

**Risk, Performance and Executive Compensation:
A Simultaneous approach on China Listed Firms
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ABSTRACT

Corporatization and listing of State Owned Enterprises (SOEs) and the adoption of profit objectives is meant to accelerate growth and encourage innovation and investment. This study assess the relation between executive incentives, risk-taking and firm performance. I applied three-simultaneous-equation using 3 Stage least Square (3SLS) method in which vega, delta and firm risk/performance are all treated as endogenous variables and are jointly determined. I find positive relationship between CEO compensation and performance. Moreover, empirical results show that vega is an incentive compensation measure that encourage managers risk-taking behavior, while delta is part of compensation that could align the interests between firm and shareholders. This study is an innovative study to foster a better understanding of compensation structure in China and has important implications for China's current privatization reforms.

INTRODUCTION

China has experienced rapid economic growth since privatization reform introduced 25 years ago. The central of the reform is adoption of free market to set price and production of goods, labor and services in competitive markets. The key component of the reform is the State Owned Enterprises (SOEs) that were listed on Shanghai and Shenzhen stock exchanges. Managers in SOEs have more power and control on various business activities and decision-making while control power of the state has been reduced significantly. During this process, a key issue to ensure the success of firms is a proper design of incentives that align the interest between managers and shareholders to increase the value of the business. Compensation scheme is an effective way to mitigate agency problem, which align the interest between executives and shareholders. To date, however, there has been incredible little research have been done on how the top managers are rewarded in China listed firms. This study help to fill this void by a rigor examination on CEO pay in China listed firms.

The purpose of this study is to examine CEO compensation structure in China listed firms. Especially, the relation between executive compensation and firm performance. I estimate the pay-performance sensitivities along the lines pioneered by Jensen and Murphy (1990). Executive compensation has attracted much attention in the past decade yet most of these research work on CEO compensation has been focused on a few developed countries (Yang, 2011). It is now critical importance to examine how firms in developing countries pay their top management. In particular, for the developing countries that are currently in transition their SOEs into free market, the efficiency of compensation structure design for managerial incentives becomes a crucial ingredient for successful economic reform. Therefore, a closer investigation on the structure and relation of

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executive pay-performance in transitional economies will provide much needed information to gauge the efficiency of current economic reform.

BACKGROUND AND LITERATURE

This section describes the mechanism of determining executive compensation in China listed firms, especially the SOEs. Before 1970s when economic reform just started, top management compensation was mainly determined based on non-economic factors that not closely related to firm performance. Such factor include the region, industry, management, size of the enterprise, job title, occupation, and seniority of the individual (Liu and Otsuka, 2004). In late 1970, to executives were allowed to pay a portion of the residual earnings as incentive compensation based on firm performance.

There are two waves of SOE compensation reforms. One was in 1985 and the other was in 1992, which allowed the SOE's compensation to be linked to firm performance. This is the first step to provide more profit-oriented incentives to the management in SEOs. This executive compensation structure reform took substantial impact in China SOEs. In the same year CCP accepted a modern corporation system that adopting corporations in the west as the goal for SOE reform. By 1994, many cities such as Beijing, Shenzhen, Sichuan, Henan, and Liaoning had also started their own reform. Since then, the yearly salary system became officially advocated in SOEs (Liu and Otsuka, 2004). The top executive compensation has two parts: the first part is base salary based on average wage and size of the firm; the second component is variable salary that linked to firm performance. The second component of variable salary are usually paid at the end of the year in form of bonus pay. This component is a key incentive mechanism to motivate top management as a vital part of the enterprise reform.

