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On CEO Compensation and Board Structure

ECO2511 Assignment

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Introduction:

Chhaochharia and Grinstein (2009, abbreviated as CG) initiated an investigation of the relationship between CEO compensation and board structure and argued that more independent board members could result in lower CEO compensation. The result was criticized by Guthrie, Sokolowsky, and Wan (2012, abbreviated as GSW), indicating that they are driven by outliers in the analysis. As a reply to the criticism, Chhaochharia and Grinstein (2012, abbreviated as CG-R), controlled for the outliers and reestablished the results in a way that was more robust, and this reply was again criticized by Guthrie, Sokolowsky, and Wan (2012, abbreviated as GSW-R) pointing out addition error in the analysis of the sample.

The determination of CEO compensation is always an interesting topic in corporate finance, and different microeconomic models are developed to explain the relationship between CEO compensation with different economic variables. The results could be useful in determining socially optimal corporate governance structure and corporate laws to enforce such structures. The theoretical models used are often derived using game theory, but majority of them have simplifying assumptions thus could not be applied directly to find the determinants CEO compensation. The empirical literate focuses on different characteristic of the firms and try to understand the existing relationship between these characteristics and the amount of compensation. The series of papers by CG and GSW focus on the impact of a change in board structure on CEO compensation. The two groups of authors reach different conclusions mainly because of the discrepancy in statistical methods of analyzing the data due to qualitative interpretation of particular subset of the data in the sample. Both sides have reasons to include or exclude certain subset of the sample, and due to the lack of more recent data, a consensus is naturally very difficult to reach.

Discussion:

Intuitively, a particular CEO's compensation is only related to whether he or she is a board member, and his or her power in making compensation decisions. This view is shared by Fama (1980), Fama and Jensen (1983), Bebchuk and Fried (2003, 2004)), and other economic theorists. As a result, although the new requirement of board independence

introduced in 2003 used in CG is an exogenous shock that could be used to identify econometrically the relationship between board structure and executive compensation, understanding the issue from original cause is still preferable, and this report attempts to take this direction.

The board members have no incentive to set the compensation above or below the market value of the service provided by a particular CEO. Therefore, the compensation decision only deviates from best estimate of market value of the service if the CEO is a member of the board him or herself. The higher the power the CEO has among the board of directors, the higher his or her compensation should be. Therefore, one independent variable in the regression should be an indicator (dummy) variable whether the CEO is a member of the board, which in turn affects the board structure.

Also, the compensation, especially in the forms from bonus, stock, and options will depend on the profitability of the firm. Thus, accounting measures of profitability such as sales and return on asset (ROA) should be included in the regression as in CG.

Another observation from the summary statistics of CEO compensation and financial characteristics provided by CG reveals that both the compensation and the earnings of the firms were decreasing in the period from 2000 to 2002, and they were increasing at the same time in the period from 2003 to 2005. According to CG, the change of board structure requirement occurred at 2003, therefore, a possible explanation is that the board took the new regulation as a signal that the executive compensation was too high, and reacted by decreasing the CEO compensations, but found that this action caused profits to decrease, therefore, adjusted the compensation in the following years by gradually increasing the compensation. Combining with this observation, the indicator variable of whether the period is before or after 2003 should be included as an independent variable.

The following sections of this report set up a game-theoretic model and its reduced-form estimation model, and presents the summary of the data and the regressions, followed the analysis of main results and the conclusion.

Theoretical Model:

A simple principal-agent model could be built to examine the situation. For a firm where CEO participates in the decision of compensation, the CEO can observe his own effort when making the decision, therefore the profit maximization problem for the firm could be specified by:

$$\pi_D = \max_{\{w_1, w_2\}} \{p_H \cdot (\pi_H - w_1 - w_2) + (1 - p_H) \cdot (\pi_L - w_1)\}$$

$$s.t. \quad p_H \cdot u(w_1 + w_2) + (1 - p_H) \cdot u(w_1) - c_H \geq \underline{u}$$

And for a firm where the CEO is not a board member, the board does not observe his effort when deciding the compensation, thus the profit maximization problem is given by:

$$\pi_I = \max_{\{w_1, w_2\}} \{p_H \cdot (\pi_H - w_1 - w_2) + (1 - p_H) \cdot (\pi_L - w_1)\}$$

$$s.t. \quad p_H \cdot u(w_1 + w_2) + (1 - p_H) \cdot u(w_1) - c_H \geq \underline{u}$$

$$p_H \cdot u(w_1 + w_2) + (1 - p_H) \cdot u(w_1) - c_H \geq p_L \cdot u(w_1 + w_2) + (1 - p_L) \cdot u(w_1) - c_L$$

Here, w_1 is the salary for the CEO and w_2 is the bonus when his job yields higher profits for the firm. $u(\cdot)$ is the utility function of the CEO and $\underline{u}$ is the reservation utility, or the utility of the outside option when he quits the job.

