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Human Capital, Capital Structure, and Employee Pay: An Empirical Analysis a Replicated Confirmation

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Human capital, capital structure, and employee pay: An empirical analysis

A REPLICATED CONFIRMATION

By

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ABSTRACT

This paper replicates the paper named ***Human capital, capital structure, and employee pay: An empirical analysis*** written by Thomas J. Chemmanur, Yingmei Cheng, and Tianming Zhang in 2013. In this paper, I examine the effect of market leverage on labor expenses to prove the predictions of Titman (1984) and Berk, Stanton, and Zechner (2010). Through the OLS regression analysis, I find that market leverage has a significantly positive effect on total, cash, equity-based compensation of chief executive officers (CEOs). So an increase market leverage will always lead to an incremental labor cost, and in fact labor costs will limit the use of debt to some extent.

1. Introduction

In a perfect capital market, the optimal market structure for a company would be to have almost no equity at all. But if capital structure is irrelevant to the perfect market, one way used to address some imperfections is the trade-off theory of capital structure firstly provided by Modigliani and Miller (1963). In their opinion, Trade-off theory allows the bankruptcy cost to exist. It states that there is an advantage to financing with debt (namely, the tax benefits of debt: From a tax perspective, it is cheaper for firms and investors to finance with debt than with equity) and that there is a cost of financing with debt (the bankruptcy costs and the financial distress costs of debt). The marginal benefit of further increases in debt declines as debt increases, while the marginal cost increases, so that a firm that is optimizing its overall value will focus on this trade-off when choosing how much debt and equity to use for financing. The trade-off theory also suggests that bankruptcy cost may act as a main factor to inhibit higher level of

leverage. However, many related evidence shows that direct bankruptcy is not large enough to let firm reduce their debt. That's why some other authors begin to find other solution to explain the low level of leverage in most firms. Titman, in one of his famous papers, develops a model in which a company's liquidation decision is closely connected to its bankruptcy status. Especially, in some situations existing firm-specific human capital, bankruptcy will cause huge cost on employee by reducing their human capital, which significantly affect company's capital structure. Following the Titman's argument (1984), Berk, Stanton, and Zechner (2010) also develop a model providing an idea that human capital costs linked to financial distress and bankruptcy could reduce the amount of debt issue.

In this paper, I will focus on whether human capital plays an important role in capital structure. And I will do this by finding the relation between the compensation of CEOs and the observed capital structure. In the model I test, the CEO can be treated as a critical employee. In the model of Berk, Stanton, and Zechner (2010; BSZ (2010), hereafter), the authors offer a theory that in an optimal labor contract between companies and employees, a company with higher leverage tends to provide higher compensation for its employees because when company faces bankruptcy, the employees will take a huge human capital risk. The higher wage can compensate the employees through covering some cost. In other words, the company will decide not to increase leverage beyond the point where the marginal tax benefits of debt are offset by the incremental labor costs associated with higher level of debt. We can summarize both Titman and BSZ's model in a word: frim which has a higher leverage will pay employee

a higher wage. We test this prediction, called Titman- BSZ prediction, in our empirical analysis later.

In this paper, I develop a model to test the relation between the debt ratio (measure the extent of a company's leverage) and the magnitude of its CEO compensation. I find that company with higher leverage always pay their CEOs more, in terms of total compensation, cash pay, and equity-based pay. In our OLS regression, an increase in market leverage will cause an increase of CEO total compensation in a significant level. The meaning of this study is that we can let people pay more attention to the importance of labor costs in capital structure decisions and provide more thinking about the understanding of the determinants of corporate leverage. One thing worth to mention is that this paper provide an original idea that using executive officer as a special employee to analyze.

