as the stock price divided by the estimated strike price minus one.

4.2. Results

4.2.1. The innovation model regression results

Table 3 reports the regression results of the ordinary least square analysis of the innovation model (Eq. 1). Model 1 includes R&D expenditures as the dependent variable. The endogenous variables in Model 2 and Model 3 are respectively the number of patents and the number of all patents' citations filed by the firm in a year. The independent variables in all models are firm's and CEOs' characteristics. As we can see from model 1, firms in which EDOL is high increase innovative investment, as measured by R&D expenditure. This model shows, moreover, that high growth firms spend more on R&D. A possible interpretation for this result is that firms with high growth opportunities accumulate cash in order to invest more in the future. Wu and Tu (2007) dissert that top managers have incentives to increase R&D investments when expected firm performance is good. That is, when growth opportunities are generous, managers more attention to future development plans such as R&D. The coefficient on *Overconfident CEO* is significantly positive. Thus, having an overconfident CEO increases the amount of R&D by about 22%. The effects of the contextual features are significant at the 1%-5% levels. They are consistent with the powerful compensation committee and strong shareholders' rights protection being more stringent determinants of firm's innovation.

Models (2) and (3) use the innovative outputs, patents and patent citations, as dependent variables. The qualitative and quantitative conclusions are similar to those using the R&D measure. The use of the manner proxies causes a modest increase in the coefficient of *EDOL* to nearly 0.28, and the effects become more significant (p<0.01). Taken together, the evidences from Models (2) and (3) indicate that, generous growth opportunity, overconfidence, investors' rights protection and compensation committee independence are associated with a substantially greater number of patents and patent citations grants. Hence, we confirm the Bebchuck et al.,'s (2009) "statutory" and "activist" perspectives which support that CEOs' intends to invest in value-enhancing innovations are contingent upon compensation committee independence and investor protection level. These results are, moreover, in line with previous research (Kore, 2006; Fernando & Xu, 2012; Hirshleifer et al., 2012).

4.2.2. The compensation model regression results

Table 4 displays results from 2SLS of the effect of EDOL on firm innovation. The variable of interest is the Executive Director's Organizational Level. The exogenous variables are measures of

Table 4
CEO incentives and firm innovation.

Dependent variable: $EDOL_t$	Model 1	Model 2	Model 3
Independent variables			
Intercept	0.893** (2.11)	0.771** (2.08)	0.911** (2.00)
Log($R\&D_{t+1}$)	0.226*** (3.63)		
Log($Patent_{t+1}$)		0.179** (2.13)	
Log($Citations_{t+1}$)			0.173** (2.21)
LnTA	0.134*** (3.05)	0.107** (2.11)	0.098** (1.96)
Tobin's Q	0.144*** (3.31)	0.14*** (3.33)	0.137*** (3.17)
RISQ	0.072** (2.25)	0.057* (1.78)	0.061** (1.98)
AGE	0.058* (1.76)	0.05* (1.66)	0.044 (1.42)
TEN	0.131* (1.85)	0.124* (1.69)	0.127* (1.67)
OVE	0.191** (2.21)	0.179** (2.18)	0.171** (2.22)
COM	–0.101*** (–3.37)	–0.096** (–2.06)	–0.1* (–1.77)
SRP	–0.133*** (–3.01)	–0.117** (–2.21)	–0.109** (–2.1)
Number of firm-year observations	1025	1025	1025
Adjusted R^2	0.537	0.491	0.493
Year control	Yes	Yes	Yes
F Fisher (*p-value*)	10.142*** (0.004)	11.039*** (0.001)	10.093*** (0.006)

EDOL, Executive Director's Organizational Level;
Standard errors are shown in parentheses.
* p<0.10; ** p<0.05; *** p<0.01.