The CEO can choose between efforts level $\{e_H, e_L\}$:

Choosing e_H costs c_H yields profit $\begin{cases} \pi_H, & with\ probability\ p_H \\ \pi_L, & with\ probability\ 1 - p_L \end{cases}$ for the firm and wage $\begin{cases} w_1 + w_2, & when\ \pi_H\ is\ realized \\ w_1, & when\ \pi_L\ is\ realized \end{cases}$.

Choosing e_L costs c_L yields profit $\begin{cases} \pi_H, & with\ probability\ 1 - p_H \\ \pi_L, & with\ probability\ p_L \end{cases}$ for the firm and wage $\begin{cases} w_1 + w_2, & when\ \pi_H\ is\ realized \\ w_1, & when\ \pi_L\ is\ realized \end{cases}$.

The first constraint in each of the maximization problems is the individual rationality constraint, which states that exerting effort should be preferred to quitting the firm and get the reservation utility. The second constraint is the incentive compatibility constraint, which states that exerting high effort should be preferred by the CEO compared to exerting low effort.

The additional assumption is that high effort yields higher profits for the firm in expectation and the firm is risk neutral. The cost for the CEO to exert high effort should be higher than the cost of low effort as well.

The main intuition is that if a CEO is a board member, his effort is observable to himself when deciding the compensation. On the other hand, when there is an independent board, the CEO's effort is unobservable. Therefore, to model this aspect of the problem, a principal-agent model is suitable.

The solution to the above game could be obtained by solving the constraints with equality, and is given by:

$$u(w_1^D) = \underline{u} + c_H$$

$$u(w_1^D + w_2^D) = \underline{u} + c_H$$

And

$$u(w_1^I) = \underline{u} + c_H - \frac{p_H}{p_H - p_L} \cdot (c_H - c_L)$$

$$u(w_1^I + w_2^I) = \underline{u} + c_H + \frac{1 - p_H}{p_H - p_L} \cdot (c_H - c_L)$$

The derivation is omitted and could be found in microeconomic theory books such as "Microeconomic Theory" by Mas-Colell, Whinston, and Green.

Several aspects could be noted here: $w_1^D > w_1^I$ and $w_2^D < w_2^I$ since u is increasing. Here, it means that bad performance is punished and good performance is rewarded when the CEO is not a member of the board. This is inefficient because the agent, the CEO here, is now taking risks.

Also, the event in 2003 of the independent board structure requirement could be interpreted as decrease in the reservation utility. The firms may took the new policy as a signal of reduction in executive compensation, or there may be possible information cascade, which means a firm learns from the behavior of the other firms who may have incorrect information when making their decisions. In any case, the firms, especially the noncompliant ones, will reduce their CEO pay, causing the market value of management service to decrease, thus decreasing the reservation utility.

This could be used to explain the initial decrease and eventual increase of the CEO compensation after 2003. The signaling effect diminishes over time, or if information cascade is present, then the learning of the true value from larger sample could explain the adjustments. It is very similar to the undershooting of a stock price when there is a negative signal, and the stock goes back up slowly to equilibrium value after initial drop at the moment of the news.

Also, the probabilities $\{p_H, p_L\}$ could be changed to reflect the general economic conditions. When the economy is good, p_H increases and p_L decreases, and when the economy is in a recession, p_H decreases and p_L increases. This aspect is not investigated in this report.