Previous studies on pay-performance in China listed firms focused on SOEs before the stock market era and found positive and significant linkage of accounting performance measures to executive compensation (Roves et al., 1995, and Mengistae and Xu, 2004). By exploring pay-performance relation for the SEOs in China, this paper contribute to the literature by providing the first investigation on pay-performance sensitivities and elasticities. Massive empirical research in Britain, the U.S., and elsewhere, has provided mixed findings on the pay-for-performance relationship. Jensen and Murphy (1990) also find a positive association between CEO pay and stock returns, but they caution that the sensitivity of pay to performance is very small. Coughlan and Schmidt (1985), Mehran (1995), and Murphy (1985, 1988), among others, report a positive pay-performance relationship. More recent studies that include the benefits from stock options in top management pay, find positive relationship between pay and stock returns (Conyon and Murphy, 2000; Main et al., 1996). Other studies have found very weak or no pay-for-performance link (Gregg et al., 1993; Conyon et al., 1995; Zhou, 1999). More recent studies by Lam (2017) examines CEO gender, compensation and performance in Chinese-listed firms. They found Female CEOs are more likely to emerge in private (rather than state-held) firms. A female CEO is more likely in entities where other women are present as directors. Overseas listing does not enhance female CEO participation or compensation rates. Xiao (2016) investigates the determinants of Chief Executive Officer (CEO) cash compensation in relation to corporate governance and performance in China's

listed firms. Conyon and He (2015) investigates the determination of Chinese CEO pay. They found significant changes in CEO pay, ownership and board structure.

This paper contributes to the literature on executive compensation in emerging markets by, it is the first to look at pay-performance sensitivities and elasticities for listed firms in China. This study assesses the relation between executive incentives, risk-taking and firm performance measured by both ROA and stock return. I applied three-simultaneous-equation using 3 Stage least Square (3SLS) method in which vega, delta and firm risk/performance are all treated as endogenous variables and are jointly determined, which avoid spurious inferences in OLS estimate and provide asymptotically correct estimates of the standard errors (Sawa, 1969).

The structure of the paper is as follows. Section II provides methodology and model and reviewing the relevant literature. Section III describes data followed by Section IV where the main results are reported. Section V concludes the paper by summarizing the findings and discussing policy implications.

METHODOLOGY AND MODEL

In current literature, most studies use the ratio of stock option based compensation to total compensation as a measure of compensation structure. Such measures cannot precisely capture risk-taking incentives induced by the compensation. Core and Guay (2002a) view such measures as noisy proxies for vega and delta. For example, a positive relation between the ratio of stock option compensation to total compensation and stock return volatilities could be caused by certain factor having positive effect on stock return volatility. In such a case, the positive relation cannot be attributed to managers' compensation structure.

In this study I estimate vega and delta. This is a more precise measure of managers' incentives which will not be affected by potentially noisy proxies. In addition, I include both vega and delta into empirical models. This approach allows me to isolate the effect of vega and delta. Prior studies usually use compensation structure in just one dimension, such as either delta or vega, without controlling for the other measure. However, the mix effect of vega and delta are likely to have substantially cross-sectional differences and both affect risk-taking behavior (Guay, 1999). Therefore, in order to isolate risk-taking investments and vega, delta should be counted as a control variable.

Moreover, very few studies on the association between risk and compensation structure estimate the underlying causality relationships. Rogers (2002) argued if a positive relation between stock return volatility and vega indicates that vega attributes to high-risk investment decisions, does this suggest that some underlying omitted factors could possibly drive the association between vega and volatility? Similar questions need to be addressed over the association between vega and other managerial decisions. All of these concerns imply that possible causation is running in both directions for vega and delta. It is therefore critical to estimate how investment choices and managerial compensation structures are jointly determined. When both compensation characteristics

and managerial decisions are endogenous, OLS results are invalid because the orthogonality assumption is violated, and the use of OLS causes biased and inconsistent parameter estimates. The usual t and F tests for these parameters are therefore imprecise value. The primary characteristic of compensation considered in this study is the sensitivity of CEO wealth to stock return volatility, or vega. Vega is defined as the change in the dollar value of the executive's wealth for a one percentage point change in the annualized standard deviation of stock returns. Delta is defined as the change in the dollar value of the executive's wealth for a one percentage point change in stock price. Guay (1999) shows that option vega is many times higher than stock vega. The vega and delta calculations follows Guay (1999) and Core and Guay (2002a). Vega is computed as the partial derivative of the Black-Scholes option pricing model with respect to stock return volatility. The higher the sensitivity of the manager's compensation to risk the more he/she gains from increasing risk. Therefore, this measure captures directly the incentives of executives to increase risk. The sensitivity with respect to a 1% change in stock price, delta, is partial derivative with respect to stock price.

