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Credit Risk and Corporate Governance

Olivier Mugisho Mudekereza
CUNY Hunter College

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by

Olivier Mudekereza

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Ingmar Nyman
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Devra Golbe
Second Reader

Abstract

I study how credit rating affects the executive incentive compensation of 305 rated public U.S. corporations from 1996 through 2006, using the random-effects and fixed-effects estimation approach to address the omitted variables bias and the within panel correlation. I find that firms with lower credit rating rely more on incentive compensation: the incentive proportion in their CEO's compensation is six percentage points higher for firms with a speculative-grade rating than those with an investment-grade rating. My results indicate a corporate policy aimed at strengthening the tie between the executive's interest with those of the shareholders when facing higher credit risk.

Keywords: credit risk, corporate governance, credit rating, executive incentive compensation, corporate finance, agency theory, contract theory, applied econometrics, random effects fixed effects model, panel data.

Dedication

To my beloved parents Jean Mudekereza Namegabe and Jeanne Chishugi Nsimire, and to my late grandmother Janine Igega Mwa Nembirikira.

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1 Introduction

The 2008 financial crisis was in part caused by bank CEOs taking excessive risks due to poorly designed incentive schemes. Another contributing factor was that credit rating agencies failed to accurately evaluate the probability of default. The purpose of this study is to investigate the relationship between credit risk and corporate governance. The separation of ownership and control is necessary for corporation permanence. However, this separation also creates conflicting objectives between the firm's stackeholders (shareholders, managers, suppliers, employees, et cetera). The goal of corporate governance is to address these agency problems. Indeed, the specific principal-agent problem between shareholders and managers can be mitigated by mechanisms such as: independent board of directors, appropriate compensation plans, effective monitoring, consistent regulatory requirements, threats of takeovers, and timely shareholder pressure (Brealey, Myers and Allen, 2011). The idea that variations in credit risk may change corporate governance has a theoretical basis in the corporate-finance literature. In general, when credit quality changes corporations adapt their financing decisions. For example, lower-credit companies favor bank financing because they value the ability to monitor by the bank (Bolton and Freixas, 2000).

The specific question I ask is whether the credit rating assigned to a company affects the CEO's incentive compensation. Based on the dataset from Rauh and Sufi (2010), I construct and study a panel of 305 non-financial public firms during the period from 1996 to 2006. After estimating random-effects and fixed-effects models, I find evidence that firms with better credit rating rely less on incentive compensation: on average, the incentive proportion in their CEO's compensation is six percentage points higher for firms with a speculative-grade rating than for those with an investment-grade rating. These results suggest that when the situation deteriorates, companies strengthens the tie between the manager's interests with those of the shareholders. These high-powered incentives are meant to increase the motivation of the executive to work harder, and to mitigate distortions in managerial incentives from the higher credit risk.

My work is closely related to several topics in corporate-finance literature. First, my research question arises from the important role played by the executive incentive compensation

in the overall corporate governance. In a survey of the literature on CEO compensation, Frydman and Saks (2010) find that CEO compensation and portfolio incentives are correlated with a wide range of corporate behaviors such as: risk taking, manipulation, financial and investment policies. However, they note that it is difficult to measure the causal effects of compensation arrangements on firms value because of endogeneity.

Second, the debate over the determinants of executive compensation is very intense. Conyon (2014) shows that executive compensation has grown significantly from 1992 to 2002. The structure of the executive compensation has also changed. Compared to the early 1990s when the majority of the pay consisted of base salaries, in 2012 stock options and restricted stock form the major components of executive compensation in the US. The author also find that on average, executive compensation is positively correlated with firm size and firm performance.

Third, the impact of credit rating on the financial system is another important area of research. Bolton, Freixas and Shapiro (2012) analyse the conflicts of interest of credit rating agencies. Their model takes into account the facts that: issuer's payment may influence ratings, issuers may shop for ratings, credit rating agencies models may vary in precision, barriers to entry creates market power for the agencies, reputation considerations affect decision making, and that there are different clienteles for investments. The authors find that a monopoly is more efficient than a duopoly because it reduces the issuer's ability to shop and mislead naive investors.