Estimation Model:

A set of regressions are done to test the relationship between the following variables:

$$SALARY_{ijt} = \beta_0 + \beta_1 \cdot SALE_{jt} + \beta_2 \cdot ROA_{jt} + \varepsilon_{ijt}$$

$$BONUS_{ijt} = \beta_0 + \beta_1 \cdot SALE_{jt} + \beta_2 \cdot ROA_{jt} + \varepsilon_{ijt}$$

Here, $i \in \{1,2,\dots,I_{jt}\}$ is the index for the CEO in the firm j, and I_{jt} is the number of CEOs in firm j at time t, $j \in \{1,2,\dots,J_t\}$ is the index for firms at time t, and J_t is the number of

firms at time t, and finally, $t \in \{1,2,\dots,T\}$ is the time index, T is the total number of years in the sample. Ideally, $\beta_1 = \beta_2 = 0$ in the first equation and $\beta_0 = 0$ in the second equation, but it is not the case in the data.

To test whether the structure is different for a CEO who is also a director, define the indicator variable $EXECDIR_{ijt} = \begin{cases} 0, & if\ i \notin B \\ 1, & if\ i \in B \end{cases}$ where B is the set of directors.

Then,

$$SALARY_{ijt} = \beta_0 + \beta_1 \cdot SALE_{jt} + \beta_2 \cdot ROA_{jt} + \beta_3 \cdot EXECDIR_{ijt} + \beta_4 \cdot SALE_{jt} \cdot EXECDIR_{ijt} + \beta_5 \cdot ROA_{jt} \cdot EXECDIR_{ijt} + \varepsilon_{ijt}$$

$$BONUS_{ijt} = \beta_0 + \beta_1 \cdot SALE_{jt} + \beta_2 \cdot ROA_{jt} + \beta_3 \cdot EXECDIR_{ijt} + \beta_4 \cdot SALE_{jt} \cdot EXECDIR_{ijt} + \beta_5 \cdot ROA_{jt} \cdot EXECDIR_{ijt} + \varepsilon_{ijt}$$

Also, to remove the fixed effects of the firm, define:

$$\widetilde{SALARY}_{ijt} = SALARY_{ijt} - \overline{SALARY_j}, \qquad \overline{SALARY_j} = \frac{1}{I_j \cdot T} \sum_{t=1}^{T} \sum_{i=1}^{I_{jt}} SALARY_{ijt}$$

$$\widetilde{BONUS}_{ijt} = BONUS_{ijt} - \overline{BONUS_j}, \qquad \overline{BONUS_j} = \frac{1}{I_j \cdot T} \sum_{t=1}^{T} \sum_{i=1}^{I_{jt}} BONUS_{ijt}$$

$$\widetilde{SALE}_{ijt} = SALE_{ijt} - \overline{SALE_j}, \qquad \overline{SALE_j} = \frac{1}{T} \sum_{t=1}^{T} SALE_{ijt}$$

$$\widetilde{ROA}_{ijt} = ROA_{ijt} - \overline{ROA_j}, \qquad \overline{ROA_j} = \frac{1}{T} \sum_{t=1}^{T} ROA_{ijt}$$

Then the regressions are given by:

$$\widetilde{SALARY}_{ijt} = \beta_0 + \beta_1 \cdot \widetilde{SALE}_{jt} + \beta_2 \cdot \widetilde{ROA}_{jt} + \beta_3 \cdot EXECDIR_{ijt} + \beta_4 \cdot \widetilde{SALE}_{jt} \cdot EXECDIR_{ijt} + \beta_5 \cdot \widetilde{ROA}_{jt} \cdot EXECDIR_{ijt} + \varepsilon_{ijt}$$

$$\widetilde{BONUS}_{ijt} = \beta_0 + \beta_1 \cdot \widetilde{SALE}_{jt} + \beta_2 \cdot \widetilde{ROA}_{jt} + \beta_3 \cdot EXECDIR_{ijt} + \beta_4 \cdot \widetilde{SALE}_{jt} \cdot EXECDIR_{ijt} + \beta_5 \cdot \widetilde{ROA}_{jt} \cdot EXECDIR_{ijt} + \varepsilon_{ijt}$$