firm's investment in innovation (R&D) and innovation's quantity and quality (patents and citations respectively). The economic and contextual determinants of CEO compensation closely follow those of Lhuillery (2011), Fernando and Xu (2012) and Jouber and Fakhfakh (2012). The coefficients on firm's innovation attributes are positive and significant in all specifications meanings that over-paid CEOs invest more in R&D which enhance innovation quantity and quality as measured by the patents' and citations' numbers. We interpret the economic significance of these coefficients as the compensation-innovation elasticity as both EDOL and Innovation proxies are in log forms. Thus, as Panel A of model 1 shows, a one standard deviation of EDOL is about 819 percent of mean total incentives which implies that a one standard-deviation increase in CEO total compensation corresponds to 23 percent in R&D expenses. Firm characteristics' and manager-related controls' effects on EDOL are of the expected sign. CEOs of big, risky and high-growth firms are significantly over-paid. These results parallel the ones obtained by Conyon & Sadler (2010), who find that size and growth opportunity explain by about 37.7 and 28.1 percent of CEOs incentives gap between large and small firms.

Estimates on CEO characteristics explore a significant monotone association between the tenure in the CEO position and the EDOL. The coefficient is economically important (0.131 –Model 1–) implying that an increase in the CEO's tenure by one year will increase executives' rewards by roughly 14 percent. This finding stands in line with the previous evidence of Nourayi and Mintz (2008) and Walker (2010) suggesting that high-growth firms pay their CEOs a greater proportion of performance-based pay. Overconfident managers are, moreover, presumably over-rewarded. Contextual features have, however, significant negative effects on CEO's pay level. These negative effects are hold for all specifications and are relatively larger in Model 1. This is may be consistent with Fahlenbrach's (2009) thesis that the interactions of the corporate governance mechanisms with total excess compensation can be explained by governance substitution. That is, firms in which stronger corporate governance tools are holds (e,g; which tend to give less power to management) do not seem to considerably enhance CEOs' total pay to mitigate agency problems.

Combined with findings from the innovation model, 2SLS regressions display a noteworthy result; under effective compensation committee independence and strong shareholder's rights protection, CEOs are under-paid and better innovators. This result provides striking evidence; powerful compensation committee' oversight and strong shareholders' rights protection help to overcome management ability to extract compensation-rents (CEO dominance) and to encourage management initiative (CEO activism) to seek for firm's value-added projects. Therefore, we reveal, as Fernando and Xu (2012), that independent compensation committee significantly adjust CEO rewards up-ward effectively for incurring R&D expenses. Consequently, we share with Duru, Iyengar & Thevaranjan (2002), hypothesis that independent compensation committee shield *judiciously* CEOs from strategic expenses when determining compensation. Hence, the higher the compensation committee independence is, the more likely that the CEO undertakes risky projects. This result is indeed consistent with the institutional theory which offer insights reflecting more substance than symbolism (agency theory) when dealing with firms' compensation process or outcomes (Hermanson et al., 2012).

Taken to gather, the specifications of the innovation and compensation models support our hypotheses and corroborate both the "statutory" and the "activist" perspectives suggested by Bebchuck et al. (2009).

4.2.3. Robustness checks

We perform a number of robustness checks to test the sensitivity of our empirical findings. First, we test to see if our results change when we split CEO's total compensation into its stock options and stocks components. Second, we decompose incentives from stocks into restricted and unrestricted stocks to test if restricting may drive special effect in management incentives to undertake risky but value-increasing projects. Third, we check to ensure if incentives from unvested options have differential effects on innovation than incentives from vested options.

Table 5 displays the results of this list of checks. When we divide the long-term compensation into stock options and stocks, our results change. Stock options and stocks affect differently firm innovation proxies. In all specifications, we reveal that incentives from options significantly motivate innovation but stock-based incentives discourage innovation. This is in line with previous studies. Stock rewards increase CEOs exposure to firm risk as stocks have linear payoffs. Options-based incentives help, however, overcoming the downside price declines as options have convex payoffs. This convexity means that their value have no upper limits in success and cannot be negative in failure. Consequently, options encourage managerial tolerances to accept risk more than stocks. These findings are hold for all regression specifications.

The fourth and fifth rows of Table 5 display results from restricted versus unrestricted stocks models. It seems that restricted stock

Table 5
Robustness check results.