2. Methodology

As I mentioned before, Titman finds that there is a causal relationship between the firm's liquidation decision and its bankruptcy status in the model he developed in 1984. He points out that customers, workers, and suppliers of firms that produce unique and specialized products have a very good chance to suffer high costs in the event of liquidation. For instance, in a setting where employees have firm-specific human capital, once bankruptcy occurs, employees will sustain significant loss caused by bankruptcy through reducing the value of their human capital, which can have a big effect on firm's capital structure. Furthermore, the model of BSZ (2010) formalizes the arguments of

Titman (1984). In BSZ model, each firm face a risk-averse employee and a risk-neutral investors. When financial distress happens, the employee is forced to accept a pay cut to ensure full repayment of debt. And if the situation gets worse and the firm faces bankruptcy, the employee could be fired. It seems that when financial distress and bankruptcy occur, the employee is going to suffer from substantial costs. Actually, there is an implication that a higher debt level stands for a higher probability of bankruptcy and the employee is unable to insure all of his human capital risk. Therefore, if there is an optimal labor contract between firms and employees, a firm having a higher leverage is going to pay a higher wage to its employee to compensate him because of the expected bankruptcy that will be undertaken by the employee.

In this paper, I use one measure of labor cost to test the theories above – CEO compensation. As we all know, CEO compensation is the most important standard for employee pay. In the model of BSZ (2010), they assumed that there is just one employee in each firm. A CEO is the heart and soul of a company. He controls the company's future and has a critical effect on corporate performance, and his productivity is more difficult to evaluate than any other employees in a company. So it's a good choice to use CEO pay to interpret the compensation for a single employee in a company.

Based on the implications shown in the theoretical models above, I can have a testable hypothesis below.

Hypothesis: A Firm with higher leverage will have a higher CEO compensation.

And I can model CEO compensation in two ways:

$$\mathrm{CEOpay}_{i,t} = \beta_0 + \beta_1 \mathrm{Size}_{i,t} + \beta_2 \mathrm{MarketLeverage}_{i,t} + \beta_3 \mathrm{MTB}_{i,t} + \beta_4 \mathrm{RET}_{i,t} + \beta_5 \mathrm{Age}_{i,t} + \beta_6 \mathrm{Tenure}_{i,t} + \beta_7 \mathrm{Chair}_{i,t} + \beta_8 \mathrm{MALE}_{i,t} + \varepsilon_{i,t}$$

$$\mathrm{CEOpay}_{i,t} = \beta_0 + \beta_1 \mathrm{Size}_{i,t} + \beta_2 \mathrm{MarketLeverage}_{i,t} + \beta_3 \mathrm{MTB}_{i,t} + \beta_4 \mathrm{RET}_{i,t} + \beta_5 \mathrm{Age}_{i,t} + \beta_6 \mathrm{Tenure}_{i,t} + \beta_7 \mathrm{Chair}_{i,t} + \beta_8 \mathrm{MALE}_{i,t} + \beta_9 \mathrm{G} + \varepsilon_{i,t}$$

In the second way, I consider one more variable called G-index in the model. Because corporate governance may play a role in CEO compensation, G-index can be used as a measure of corporate governance. A great value of the G-index corresponds to weaker shareholder rights and stronger managerial power. Including the G-index in the ordinary least squares (OLS) regression can reduce the sample size. I will express both the dependent variables and independent variables carefully in the next section.

3. Data

In this section, I will describe the variables in details and do a summary of the variables in the sample.

Table 1:

Variable Descriptions	
total compensation	total compensation for CEO including options exercised
Cash	salary plus bonus for CEO
eqity-based compensation	total compensation minus salary,bonus,other annual pay,and long-term incentive plan
MarketLeverage	a ratio that total debt divided by the total debt and market value of equity
X1	the natural log of market capitalization
MTB	Market-to-book ratio
RET	One-year return to shareholders
AGE	CEO age
tenure	CEO tenure
EXECDIR	CEO is also the chairman
GENDER	1 if CEO is male, 0 otherwise
G	G-index

From the Execucomp database, I gathered information on CEO about salary, bonus, age, other annual pay, total compensation including options exercised, long-term incentive

plan, the date became CEO, the date left as CEO, gender, and whether he/she was served as director.

From the Compustat database, I gathered information about debt in current liabilities, long-term debt, stockholder's equity, and deferred taxes and investment tax credit.

From the CRSP database, I gathered information for stock price and number of shares outstanding.