Which is equivalent to:

$$\widetilde{SALARY}_{ijt} = \begin{cases} \beta_0 + \beta_1 \cdot \widetilde{SALE}_{jt} + \beta_2 \cdot \widetilde{ROA}_{jt} + \varepsilon_{ijt}, & if\ i \notin B \\ (\beta_0 + \beta_3) + (\beta_1 + \beta_3) \cdot \widetilde{SALE}_{jt} + (\beta_2 + \beta_4) \cdot \widetilde{ROA}_{jt} + \varepsilon_{ijt}, & if\ i \in B \end{cases}$$

$$\widehat{BONUS}_{ijt} = \begin{cases} \beta_0 + \beta_1 \cdot \widehat{SALE}_{jt} + \beta_2 \cdot \widehat{ROA}_{jt} + \varepsilon_{ijt}, & if\ i \notin B \\ (\beta_0 + \beta_3) + (\beta_1 + \beta_3) \cdot \widehat{SALE}_{jt} + (\beta_2 + \beta_4) \cdot \widehat{ROA}_{jt} + \varepsilon_{ijt}, & if\ i \in B \end{cases}$$

Similar equations for stock and options as compensation could be set up too, but since the problem of large amount of missing data, the analysis for those will be omitted for the purpose of this report.

At the end, another two variables are added to the regression:

$NEXECDIR_{ijt} = \sum_{i=1}^{I_j} EXECDIR_{ijt} - EXECDIR_{ijt}$ is the number of other executives on the board of directors for firm j at time t for executive i. This variable is related to the independence of the board.

$BEFORE_t = \begin{cases} 0, & if\ t > 2003 \\ 1, & if\ t \leq 2003 \end{cases}$ is the indicator variable to distinguish the effects before and after the policy change.

Data:

The data are obtained of WRDS (Wharton Research Data Services). The procedure of getting the dataset is described in appendix 3.

Below is the summary of 3344 firms and 40697 executives in the period from 1992 to 2012. Plots of time series of these variables are in appendix 1. The data for stock and options as compensation are included in the raw data, but are omitted in the analysis because around half of the data are missing causing a significant reduction in the total number of useful data.

Year	Average Non-Director CEO Salary	Average Director CEO Salary	Average Non-Director CEO Bonus	Average Director CEO Bonus	Average Total Sales	Average ROA
1992	213.36	387.83	118.98	249.36	2914.74	0.07
1993	212.81	392.41	114.93	296.57	2905.24	0.07
1994	218.11	410.27	128.16	342.62	2921.22	0.07
1995	225.40	427.59	138.85	373.95	3157.48	0.07
1996	231.09	440.31	155.91	460.21	3154.92	0.07
1997	239.12	453.21	172.88	489.41	3425.27	0.06
1998	248.05	473.15	174.04	479.00	3597.14	0.05
1999	261.60	494.00	211.90	583.68	4016.38	0.06
2000	276.92	523.59	244.45	637.77	4844.74	0.05

2001	291.19	556.42	219.24	576.18	5012.00	-0.01
2002	303.72	572.71	230.84	638.11	4674.75	-0.02
2003	312.18	592.31	260.71	750.55	4783.89	0.05
2004	337.33	618.08	334.23	897.74	5315.05	0.05
2005	357.59	660.13	390.32	1014.16	6003.86	0.06
2006	355.28	659.71	150.38	455.15	6140.22	0.08
2007	354.57	619.75	98.24	283.74	6124.50	0.08
2008	371.36	649.15	78.50	234.20	6324.42	0.01
2009	385.55	673.57	83.97	194.89	5792.40	0.03
2010	403.41	703.83	97.01	245.90	6682.38	0.07
2011	417.64	733.89	90.25	231.44	7482.05	0.06
2012	438.83	766.79	94.44	248.43	8012.55	0.06

From the table and the plots, major observations include:

CEOs that are directors have significantly higher (almost double) salary as well as bonus in all periods. This contradicts part of the theoretical model.

Salary is increasing over the years, but bonus increased then decreased after 2005, possibly replaced by stocks and options as payments.