In this study, in order to avoid spurious inferences and to isolate causation, I apply 3 stage least square (3SLS) method. Three-stage least squares (3SLS). The three-stage least squares estimator was introduced by Zellner& Theil (1962). It can be seen as a special case of multi-equation GMM where the set of instrumental variables is common to all equations. If all regressors are in fact predetermined, then 3SLS reduces to seemingly unrelated regressions (SUR). Thus it may also be seen as a combination of two-stage least squares (2SLS) with SUR. The method is called "two-stage" because it conducts estimation in two steps, where *step one*: Regress Y_{-i} on X and obtain the predicted values $\hat{Y}_{-i}$; *Step 2*: Estimate γ, β_i by the ordinary least squares of y_i on $\hat{Y}_{-i}$ and X_i . If the i^{th} equation in the model is written as

$$y_i = (Y_{-i} \quad X_i) \begin{pmatrix} \gamma_i \\ \beta_i \end{pmatrix} + \mu_i \equiv Z_i \delta_i$$

$$\hat{\delta}_i = (\hat{Z}_i' \hat{Z}_i)^{-1} \hat{Z}_i' y_i = (Z_i' P X Z_i)^{-1} Z_i' P y_i$$

Where Z_i is a matrix of both endogenous and exogenous regressors in the i th equation, and $P = X(X'X)^{-1}X'$ is the projection matrix onto the linear space spanned by the exogenous regressors X .

This study uses the 3SLS method followed by Coles et al. (2006) and Yang (2010), where one of the interested variables (firm risk, security underwriting, mortgage loan or write-offs), vega and delta, are contemporaneously determined to disentangle the causality between compensation incentives and risk-taking. I used the model to testing: (1) How board and ownership structure affect firms' CEOs' incentive compensation, or vega (controlling for delta), and (2) How equity-based compensation, vega and delta, affect firms' risk-taking investments. To assess the relation between ownership structure, vega and firm risk, I apply a three-simultaneous-equation with 3 Stage

Least Square (3SLS) method in which vega, delta, and firm risk are treated as endogenous variables and are jointly determined. The 3SLS estimate could avoid spurious inferences in OLS estimate and provide asymptotically correct estimates of the standard errors (Sawa, 1969). Although I focus on vega as the primary explanatory variable, here and in subsequent sections, all model specifications include both delta and control variables based on current literature. I control for firm size, stock prices, long-term debt ratio and growth opportunities. An important reason to include control variables is to represent forces that drive both vega and delta together on investment decisions. The regression equations are as the follows,

$$FirmRisk_{it} = \alpha_0 + \alpha_1 vega_{it} + \alpha_2 delta_{it} + FirmSize_{it} + \mu_i + \nu_t + \varepsilon_{it}$$

$$Vega_{it} = \beta_0 + \beta_1 FirmRisk_{it} + \beta_2 Delta_{it} + FirmSize_{it} + Growth_{it} + DebtRatio + \eta_i + \delta_t + \zeta_{it}$$

$$Delta_{it} = \gamma_0 + \gamma_1 FirmRisk_{it} + \gamma_2 Vega_{it} + FirmSize_{it} + Stock Price_{it} + \varphi_i + \nu_t + \xi_{it}$$

Where, the control variables are firm size, growth opportunities, long-term debt ratio, stock price. The reasons for choosing these variables as instrument variables are, first, they are informative for the dependent variables, and second, these variables are exogenous in the system equations. μ_i , η_i and φ_i represent a firm-specific effect, ν_t , δ_t and ν_t represent a cross-sectional time-specific effect, and ε_{it} , ζ_{it} and ξ_{it} captures the measurement errors. In the following sections, the 3SLS models are specified in a similar way, where the dependent variable in the first equation, firm risk, is replaced by one of the investment variables (security underwriting, mortgage loan, and write-offs).