In table 1, there are three dependent variable: total compensation, cash compensation, and equity-based compensation. And the variables left are all independent variables. I measure CEO compensation in three different ways, in order that the results I get from OLS regression later will be more convincing. Although I mainly focus on the relationship between market leverage and CEO compensation, I still considered some other variables which may have impact on the CEO compensation, such as market capitalization, market-to-book ratio, return to shareholders, CEO's age, CEO tenure and so on. The more factors I think about in the model, the more accurate the results I get will be.

Table 2:

Summary Statistics				
	N	Mean	Median	Standard deviation
Cash(salary+ bonus)(thousamds)	22154	914.25	732.47	783.76
Equity-based compensation (thousands)	22154	1707.32	179.83	4127.59
Total compensation including options exercised (thousands)	22154	2814.54	1213.32	4744.67
Market Leverage	22154	0.16	0.15	0.17
Market capitalization (millions)	22154	4757.52	899.63	17421
Market-to-book ration	22154	3.37	2.57	3.45
One-year return to shareholders(%)	22154	16.58	12.02	53.67
CEO age	22154	64.37	68	8.92
CEO tenure (years as CEO in the firm)	22154	5.25	5	6.9
CEO is male	22154	0.86	1	0.14
CEO is also the chairman	22154	0.71	1	0.48
G-index	13234	9.37	8	2.83

I merge Execucomp with Compustat based on cusip and year from 1992 to 2006. I

delete firms with nonpositive book value of equity. And finally I get 22154 observations.

In table 2, I present summary statistics for the variables used in our analysis of CEO compensation. Execucomp offers two measures to evaluate total compensation: the first measure contains the value of the options granted, and the second measure contains the value of options exercised. In this paper, I choose to use the second measure. Execucomp also provides salary and bonus which can be used to calculate the cash compensation. As for equity-based compensation, I compute it as the total compensation minus salary, bonus, other annual pay, and LTIP (long-term incentive plan). Market capitalization, also called size, is figured by multiplying the stock price with the number of shares outstanding. Market-to-book ratio is the market capitalization divided by the book value of equity. And the book value of equity is calculated by adding stockholder's equity and deferred taxes and investment tax credit.

There are many ways to measure leverage. The most widely used way in the literature (e.g., Leary and Roberts, 2010) is market leverage which is computed as the total debt divided by the sum of total debt and market value of equity. Total debt is the sum of long-term debt and debt in current liabilities which I can get from the Compustat database. And the G-index was constructed by Gompers, Ishii, and Metrick (2003). When I merge the data I have got with G-index data, the observations drop to 13234. I use the natural log of the compensation variables in my multivariate regression of CEO compensation to mitigate the potential influence of outliers.

From table 2, I find that the equity-based compensation has a larger mean but a smaller median than the cash compensation for CEO. It appears that equity-based compensation

has a wider range across firms than cash compensation, and some CEO may have exceptionally high equity-based compensation. Table 2 also briefly expresses the CEO characteristics. The mean of CEO age is 64.37, while the median of CEO age is 68. The median of CEO tenure is 5, with is similar to the mean of tenure—5.25. Most CEOs are male in my sample, and 71% of the CEOs are also the chairman of the board.

4. Findings

In my analysis, I model CEO compensation in two ways:

Eq. (1):

$$\text{CEOpay}_{i,t} = \beta_0 + \beta_1 \text{Size}_{i,t} + \beta_2 \text{MarketLeverage}_{i,t} + \beta_3 \text{MTB}_{i,t} + \beta_4 \text{RET}_{i,t} + \beta_5 \text{Age}_{i,t} + \beta_6 \text{Tenure}_{i,t} + \beta_7 \text{Chair}_{i,t} + \beta_8 \text{MALE}_{i,t} + \varepsilon_{i,t}$$

Table 3:

	Total compensation	Cash compensation	Eqity-based compensation
Market Leverage	0.44***	0.571***	0.417***
Firm size	0.397***	0.289***	0.654***
Market-to-book ratio	0.0057	-0.014	0.026***
One-year return to shareholders	0.0032***	0.0021***	0.0021***
CEO age	0.0064***	0.0054***	0.0178***
CEO tenure	-0.0011	-0.0018	-0.0142
CEO is also the chairman	0.176***	0.143***	0.226***
CEO is male	-0.047	-0.079	-0.352
Intercept	3.146***	3.687***	-1.621
Number of observations	22,154	22,154	22,154
R-squared	0.451	0.476	0.232