Fourth, given the crucial role that it plays in the capital structure, the literature on how the use of debt is affected by credit rating is abundant. Rauh and Sufi (2010) find that the distribution of the capital structure changes after a downgrade from investment-grade to speculative-grade. Before the downgrade, companies rely only on senior unsecured debt and equity. By contrast, after the downgrade, there is an increased dependence on both secure bank debt, subordinated bonds, and convertibles. My study empirically links credit-rating variations with executive incentive compensation.

The rest of the paper is organized as follows. In the next two sections, I first explain the methodology, then describe the data. In Section 4, I present the results and conclude with a discussion in section 5.

2 Methods

My focus is the hypothesis that credit risk (captured by the credit rating assigned to the firm) alters corporate governance (captured by the proportion of the CEO's incentive compensation) because higher probability of default intensifies agency problems. Understanding executive compensation is important from an economic perspective because it is a potential solution to the latent moral hazard problem arising from the separation of the firm ownership and control (Conyon, 2014).

There is a good reason to believe that the model of CEO incentive compensation suffers from omitted variable problems. This complication would make the explanatory variable of interest, credit rating, correlated with the error term in the econometric model. Because such correlation biases the estimated coefficients, I need an estimation strategy that addresses this issue.

2.1 Theoretical Models

I write the implicit theoretical model of Corporate Governance in general form as

$$CorporateGovernance = F(CreditRisk, \boldsymbol{X}) \tag{1}$$

where Corporate Governance is measured by the fraction of the CEO Incentive Compensation, Credit Risk is proxied by the Credit Rating, and $\boldsymbol{X}$ is a vector of exogenous regressors.

The explicit theoretical model of CEO incentive-based pay is:

$$CEOIncentiveCompensation = \beta_0 + \beta_1 CreditRating + \boldsymbol{X}\boldsymbol{\beta} + \epsilon \tag{2}$$

As noted above, omitted variables would make the Credit Rating correlated with the error term in Eq. (2) and bias the estimated coefficients. Accordingly, I include unobserved individual-specific effects in the model to purge the correlation between $CreditRating$ and ϵ. Thus, I specify a model of CEO Incentive Compensation written as a function of the exogenous variables $\boldsymbol{X}$ in Eq. (2), the individual-specific effects α_i and the error term $\epsilon_{i,t}$:[1]

$$CEOIncentiveCompensation_{i,t} = \beta_0 + \beta_1 CreditRating_{i,t} + \boldsymbol{X}_{i,t}\boldsymbol{\beta} + \alpha_i + \epsilon_{i,t} \tag{3}$$

[1]Individual-specific effect captures all unobserved, time-constant factors that affects the dependent variable. In this case, it includes firm-specific effects and CEO-specific effects.

Eq. (3) is the individual-effects model and the general modeling framework for analyzing panel data (Greene, 2012).[2] The two different models for the unobserved individual-level effect α_i are the Random-Effects (RE) model and the Fixed-Effects (FE) model. The Hausman specification test helps determine whether the FE model is better suited than the RE model.

2.1.1 Pooled Model

Wooldridge (2008) recommends that in addition to estimating the RE and FE models, it is usually informative to compute the corresponding pooled OLS estimates. Indeed, comparing these three sets of estimates can help determine the nature of the biases caused by the leaving the unobserved effect either entirely or partially in the error term.

The Pooled Model or Population-Averaged Model is the simplest version of the model. It assumes that unobserved individual effects are included in the error term:

$$CEOIncentiveCompensation_{i,t} = \beta_0 + \beta_1 CreditRating_{i,t} + \boldsymbol{X}_{i,t}\boldsymbol{\beta} + \mu_{i,t} \tag{4}$$

where $\mu_{i,t} = \alpha_i + \epsilon_{i,t}$.