DATA

The compensation data for management in China listed firms were not available until 1998. Since then, listed companies were required to disclose top management compensation. The required compensation disclosures are total remuneration to the members of the board of directors, the supervisory board, and senior managers. Compensation of the highly paid executives in the firms is also disclosed. I use these as proxy for CEO pay variables. The payment is calculated as the total cash compensation includes base salary, bonuses, and commissions. Bonus pay is counted as incentive payment tied to firm performance. I applied a simulation approach to generate the sample include all non-financial firms which are listed on the Shanghai and Shenzhen stock exchanges. In line with other studies, I exclude firms in financial sector. The sample consists of 536 firms and 1638 firm-year observations. Executive compensations are estimated on shareholdings of the three largest shareholders, board size, and board compensations. The analysis is based on information extracted from annual reports over the 1998-2006.

Table 1 reports descriptive statistics on compensation, firm characteristics, and other control variables. The mean and median cash compensation are RMB432,570/USD55,458. The pay varies from RMB 8,000 to 448,000 (USD1,000 to 56,238). The figure of the overall payment is much lower than that in developed countries. For example, the average value of cash compensation is USD 621,000 for a sample of 200 firms in the U.S. between 1992-20014 Core et al. (2015). Zhou

(2017) reports an average compensation of USD288,000 for Canada. Conyon (2017) reports an average pay of GBP 281,000 in the U.K. in 2013. Mean and median vega are 10.45 and 12.36. While mean and median delta are 10.23 and 8.57. Means stock return during sample period is high, which is 42.15% while is associated with high standard deviation of 71%. Debt to ratio is on average low. Mean and median debt ratio are 5% and 8%. State ownership takes more than a half of firms. Ownership concentration on average is 23%. Foreign shares take on average of 10% with median of 5%. Board size on average around 9.

The accounting performance measures are relatively low and has a deteriorating trend. However, stock returns are very good and indicates an increasing trend. Accounting returns and stock returns are different indicators. This is due to: first, stock return are forward looking indicating firm's earning power and investors' expectations for the future; while ROA is backward looking indicating what happened in the past. This could represents an unique feature for firms in China that stock prices often give a more optimistic picture of firms' financial standing than does accounting measure such as ROA.

EMPIRICAL RESULTS

In this section I assess the relation between executive incentives and firm risk-taking investments. I examine the relation among three variables: vega, delta, and firm risk. Therefore I apply a three-simultaneous-equation using a 3 Stage Least Square (3SLS) method. This approach allow vega, delta and firm risk are treated as endogenous variables and jointly determined. The 3SLS estimate could avoid spurious inferences in OLS estimate and provide asymptotically correct estimates of the standard errors (Sawa, 1969).

Although this study focus on vega as the primary explanatory variable, all model specifications include both delta and control variables based on current literature. I control for firm size, cash compensation and stock price. (Servaes, 1994; Bhagat and Ilch, 1995; and Opler et al., 1999). The reason to include these control variables is to represent factors that drive both vega and delta together. In order to capture the possible effects of other omitted variables, I include both industry (two-digit SIC) fixed and year effects in all specifications.

Table 2 reports the estimates of three-simultaneous-equation model (3SLS). The jointly determined variables are vega, delta, and firm risk. Here and throughout, reported *t*-statistics are based on robust standard errors. I draw independent variables from the prior literature (e.g., Bizjak et al., 1993; Guay, 1999; Core and Guay, 1999) for vega and delta. First, vega is significantly positively correlated with delta, which is consistent with prior literature. Second, the coefficients on firm risk is positive and significant different from zero. It implies that higher level of risk increase the managerial incentive in compensation, as reflected in vega, which is consistent with my expectations. Moreover, vega is positively correlated with and firm size, which are consistent with prior literature. Finally, in this study, I find the coefficient on firm risk is positive and significant. It implies that higher risk level of firm will induce higher managerial incentives, which cause higher vega. From the equation of delta, delta depends positively on vega. Delta is also positively correlated with stock price and negatively correlated with firm size. These findings are consistent with Guay (1999, 2002) among the others.