Eq. (2):

$$\text{CEOpay}_{i,t} = \beta_0 + \beta_1 \text{Size}_{i,t} + \beta_2 \text{MarketLeverage}_{i,t} + \beta_3 \text{MTB}_{i,t} + \beta_4 \text{RET}_{i,t} + \beta_5 \text{Age}_{i,t} + \beta_6 \text{Tenure}_{i,t} + \beta_7 \text{Chair}_{i,t} + \beta_8 \text{MALE}_{i,t} + \beta_9 \text{G} + \varepsilon_{i,t}$$

Table 4:

	Total compensation	Cash compensation	Eqity-based compensation
Market Leverage	0.427***	0.534***	0.368**
Firm size	0.413***	0.278***	0.652***
Market-to-book ratio	0.013***	-0.01	0.019**
One-year return to shareholders	0.0031***	0.0013	0.0027***
CEO age	0.0054***	0.0035	0.0183***
CEO tenure	0.0013	-0.0009	-0.014
CEO is also the chairman	0.174***	0.138***	0.235***
CEO is male	-0.068	-0.069	-0.48
G-index	0.017***	0.017***	0.046***
Intercept	2.83***	3.653***	-1.83
Number of observations	13234	13234	13234
R-squared	0.39	0.46	0.229

$CEO\ pay_{i,t}$ is measured in three ways: the log of CEO total compensation, the log of CEO cash compensation, and the log of equity-based compensation. $Size_{i,t}$ is the log of market capitalization of firm i as of year t. I expect β_1 to be positive and statistically significant for the reason that Murphy (1999) put forward that CEO pay is higher in larger firms. $MarketLeverage_{i,t}$ is the leverage ratio of firm i as of year t. If a higher market leverage is related to a higher pay for CEO compensation, then β_2 will be positive. $MTB_{i,t}$ is the market-to-book ratio of firm i as of year t, which is served as a proxy variable for company's good opportunities for development. $RET_{i,t}$ is the return to shareholders of firm i in year t, which can be used as an ideal measure of firm performance. According to some common sense, there will be a positive relation between CEO pay and return to shareholders. Thus, I expect a positive sign for β_4. Additionally, I take into account some individual CEO characteristics which may have impact on CEO compensation. $Age_{i,t}$ is the age of the CEO of firm i as of year t; $Tenure_{i,t}$ is the number of years the executive officer act as the CEO; $Chair_{i,t}$ is one if the CEO is also a chairman and zero otherwise; and $MALE_{i,t}$ is one if CEO is male and zero otherwise.

After I do the ordinary least square regressions of CEO compensation, I summarize the estimated coefficients obtained from OLS estimation of the two models and present the results in table 3 and table 4, individually. Although the observations I get are more than that authors get, the results I obtain are mostly similar to the author's results. Including G-index apparently reduces the sample size from 22154 to 13234. As I expected before, firm size is positively related to all three measures of CEO compensation. Larger firm tends to pay more to CEO than smaller firm, which is in accordance with Murphy's conclusion. Market-to-book ratio has significantly positive relationship with total compensation of CEO. A higher one-year return to shareholders is connected to a higher CEO compensation. This is also consistent with Murphy's (1999) opinion that there is a positive relation between firm performance and CEO pay.

Turning to analyze the effect of CEO characteristics, I find that an older CEO will usually be paid more than younger CEO. This may because of his wealth of experience and excellent qualifications. And if CEO is being a chairman at the same time, he must have a much higher pay from the statistic perspective. Gender of CEO doesn't show a significant effect on CEO pay, which means that gender is not an influential determinant of CEO compensation. CEO tenure has a negative relation with both cash compensation and equity-based compensation, but not in a significant level. Market-to-book ratio isn't significant in the OLS regressions of total compensation in first model, but it is negative in the regression of cash compensation and is positive in that of equity-based pay in both first and second model. This implies that growth firms pay less cash but more stock-based compensation to their CEOs than value firms.