Analysis:

The following table is the first regression with only sales and ROA:

	SALARY Estimate	P-value	BONUS Estimate	P-value
Intercept	-66.3095	0.0000	-70.0689	0.0000
EXECDIR	226.5107	0.0000	239.6681	0.0000
SALE	0.0040	0.0000	0.0022	0.0000
ROA	-2.4993	0.0055	-3.8406	0.3041
EXECDIR:SALE	0.0022	0.0000	0.0041	0.0000
EXECDIR:ROA	-2.4219	0.2525	22.1420	0.0117

Here, terms with ROA are the only insignificant terms. The executive pay is positively correlated with sales. More importantly, for a CEO, being a director increases both types of compensation by around $200000. The increase is statistically significantly different from 0. Written with equations:

$$\widehat{SALARY}_{ijt} = \begin{cases} -66.31 + 0.004 \cdot \widehat{SALE}_{jt} + \cdots + \varepsilon_{ijt}, & if\ i \notin B \\ 160.20 + 0.0062 \cdot \widehat{SALE}_{jt} + \cdots + \varepsilon_{ijt}, & if\ i \in B \end{cases}$$

$$\widehat{BONUS}_{ijt} = \begin{cases} -70.07 + 0.0022 \cdot \widehat{SALE}_{jt} + \cdots + \varepsilon_{ijt}, & if\ i \notin B \\ 169.6 + 0.0063 \cdot \widehat{SALE}_{jt} + \cdots + \varepsilon_{ijt}, & if\ i \in B \end{cases}$$

The regression result shows that, after removing the firm fixed effects, the salary is not independent of the performance, and the bonus is not completely depending on the performance. Thus, salary and bonus are not good variables for w_1, w_2 in the theoretical model. However, for the fixed portion of both types of compensation, being a board member is highly positively correlated with the amount of compensation, which agrees with the prediction of the theoretical model.

It is not surprising that sales are positively correlated with compensation because larger firms have larger sales, thus large salary and bonus for the executives. The ROA measures profitability independent of the size, so the result that it is not statistically significantly correlated with compensation is surprising. It means that bonus is not given to CEOs when the firm has a good performance, but rather, it behaves more like a part of salary.

The following table is the regression with number of other executive directors variable added:

	SALARY Estimate	P-value	BONUS Estimate	P-value
Intercept	-23.5252	0.0000	-18.5094	0.0000
EXECDIR	284.8955	0.0000	239.7037	0.0000
SALE	0.0038	0.0000	0.0020	0.0000
ROA	-2.2759	0.0086	-3.5713	0.3388
NEXECDIR	-27.8825	0.0000	-33.6013	0.0000
EXECDIR:SALE	0.0013	0.0000	0.0037	0.0000
EXECDIR:ROA	-0.2428	0.9050	23.0980	0.0085
EXECDIR:NEXECDIR	-52.9648	0.0000	-7.6299	0.0350

The variable NEXECDIR has significant and negative impact on both types of compensations as expected. The interpretation is that the more CEOs are members of the board, the less control a particular CEO has on his compensation decision, thus the smaller the compensation is.

$$\widehat{SALARY}_{ijt} = \begin{cases} -23.52 + 0.0038 \cdot \widehat{SALE}_{jt} - 27.88 \cdot NEXECDIR + \cdots + \varepsilon_{ijt}, & if\ i \notin B \\ 261.37 + 0.0052 \cdot \widehat{SALE}_{jt} - 80.85 \cdot NEXECDIR + \cdots + \varepsilon_{ijt}, & if\ i \in B \end{cases}$$

$$\widehat{BONUS}_{ijt} = \begin{cases} -18.51 + 0.002 \cdot \widehat{SALE}_{jt} - 33.6 \cdot NEXECDIR + \cdots + \varepsilon_{ijt}, & if\ i \notin B \\ 221.19 + 0.0058 \cdot \widehat{SALE}_{jt} - 41.23 \cdot NEXECDIR + \cdots + \varepsilon_{ijt}, & if\ i \in B \end{cases}$$

ROA are still insignificant here thus omitted in the equations.

Note that number of CEOs on the board of directors affects salary significantly more than it affects bonus, which is reasonable as well. In other words, holding the number of executive-directors constant, the decrease in salary for a CEO who is a board member is significantly larger than the decrease in bonus.