The risk level of the firms is expected to be higher as firms expand more risky investments. Thus, there should be a positive association between firms risk and vega; and negatively relation between firm risk and delta. Table 2 shows the regression results consistent with this predictions. The estimated coefficient on vega is positive and is significant at 5% level. This implies that higher vega induce higher level of risk of the firm. Higher delta, on the other hand, implies lower risk level. The coefficient on delta is negative and significant, which implies that firm risk level is negatively associated with delta. All coefficients are significant.

Table 3 reports the 3SLS model for the jointly determined variables on vega, delta, and firm performance (ROA). The coefficients on both vega and delta are positive and significant. It implies that increase CEO incentive compensation as indicated as vega and delta is positively associated with firm performance. Firm size is positively correlated with firm ROA, which is consistent with literature. For relation between vega and delta, vega is significantly positively correlated with delta as predicted. The coefficients on ROA is positive and significant different from zero. It implies that higher level of firm performance increase the managerial incentive in compensation, as reflected in vega, which is consistent with my expectations. Moreover, vega is positively correlated with firm size which are consistent with prior literature. From the equation of delta, delta depends positively on vega. Delta is also positively correlated with stock price and negatively correlated with firm size. As firms expand and have higher level of return as reflected on higher ROA, CEO incentive compensation should be higher. Therefore, ROA should be positively correlated with vega and delta. Table 3 provides consistent results with expectation. The estimated coefficient as show on vega is positive and significant at 5% level. This implies higher vega induce higher firm performance. Higher delta on the other hand, induce higher level of firm performance. The coefficient on delta is positive and significant.

Table 4 reports the 3SLS model for the jointly determined variables on vega, delta, and firm performance (Return). The coefficients on both vega and delta are positive and significant. It implies that increase CEO incentive compensation as indicated as vega and delta is positively associated with firm stock return. Firm size is positively correlated with return, which is consistent with literature. For relation between vega and delta, vega is significantly positively correlated with delta as predicted. The coefficients on ROA is positive and significant different from zero. It implies that higher level of stock return increases the managerial incentive in compensation, as reflected in vega, which is consistent with my expectations. Moreover, vega is positively correlated with firm size as predicted. From the equation of delta, delta depends positively on vega. Delta is also positively correlated with stock price and negatively correlated with firm size. As firms expand and have higher level of return, CEO incentive compensation should be higher. Stock return should be positively related to vega and delta. Table 4 provide the regression results are consistent with predictions. Year dummy variables are included in all table results in Tables 2, 3 and 4. I use logarithmic values of vega and delta rather than the raw values as robustness check. The magnitude and significance are consistent with all these alternative specifications.

CONCLUSION

This study assess the relation between executive incentives, risk-taking and firm performance measured by both ROA and stock return. I applied three-simultaneous-equation using 3 Stage least Square (3SLS) method in which vega, delta and firm risk/performance are all treated as endogenous

variables and are jointly determined. Empirical results showed as firms expand more risk investments, firm risk is positively related to vega and negatively related to delta. This finding has important implication that vega attribute to managers' risk-taking behavior while delta align interest between investor and firm. Moreover, CEO incentive compensation, measured by both vega and delta, are positively related to firm performance. These results are robust with logarithmic values and I include both industry dummy as well as year dummy variables.

The findings of this study have important implications for privatization reforms in China: First the findings of this study suggests that privatization process induce significant changes in compensation structure in China listed firms. SOEs adopted performance based payment for top executives in the firm. This payment transition is in line with the ownership reform suggested by Chen et al. (1998). Another policy implication is that executive stock options could be a better solution to align the interest between management and shareholder thus attribute to higher performance. Right now, executive stock options and stock appreciation rights are not widely used in most SOEs firm in CEOs compensation package. Compensation committees should be established and encourage to design appropriate incentive compensation systems that align the interests of managers and investors. There must be a concerted effort to improve the incentives of CEOs. Without appropriate compensation scheme for top management, the efforts exerted in economic restructuring may be in vain.