Dependent variables	Stock rewards	Options rewards	Restricted stocks	Un-restricted stocks	Vested options	Unvested options
Panel 1: Primary dependent variable (Log(R&D$_{t+1}$))						
Intercept	0.303**	0.219***	0.202**	0.311*	0.218*	0.291**
	0.042	0.001	0.021	0.063	0.057	0.03
Log(R&D$_{t+1}$)	−0.177**	0.219**	0.103**	-0.071*	0.087**	0.138***
	0.041	0.039	0.037	0.057	0.046	0.003
LnTA	0.091***	0.101***	0.083*	0.044	0.11*	0.092**
	0.001	0.003	0.071	0.138	0.053	0.047
Tobin's Q	0.131*	0.177**	0.088*	0.047*	0.057*	0.119**
	0.055	0.039	0.062	0.07	0.058	0.049
RISQ	−0.054	0.111**	−0.039*	−0.04	0.092**	0.101**
	0.102	0.041	0.057	0.121	0.039	0.027
AGE	0.013	0.013*	0.019*	0.021	0.020	0.018*
	0.211	0.077	0.061	0.131	0.109	0.071
TEN	0.011*	0.010**	0.092*	0.082	0.011**	0.099**
	0.079	0.036	0.064	0.212	0.034	0.037
OVE	0.033*	0.067**	0.027*	0.025*	0.031**	0.048**
	0.051	0.033	0.075	0.054	0.044	0.036
COM	−0.021**	−0.021**	−0.013**	−0.010**	−0.009**	−0.009**
	0.035	0.042	0.044	0.03	0.041	0.047
SRP	−0.011**	−0.019***	−0.009**	−0.007**	−0.01**	−0.015**
	0.039	0.04	0.033	0.041	0.039	0.037
Year control	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.531	0.617	0.505	0.491	0.511	0.609
F Fisher	13.056***	11.503***	11.018***	10.692***	11.602***	12.628***
	0.001	0.001	0.001	0.001	0.001	0.001
Panel 2: Primary dependent variable (Log(Patent$_{t+1}$))						
Intercept	0.282**	0.189***	0.207**	0.309*	0.221*	0.301**
	0.037	0.001	0.031	0.059	0.061	0.031
Log(Patent$_{t+1}$)	−0.158*	0.171**	0.092**	−0.068*	0.071*	0.103**
	0.055	0.041	0.037	0.055	0.054	0.029
LnTA	0.083***	0.112***	0.068*	0.047	0.09*	0.092**
	0.001	0.003	0.060	0.104	0.059	0.031
Tobin's Q	0.123*	0.163**	0.088*	0.037*	0.049*	0.113**
	0.051	0.029	0.057	0.073	0.057	0.04
RISQ	−0.054	0.107**	−0.041*	−0.038	0.087**	0.10**
	0.115	0.038	0.061	0.109	0.028	0.029
AGE	0.01	0.011*	0.019*	0.025	0.024	0.013*
	0.151	0.056	0.055	0.117	0.122	0.059
TEN	0.01*	0.014**	0.101*	0.087	0.011**	0.11**
	0.07	0.041	0.06	0.209	0.041	0.029
OVE	0.029*	0.055**	0.022*	0.023*	0.037**	0.04**
	0.055	0.033	0.071	0.063	0.037	0.025
COM	−0.016**	−0.016**	−0.011**	−0.009**	−0.008**	−0.008**
	0.032	0.033	0.04	0.03	0.032	0.026
SRP	−0.010**	−0.022***	−0.011**	−0.007**	−0.009**	−0.019**
	0.023	0.04	0.038	0.036	0.04	0.033
Year control	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.5	0.604	0.488	0.503	0.521	0.596
F Fisher	13.006***	11.388***	11.101***	10.393***	11.451***	12.529***
	0.001	0.001	0.001	0.001	0.001	0.001
Panel 3: Primary dependent variable (Log(Citations$_{t+1}$))						
Intercept	0.093*	0.135**	0.181**	0.201**	0.174*	0.193**
	0.063	0.037	0.023	0.041	0.073	0.052
Log(Citations$_{t+1}$)	−0.131*	0.177**	0.088*	−0.047**	0.057*	0.119**
	0.055	0.033	0.061	0.037	0.052	0.023
LnTA	0.057***	0.096***	0.057*	0.039	0.101*	0.099**
	0.001	0.001	0.062	0.112	0.055	0.029
Tobin's Q	0.119*	0.143**	0.067*	0.03*	0.038*	0.109**
	0.056	0.027	0.06	0.056	0.055	0.032
RISQ	−0.047	0.112**	−0.037*	−0.025	0.077**	0.109**
	0.107	0.029	0.059	0.096	0.022	0.036
AGE	0.009	0.010*	0.024*	0.022	0.019	0.009*
	0.133	0.094	0.061	0.132	0.102	0.061
TEN	0.008*	0.022**	0.113*	0.066	0.021**	0.107**
	0.081	0.04	0.063	0.197	0.033	0.029
OVE	0.021*	0.049**	0.017*	0.018*	0.029**	0.046**
	0.051	0.038	0.077	0.065	0.04	0.022
COM	−0.016**	−0.011**	−0.006**	−0.006**	−0.01**	−0.011**
	0.042	0.037	0.038	0.027	0.025	0.030
SRP	−0.009**	−0.027***	−0.007**	−0.009**	−0.011**	−0.023**
	0.033	0.037	0.033	0.025	0.029	0.041
Year control	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.521	0.574	0.455	0.491	0.509	0.572
F Fisher	13.44***	11.263***	11.086***	10.184***	11.225***	12.306***
	0.001	0.001	0.001	0.001	0.001	0.001