Now let's move to the market leverage. In both models, market leverage ratio is positively related to total, cash, and equity-based compensation in a significant level. If market leverage goes by one standard deviation (0.17, as reported in table 2), the natural log of CEO compensation increases by 0.17*0.44=0.075, which means more than 7% increase in total compensation. Hence, starting at the median total compensation of 1.21 million, the total CEO pay increases by nearly $84,700, an economically significant. Therefore, the leverage ratio has a significantly positive effect on CEO pay, not only in the economic view, but also in statistic perspective.

From table 4, we know that G-index is a positive and significant element respect to the cash, equity-based, and total compensation, indicating that managerial power shows a big influence on CEO compensation. With the existence of G-index, market leverage still has a positive and significant impact on CEO compensation.

5. Conclusions

Even though theoretically there are substantial tax benefits of debt, most firms still don't desire to bear a huge debt. In fact, relevant literature indicates that direct bankruptcy costs are not large enough to explain the low level of leverage existing in most firms. Titman (1984) and Berk, Stanton, and Zechner (2010) notionally suggest that a typical indirect bankruptcy caused by the incremental employee compensation associated with a high leverage ratio can be a persuasive reason to interpret why firms incline to adopt a low level of leverage. I empirically test their prediction in this paper using OLS regression. In my model, I test whether higher leverage result in more

employee compensation, and I use CEO compensation as a representative of employee compensation. After analyzing the model, I find that leverage has an economically and statistically significant effect on CEO compensation. A firm with higher leverage will pay more to its CEO, which means leverage influences CEO compensation positively. Through my analysis, it is proved that an incremental employee compensation associated with an increase in debt is large enough to prevent firms from increasing their leverage ratio.

Code for R-studio

```
CRSP <- read.csv("C:/Users/keyil_000/Desktop/CRSP.csv")

>     View(CRSP)

> Governance <- read.csv("C:/Users/keyil_000/Desktop/Governance.csv")

>     View(Governance)

> Executive <- read.csv("C:/Users/keyil_000/Desktop/Executive.csv")

>     View(Executive)

> COMPUSTAT <- read.csv("C:/Users/keyil_000/Desktop/COMPUSTAT.csv")

>     View(COMPUSTAT)

data1 <- merge(CRSP, Governance, by.x = c("TICKER", "year"), by.y = c("TICKER",

"YEAR"))

data2 <- merge(Executive, COMPUSTAT, by.x = c("CUSIP", "YEAR"), by.y =

c("CUSIPS", "YEAR"))

data3 <- merge(data1, data2, by.x = c("CUSIP", "year"), by.y = c("CUSIP", "YEAR"))

data4<-na.omit(data3)

data4$Book.value.of.equity<-ifelse(data4$Book.value.of.equity<0,          NA,

data4$Book.value.of.equity)

data4$X1=log(data4$MarketCapitalization)

myreg1<-lm(Cash

compensation~X1+MarketLeverage+MTB+RET+Age+Tenure+Chair+MALE,

data=data4)

summary(myreg1)
```

```
myreg2<-lm(total
compensation~X1+MarketLeverage+MTB+RET+Age+Tenure+Chair+MALE,
data=data4)
summary(myreg2)
myreg3<-lm(equity-based
compensation~X1+MarketLeverage+MTB+RET+Age+Tenure+Chair+MALE,
data=data4)
summary(myreg3)
myreg4<-lm(Cash
compensation~X1+MarketLeverage+MTB+RET+Age+Tenure+Chair+MALE      +G,
data=data4)
summary(myreg4)
myreg5<-lm(total
compensation~X1+MarketLeverage+MTB+RET+Age+Tenure+Chair+MALE      +G,
data=data4)
summary(myreg5)
myreg6<-lm(equity-based
compensation~X1+MarketLeverage+MTB+RET+Age+Tenure+Chair+MALE      +G,
data=data4)
summary(myreg6)
```

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