The following table is when the time indicator (before and after 2003) is added as well:

	SALARY Estimate	P-value	BONUS Estimate	P-value
Intercept	12.0293	0.0000	-32.2905	0.0000
EXECDIR	306.8161	0.0000	210.3418	0.0000
SALE	0.0028	0.0000	0.0024	0.0000
ROA	-1.9154	0.0228	-3.7110	0.3200
NEXECDIR	-21.9332	0.0000	-35.9073	0.0000
BEFORE	-77.3488	0.0000	29.9808	0.0000
EXECDIR:SALE	0.0010	0.0000	0.0043	0.0000
EXECDIR:ROA	0.9035	0.6475	22.1067	0.0117
EXECDIR:NEXECDIR	-46.5175	0.0000	-14.6293	0.0001
EXECDIR:BEFORE	-41.3163	0.0000	59.0937	0.0000

All the previous results still hold but the important observation here is that, as seen in the time series plot, the salary has increased significantly after 2003 and the bonus has decreased significantly after 2003. The impact is more severe for CEOs that are board members.

Ignoring all other variables,

$$\widehat{SALARY}_{ijt} = \begin{cases} \begin{cases} 12.03 + \cdots + \varepsilon_{ijt}, & if\ i \notin B \\ 318.85 + \cdots + \varepsilon_{ijt}, & if\ i \in B \end{cases}, & if\ t \geq 2003 \\ \begin{cases} -65.32 + \cdots + \varepsilon_{ijt}, & if\ i \notin B \\ 277.53 + \cdots + \varepsilon_{ijt}, & if\ i \in B \end{cases}, & if\ t < 2003 \end{cases}$$

$$\widehat{BONUS}_{ijt} = \begin{cases} \begin{cases} -32.29 + \cdots + \varepsilon_{ijt}, & if\ i \notin B \\ 178.05 + \cdots + \varepsilon_{ijt}, & if\ i \in B \end{cases}, & if\ t \geq 2003 \\ \begin{cases} -2.31 + \cdots + \varepsilon_{ijt}, & if\ i \notin B \\ 237.15 + \cdots + \varepsilon_{ijt}, & if\ i \in B \end{cases}, & if\ t < 2003 \end{cases}$$

From the coefficients, the bonus decreases after 2003 and salary increases after 2003. The cutoff year is more likely to be 2005, thus causation could not be established. It may not be the policy of requiring independent board structure that causes this change.

Conclusion:

The above model is a very simple model, and the data contradicts the model predictions in many places, so more features should be added to explain the data. Nevertheless, several main results are obtained from the regression:

Firstly, as expected, being a board member is positively correlated with a higher compensation in the forms of salary and bonus.

Secondly, the compensation of a particular CEO is negatively correlated with number of other executives on the board of directors.

Lastly, the introduction of the board independence policy in 2003 may have a negative impact on the compensation for CEOs who are board members.

Ideally, survey data from executives and board members should reveal how the compensation is actually determined. However, they are not available because likely, the CEOs are not willing to report truthfully. Thus obtaining an accurate sample will be very costly for the researchers. With the existing dataset, more complicated behavioral game theoretic model could be set up to explain different aspects of the sample. The decision of compensation with a group of people with different interests are likely not rational equilibrium outcomes, thus standard rational agent game theory may indeed fail to explain many of the situations.

References:

Bebchuk, Lucian A., and Jesse M. Fried, 2003, Executive compensation as an agency problem, Journal of Economic Perspectives 17, 71–92.
http://www.nber.org/papers/w9813.pdf

Chhaochharia, Vidhi, and Yaniv Grinstein, 2009, CEO compensation and board structure, Journal of Finance 64, 231–261.

Chhaochharia, Vidhi, and Yaniv Grinstein, 2012, CEO compensation and board structure There is an effect after all, Journal of Finance, forthcoming.

Fama, Eugene F., 1980, Agency problems and the theory of the firm, Journal of Political Economics 88, 288–307.
http://business.illinois.edu/josephm/BA549_Fall%202010/Session%205/Fama%20%281980%29.pdf