P-values figure in the second level.
* $p<0.10$; ** $p<0.05$; *** $p<0.01$.

Table 6
Further robustness check results.

Dependent variable: (Pay-performance sensitivity)$_t$	Model 1	Model 2	Model 3
Independent variables			
Intercept	0.291** (2.034)	0.272** (1.966)	0.281** (2.114)
Log(R&D$_{t+1}$)	0.251*** (3.263)		
Log(Patent $_{t+1}$)		0.183*** (3.001)	
Log(Citations $_{t+1}$)			0.181** (2.22)
LnTA	0.204*** (3.22)	0.095** (2.31)	0.085** (1.96)
Tobin's Q	0.098*** (3.09)	0.107*** (3.23)	0.135*** (3.25)
RISQ	0.057** (2.03)	0.049* (1.66)	0.057** (2.05)
AGE	0.047* (1.79)	0.03* (1.68)	0.04 (1.18)
TEN	0.122* (1.69)	0.119* (1.75)	0.119* (1.57)
OVE	0.2** (2.18)	0.160** (2.22)	0.167** (2.07)
COM	–0.113*** (–3.01)	–0.081** (–2.31)	–0.14* (–1.68)
SRP	–0.129*** (–3.01)	–0.109** (–2.04)	–0.1** (–2.04)
Number of firm-year observations	1025	1025	1025
Adjusted R^2	0.551	0.507	0.497
Year control	Yes	Yes	Yes
F Fisher (*p-value*)	11.005*** (0.001)	11.049*** (0.009)	10.133*** (0.001)

Standard errors are shown in parentheses.
* p<0.10; ** p<0.05; *** p<0.01.

portfolios are more effective in encouraging innovation than the unrestricted ones. The latter worsens, however, CEO risk-aversion. These results are compared to Datta et al. (2004), and Sheikh (2012). Both of these studies find that restricted stocks are more efficient in providing incentive to managers to innovate than unrestricted stock. Check results regarding whether vested versus unvested options affect differently the innovation process show that incentives from unvested options are more effective in encouraging innovation than incentives from vested options. Innovation successes (patents and citations) are, moreover, more notably when options are out-of-the money than when they are in-the-money.

The significance of firm, manager, and contextual controls continue to hold when we run the robustness tests described above.