This project is an innovative study to foster a better understanding of compensation structure in China. This paper is timely insofar as it informs the current hot debate on aligning CEO pay scheme to firm performance in the emerging market. This paper provides implications for corporate governance, suggesting that compensation for executives may offer an effective tool for risk regulation. This study provides empirical evidence showing that regulators in China need to consider a new paradigm that provides appropriate incentives for risk-taking within the compensation structure. Especially the use of managerial incentives on the sensitivity of compensation to managerial risk-taking. The empirical findings of this study also have important implication for policy maker and provide critical insight to China privatization reform.

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Table 1: Data descriptive statistics

Variables	Mean	Median	Min	Max	Std
Compensation					
Vega	10.45	12.36	0.10	105.42	32.56
Delta	10.23	8.57	0.21	123.57	35.12
Cash compensation (000s)	432.57	419.23	82.57	2418.33	898.66
Performance					
ROA	1.86	3.28	-57.21	35.73	15.25
Stock return (RETURN)	42.15	51.28	-25.36	389.26	71.23
Firm characteristics					
Profit (000,000s)	42.11	38.43	-652.56	1315.19	142.38
Sales (000,000s)	852.34	361.78	-58.62	9873.41	889.25
Assets (000,000s)	1361.28	987.56	105.29	20368.57	1053.22
Market to book ratio	2.43	2.10	0	12.35	2.81
Debt ratio (DEBT)	0.15	0.08	-0.25	6.38	0.42
Governance structure					
State ownership (GOV)	0.56	0.76	0	1	0.48
Ownership concentration (CONC)	0.23	0.21	0.02	0.75	0.58
Foreign shares (FSHARE)	0.15	0.08	0	1	0.62
Board size (BOARD)	9.52	8.76	5	22	2.73

Table 2: Simultaneous Equations (3SLS): Firm risk and CEO compensation structure

Variables	Risk	Vega	Delta
CEO compensation measures			
Vega	0.128*** (0.004)		1.236*** (0.015)
Delta	-0.053*** (0.006)	0.439*** (0.013)	
Risk		2.428*** (1.023)	4.521** (0.051)
Control variables			
Long-term debt ratio		4.135*** (0.006)	
Growth opportunities		2.187*** (0.024)	
Firm size	0.257*** (0.015)	3.315*** (0.062)	-4.136* (0.032)
Stock prices			0.362*** (0.082)
Dummy variables			
Year dummies	YES	YES	YES
Industry dummies	YES	YES	YES
R-square	0.368	0.756	0.718

Robust standard errors are reported in the parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Table 3: Simultaneous Equations (3SLS): Firm Performance and CEO compensation structure

Variables	ROA	Vega	Delta
CEO compensation measures			
Vega	0.135*** (0.006)		1.135*** (0.042)
Delta	0.042*** (0.014)	0.258*** (0.011)	
ROA		3.625*** (1.038)	3.312** (0.046)
Control variables			
Long-term debt ratio		3.672*** (0.015)	
Growth opportunities		2.149*** (0.036)	
Firm size	0.367*** (0.009)	2.897*** (0.041)	-3.316* (0.018)
Stock prices			0.436*** (0.017)
Dummy variables			
Year dummies	YES	YES	YES
Industry dummies	YES	YES	YES
R-square	0.420	0.698	0.731

Robust standard errors are reported in the parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Table 4: Simultaneous Equations (3SLS): Firm performance measure (Return) and CEO compensation structure

Variables	Return	Vega	Delta
CEO compensation measures			
Vega	0.105*** (0.028)		1.892*** (0.047)
Delta	0.096*** (0.062)	0.586*** (0.008)	
Risk		3.356*** (1.025)	2.289** (0.038)
Control variables			
Long-term debt ratio		4.258*** (0.017)	
Growth opportunities		3.112*** (0.083)	
Firm size	-0.361*** (0.019)	2.576*** (0.078)	-3.361* (0.048)
Stock prices			0.576*** (0.009)
Dummy variables			
Year dummies	YES	YES	YES
Industry dummies	YES	YES	YES
R-square	0.456	0.732	0.691

Robust standard errors are reported in the parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.