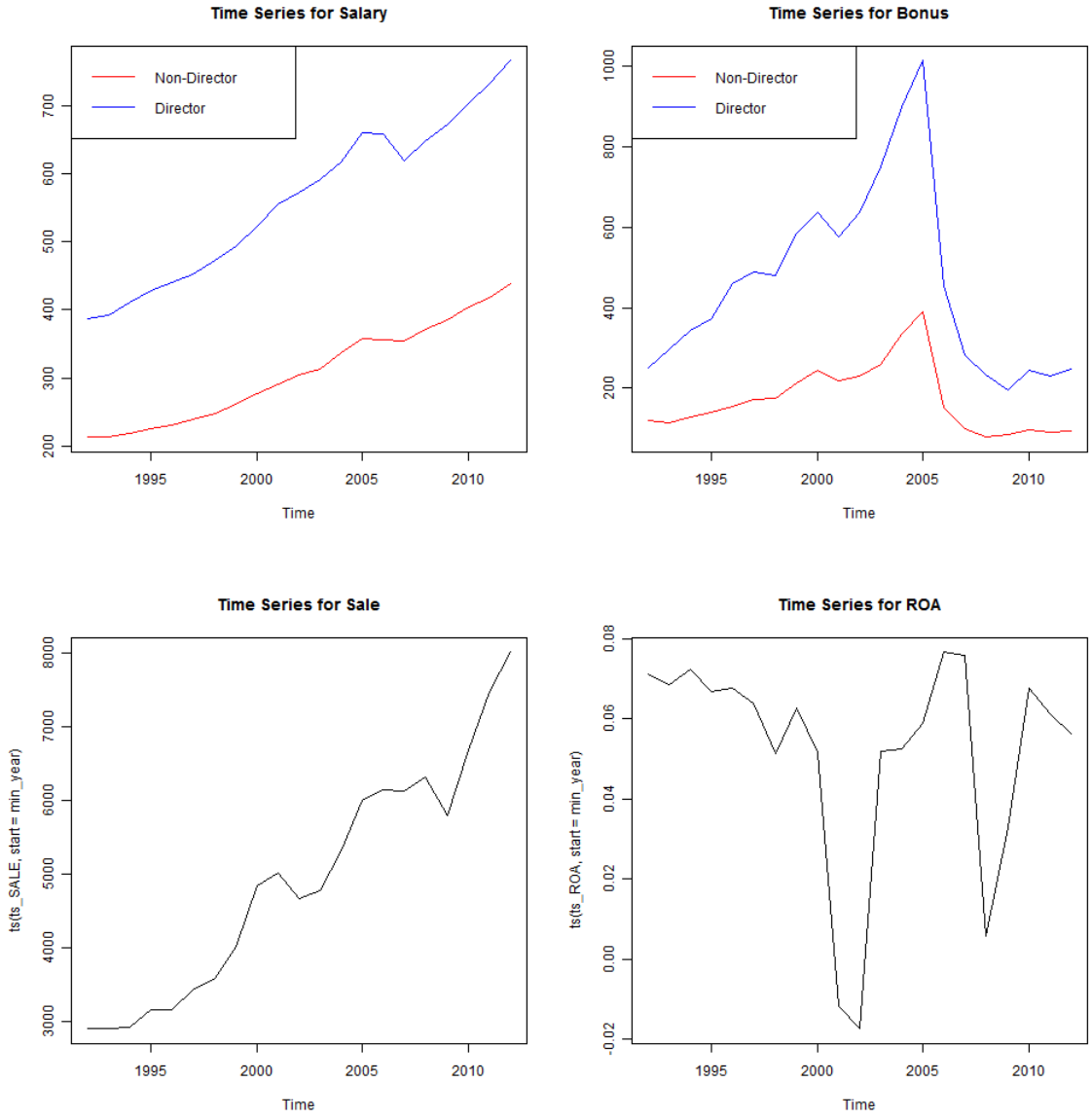
Fama, Eugene F., and Michael C. Jensen, 1983, Separation of ownership and control, Journal of Law and Economics 26, 301–325.
http://are.berkeley.edu/~cmantinori/prclass/FamaJensen.pdf

Guthrie, Katherine, Jan Sokolowsky, and Kam-Ming Wan, 2012, CEO compensation and board structure revisited, Journal of Finance 67, 1149–1168.

Guthrie, Katherine, Jan Sokolowsky, and Kam-Ming Wan, 2012, CEO Compensation and Board Structure–Rejoinder.