Next, we consider an alternative proxy for CEO compensation. We replace the EDOL with the pay-performance sensitivity (i.e, the dollar change in CEO compensation wealth for a 1 percent point change in stock price) to investigate whether the incentive-innovation link differs depending on compensation measure. We rerun Eq. 2 using pay-performance sensitivity (stock and options holdings sensitivity to firm performance[7]) as the dependent variable. Further evidences about the effect of CEO compensation on firm innovation are provided by the tests that use the pay-sensitivity measure. The results are given in Table 6. They show that the pay-performance sensitivity metric capture more perfectly R&D expenditures and success. Compared to findings from Table 4, coefficients on innovation attributes are larger. A one dollar change in CEO compensation wealth, due to a 1 percent point change in stock price, increases spending on innovation as measured by R&D expenses by about 26 percent. Pay-sensitivity improves, moreover, estimators by about 5 to 7 percent. The statistical significance of models increases indeed. The results on controls are generally similar to those summered in Table 4 and to those in other studies of the determinants of firm innovation. A noteworthy finding is that increased pay-to-performance sensitivity is associated with higher CEO overconfidence. Powerful compensation committee and higher shareholders' rights protection indexes prevent CEOs from worse pay sensitivities.

In additional tests, we get similar results when the R&D ratio is computed as R&D expenditure scaled by total assets. We also get qualitatively similar results when we replace tenure as the CEO with tenure in the firm.[8]

5. Conclusion

This study examines the relationship between managerial risk-taking as measured by firm innovation intensity and outcomes and the EDOL. Agency theory (Jensen & Meckling, 1976) suggests that CEO incentive rewards helps in overcoming agency problems between owners and managers by encouraging the latter to invest in innovation. Cumulative prospect theory (Tversky & Kahnemen, 1992) dissert that performance-based incentives help in resolving the long-horizon and managerial risk-aversion associated with investment in innovation. Using data on over-paid CEOs' compensation and observable characteristics of the innovation process, we provide evidence that the compensation of senior managers influences R&D investments and their outputs (the number of patent and citations to patents). Bebchuck et al. (2009) recognize that controlling for contextual features is a stringent test when dealing with CEO compensation incentives' effects on firm propensity to innovate. Supporting their "statutory" and "activist" perspectives, we find that CEOs' intends to invest in value-enhancing innovations are contingent upon compensation committee independence and investor protection level. In response to Wu and Tu (2007)'s call for paper to investigate separately the impacts of share-based and stock option-based compensation on R&D process, we succeed to reveal that stock options encourage investment in value-increasing innovations better than stock rewards. Decomposed values of options portfolios (vested versus invested) and stock portfolios (restricted versus unrestricted) generate, moreover, additional findings; restricted stocks (unvested options) are more efficient in providing incentive to managers to innovate than unrestricted stock (vested options). Last but not at least, we find that overconfident CEOs are better innovators than less-confident ones. Although, we have supported our hypothesis, our results should be interpreted with precaution. In fact, patents (patent citations) data do not highlight any information neither about the model innovation features nor about its economic value (innovation success). Another limitation concerns our focusing on U.S. context where shareholders are highly diversified and ownership is fully dispersed. Hence, our conclusions may go missing

7. We follow Bergstresser and Philipon (2006) who construct this measure; Stock and options holdings' sensitivity = 0.01* S_{it}* ($Stocks_{it}$ + $Options_{it}$), where; S is the company share price, Stocks is the number of shares held by the CEO, and Options is the number of options held by the CEO.

8. For the sake of brevity, the results of these checks are not reported here. Nevertheless, they are available from us under request.

when considering cases (i.e, European or Asian) where investors face systematic constraints on their financing and therefore their risk-taking preferences.

Beyond CEO compensation, other determinants of firm innovation should be explored. Future research is encouraged to delve into the implications of manager's specific-knowledge, skill and expertise in determining long-term innovation strategies.

References

Aghion, P., Van Reenen, J. & Zingales, L. (2009) *Innovation and institutional ownership.* NBER Working paper, abstract=14769.