Appendix:

[1] Plots of time series:



[2] Minor regression results:

1) Regression of SALARY and BONUS without removing their company means:

	SALARY Estimate	P-value	BONUS Estimate	P-value
Intercept	284.5090	0.0000	135.7483	0.0000
EXECDIR	225.3359	0.0000	248.3293	0.0000
SALE	0.0048	0.0000	0.0078	0.0000
ROA	4.6886	0.0000	-2.1511	0.5683
EXECDIR:SALE	0.0031	0.0000	0.0073	0.0000
EXECDIR:ROA	16.2026	0.0000	32.6082	0.0018

2) Regression of SALARY and BONUS without removing their company means:

	SALARY Estimate	P-value	BONUS Estimate	P-value
Intercept	298.0796	0.0000	112.7746	0.0000
EXECDIR	285.8896	0.0000	228.1089	0.0000
SALE	0.0048	0.0000	0.0077	0.0000
ROA	4.8419	0.0000	-2.4106	0.5225
NEXECDIR	-8.9224	0.0000	15.1048	0.0000
EXECDIR:SALE	0.0032	0.0000	0.0072	0.0000
EXECDIR:ROA	20.7914	0.0000	30.1044	0.0039
EXECDIR:NEXECDIR	-50.9098	0.0000	19.7611	0.0000

3) Regression of SALARY and BONUS with only time indicator (with and without removing company means):

	SALARY Estimate	P-value	BONUS Estimate	P-value
Intercept	-18.7884	0.0000	-82.7430	0.0000
EXECDIR	274.7521	0.0000	214.3692	0.0000
SALE	0.0029	0.0000	0.0025	0.0000
ROA	-2.0653	0.0169	-3.9563	0.2896
BEFORE	-82.2608	0.0000	21.9393	0.0000
EXECDIR:SALE	0.0014	0.0000	0.0045	0.0000
EXECDIR:ROA	-0.3957	0.8456	21.2822	0.0153
EXECDIR:BEFORE	-73.4320	0.0000	39.7980	0.0000

	SALARY Estimate	P-value	BONUS Estimate	P-value
Intercept	349.7697	0.0000	106.0192	0.0000

EXECDIR	272.1318	0.0000	208.7037	0.0000
SALE	0.0045	0.0000	0.0079	0.0000
ROA	4.0328	0.0000	-1.8524	0.6229
BEFORE	-110.5796	0.0000	50.3739	0.0000
EXECDIR:SALE	0.0029	0.0000	0.0074	0.0000
EXECDIR:ROA	19.1825	0.0000	30.8710	0.0030
EXECDIR:BEFORE	-67.4554	0.0000	59.8167	0.0000

4) Regression of SALARY and BONUS without removing their company means:

	SALARY Estimate	P-value	BONUS Estimate	P-value
Intercept	349.0699	0.0000	90.7969	0.0000
EXECDIR	310.1727	0.0000	202.8519	0.0000
SALE	0.0045	0.0000	0.0079	0.0000
ROA	4.0234	0.0000	-2.0578	0.5849
NEXECDIR	0.5075	0.4585	11.0403	0.0000
BEFORE	-110.7019	0.0000	47.7143	0.0000
EXECDIR:SALE	0.0031	0.0000	0.0074	0.0000
EXECDIR:ROA	22.2392	0.0000	29.3567	0.0048
EXECDIR:NEXECDIR	-42.9408	0.0000	12.9076	0.0022
EXECDIR:BEFORE	-43.1388	0.0000	48.8218	0.0000

[3] Procedures to replicate the results:

1) The data could be obtained from WRDS database with the following specifications:

Data Request ID	2c5db622167a16d2
Libraries/Data Sets	compm/funda /
Frequency/Date Range	ann / Jan 1992 - Oct 2013
Search Variable	GVKEY
Input Codes	-all-
all item(s)	
Conditional Statements	n/a
Output format/Compression	csv /
Variables Selected	AT PI SALE
Extra Variables and Parameters Selected	C INDL STD

Data Request ID	8b5a40982667cbd3
Libraries/Data Sets	comp/anncomp /

Frequency/Date Range	ann / 1992 - 2012
Search Variable	GVKEY
Input Codes	-all-
all item(s)	
Conditional Statements	n/a
Output format/Compression	csv /
Variables Selected	SPINDEX EXECID BONUS EXECDIR OPTION_AWARDS_BLK_VALUE RSTKGRNT SALARY
Extra Variables and Parameters Selected	

2) When the data is downloaded, rename the datasets to “data1.csv” and “data2.csv”, then run the R codes “merge.txt” to generate the consolidated dataset “data.csv”.

3) Use “summary.txt” to generate the summary tables and the plots and save them as .cvs and .png files in the working directory.

4) Use “estimation.txt” to generate all the regression results.