Agrawal, A. & Knoeber, C., R. (1998). Managerial compensation and the threat of takeover. *Journal of Financial Economics*, *47,* 219-239.

Bahaji, H. (2011). Incentives from stock option grants: a behavioral approach. *Review of Accounting and Finance*, *10,* 200-227.

Banker, D., R., Byzalov, D. & Xian, C. (2011). *Executive compensation and research & development intensity.* SSRN Working paper. Available from: http://ssrn.com/abstract=1910134 [accessed 23 Apr 2013].

Bebchuk, L. A., Cohen & Ferrell., 2009, What matters in corporate governance, *Review of Financial Studies*, 22, 783-827.

Bergstresser, D., Philippon, T. (2006). CEO incentives and earnings management. *Journal of Financial Economics*, *80,* 511-529.

Brisley, N. (2006). Executive stock options: early exercise provisions and risk-taking incentives. *The Journal of Finance*, *61,* 2487-2509.

Bryan, S. L., Hwang, L. & Lilien, L. (2000). CEO stock-based compensation; an empirical analysis of incentive-intensity, relative mix, and economic determinants. *Journal of Business*, *73,* 661-693.

Bryan, S., Nash, R. & Patel, A. (2010). How the legal system affects the equity mix in executive compensation. *Financial Management*, *spring,* 393-418.

Bryan, S., Nash, R. & Patel, A. (2011). Law and executive compensation: a cross-country analysis. *Applied Corporate Finance*, *23,* 84-91.

Cassiman, B. & Veugelers, R. (2006). In search of complementarity in innovation strategy: internal R&D and external knowledge acquisition. *Management Science*, *52,* 68-82.

Chakraborty, A. & Sheikh, S. (2010). Antitakeover amendments and managerial entrenchment: new evidence from investment policy and CEO compensation. *Quarterly Journal of Finance and Accounting*, *49,* 81-103.

Cheng, S. (2004). R&D expenditures and CEO compensation. *The Accounting Review*, *79,* 305-328.

Coles, J. L., Daniel, N.D. & Naveen, L. (2006). Managerial incentives and risk taking. *Journal of Financial Economics*, *79,* 431-468.

Conyon, M. & Sadler, G. (2010). Shareholder voting and directors' remuneration report legislation: say on pay in the UK. *Corporate Governance: An International Review*, *18,* 296-312 .

Datta, S., Iskandar-Datta, M. & Raman, K. (2004). In defense of incentive compensation: its effects on corporate acquisition policy. *Journal of Applied Corporate Finance, 16*, 82-88.

Duru, A., Iyengar, R. & Thevaranjan, A. (2002). The shielding of CEO compensation from the effects of strategic expenditures. *Contemporary Accounting Research*, *19,* 175-193.

Erkens, H., D. (2011). *Do firms use time-vested stock-based pay to keep research and development investment secret?* SSRN Working paper. Available from: http://ssrn.com/abstract=1193868 [accessed 16 Mar 2013].

Fahlenbrach, R. (2009). Shareholder rights, boards, and CEO compensation. *Review of Finance*, *13,* 81-113.

Fernando, G., D. & Xu, Q. (2012). CEO compensation and strategic expenses: penalizing, shielding or rewarding? *Review of Accounting and Finance*, *11,* 279-297.

Firth, M., Fung, P. & Rui, O. M. (2007). How ownership and corporate governance influence chief executive pay in China's listed firms. *Journal of Business Research*, *60,* 776-785.

Fong, A., E. (2010). Relative CEO underpayment and CEO behavior towards R&D spending. *Journal of Management Studies*, *47,* 1095-1122.

Gabais, X. & Landier, A. (2008). Why has CEO pay increased so much? *Quarterly Journal of Economics*, *123,* 49-100.

Georgen, M. & Renneboog, L. (2011). Managerial compensation. *Journal of Corporate Finance*, *17,* 1068-1077.

Gervais, S., Heaton, J. & Odean, T. (2011). Overconfidence, compensation contracts, and capital budgeting. *The Journal of Finance*, *66,* 1735-1777.

Henry, F., T., Shon, J. J. & Weiss, E., R. (2011). Does executive compensation incentivize managers to create effective internal control system? *Research in Accounting Regulation*, *23,* 46-59.

Hermanson, R., D., Tompkins, G., J., Veliyath, R. & Ye, S., Z. (2012). The compensation committee process. *Contemporary Accounting Research*, *29,* 666-709.

Hirshleifer, D., Low, A. & Teoh, H., S. (2012). Are overconfident CEOs better innovators? *The Journal of Finance, 66,* 1457-1498.

Jensen, M. C. & Meckling, W. (1976). Theory of the firm: Managerial behavior, agency costs, and ownership structure. *Journal of Financial Economics*, *3,* 305-360.

Jouber, H. & Fakhfakh, H. (2012). Pay for luck: new evidences from the institutional determinants of CEOs' compensation. *International Journal of Law and Management*, *54,* 485-507.

Kore, Y. (2006). Direct and indirect effects of top management team and board compositions on R&D investment strategy. *Strategic Management Journal*, *27,* 1081-1099.

Lerner, J. & Wulf, J. (2007). Innovation and incentives: Evidence from Corporate R&D. *Review of Economics and Statistics*, *89,* 634-644.

Levitas, E., Barker III, L. V. & Ahsan, M. (2011). Top manager ownership levels and incentive alignment in inventively active firms. *Journal of Strategy and Management*, *4,* 116-135.

Lhuillery, S. (2006). *The impact of corporate governance practices on R&D intensities of firms: An econometric study on French largest companies.* CEMI Working Papers cemi-report-006.

Lhuillery, S. (2011). The impact of corporate governance practices on R&D effort: a look at shareholders' rights, cross-listing, and control pyramid. *Industrial and Corporate Change*, *20,* 1475-1513.

Liu, S., L. (2008). The impact of research and development on relative performance evaluation in the UK. *International Journal of Managerial Finance*, *4,* 278-294.

Malmendier, U. & Tate, G. (2005). Does overconfidence affect corporate investment? CEO overconfidence measures revisited. *European Financial Management*, *11,* 649-659.

Malmendier, U. & Tate, G. (2008). Who makes acquisitions? CEO overconfidence and the market's reaction. *Journal of Financial Economics*, *89,* 20-43.

Masli, A., Sanchez, M., J. & Smith., E., R. (2009). *The interrelationships between information technology expenditures, CEO compensation and firm value.* SSRN Working paper.

Morse, A., Nanda, V. & Seru, A. (2011). Are incentive contracts rigged by powerful CEOs? *The Journal of Finance*, *66,* 1779-1821.

Nourayi, M., M. & Mintz, M., S. (2008). Tenure, firm's performance, and CEO compensation. *Managerial Finance*, *34,* 524-536.

Onishi, K. (2012). The effects of compensation plans for employee inventions on R&D productivity: new evidence from Japanese panel data. *Research Policy*, *42,* 367-378.

Sanyal, P. & Luban, L. (2010). *Innovation, R&D and managerial compensation.* SSRN Working paper. Available from: http://ssrn.com/abstract=1587055 [accessed 14 Apr 2013].

Sapp, G., S. (2008). The impact of corporate governance on executive compensation. *European Financial Management*, *14,* 710-746.

Sheikh, S. (2012). Do CEO compensation incentives affect firm innovation? *Review of Accounting and Finance*, *11,* pp. 4-39.

Tversky, A. & Kahneman, D. (1992). Advances in prospect theory: cumulative representation of uncertainty. *Journal of Risk and Uncertainty*, *5*(4), 297-323.

Walker, J. (2010). The use of performance-based remuneration: high versus low-growth firms. *Australian Accounting Review*, *20,* 256-264.

Wu, J. & Tu, R. (2007). CEO option pay and R&D spending: a behavioral agency explanation. *Journal of Business Research*, *60,* 482-492.

Xue, T. (2007). Make or buy technology: the role of CEO compensation contract in a firm's route to innovation. *Review of Accounting Studies*, *12,* 659-690.