Assuming that errors are not serially correlated, the Ordinary Least Square (OLS) estimation method on Eq. (4) provides consistent and efficient estimates of the slope vector $\boldsymbol{\beta}$.[3] However, with panel data the assumptions underlying OLS estimations of the pooled model are unlikely to be met (Greene, 2012). Indeed, the pooled model treats the data as a pooled cross section where every year a new random sample is drawn. This is inappropriate because a panel follows the same cross-sectional firms over a given time period. Wooldridge (2008) identifies two main advantages of a panel data. First, having multiple observations on the same firms allows to control for some unobserved firm's characteristics. The use of panel data can facilitate causal inference in situation where inferring causality would be difficult if only a single cross section were available. Second, panel data allow to analyse the importance of lags in behavior or the result of decision making. This feature can be significant because most economic policies are expected to have an impact only after some time has passed.

[2]Under the assumption that Eq. (3) is linear. Indeed, in this study, the dependent variable is quantitative and continuous.

[3]Wooldridge (2008) warns that the OLS standard errors underestimate the true standard errors when there is autocorrelation of the errors (This means that present observations are linked to past observations).

2.1.2 Random Effects Model

The Random-Effects (RE) model explicitly includes the unobserved individual heterogeneity α_i as in Eq. (3). But, the model assumes that α_i is uncorrelated with each explanatory variables in all time periods. The Generalized Least Square (GLS) estimating method is then applied.[4]

The important advantage of the RE model over the FE model is that it yields estimates of all coefficients and hence all marginal effects, even those of time-invariant regressors.[5] However, these estimates are inconsistent if the FE model is appropriate (Cameron and Trivedi, 2010).

2.1.3 Fixed Effects Model

The Fixed-Effects (FE) model permits α_i in Eq. (3) to be correlated with the regressors $\boldsymbol{X}_{i,t}$. Nevertheless, it is possible to consistently estimate $\boldsymbol{\beta}$ for time-varying regressors. To do so, appropriate differencing transformations are applied to Eq. (3) that eliminate α_i. Then, the least square estimation method is applied.

The attraction of the FE model is that we can obtain a consistent estimate of the marginal effect of a regressor, provided it is time-varying, even if the regressors are endogenous (Cameron and Trivedi, 2010).

If the Hausman test for fixed-effects rejects the null hypothesis it means that the key RE assumption (α_i is uncorrelated with each independent variable in all time periods) is false.[6] Hence, the FE estimates are more appropriate because they are consistent.

[4] Unlike the OLS method, the GLS eliminates the serial correlation problem.

[5] The FE transformation eliminates all variables (observable and unobservable) that don't change over time. For example, the FE model would not be able to estimate the coefficients on the industry of a firm.

[6] Hausman test Ho: difference in FE and RE coefficients not systematic.

2.2 Empirical Model

I arrived at the empirical individual-effects model in Eq. (5):

$$\begin{aligned} CEOIncentiveCompensation_{i,t} = \alpha_i + \beta_0 + \beta_1 CreditRating_{i,t-1} \\ + \beta_2 Leverage_{i,t} + \beta_3 GrowthOpportunity_{i,t} + \beta_4 FirmSize_{i,t} + \beta_5 Industry_i \\ + \beta_6 CEOAge_{i,t} + \beta_7 NewCEO_{i,t} + \beta_8 Year_{t-1} + \epsilon_{i,t}, \quad (5) \end{aligned}$$

where $CEOIncentiveCompensation_{i,t}$ is the proportion of CEO incentive compensation in firm i in year t, α_i is the individual-specific effect, $CreditRating_{i,t-1}$ is the credit rating assigned to firm i in year $t-1$, $Leverage_{i,t}$ is the leverage of firm i in year t, $GrowthOpportunity_{i,t}$ is the growth opportunity of firm i in year t, $FirmSize_{i,t}$ is the size of firm i in year t, $Industry_i$ is the industry in which firm i operates, $CEOAge_{i,t}$ is the age of the CEO of firm i in year t, $NewCEO_{i,t}$ is a dummy controlling for a CEO change in firm i in year t, $Year_t$ is a time dummies controlling for idiosyncratic economy-wide shocks to the proportion of CEO incentive compensation and $\epsilon_{i,t}$ is the error term.

The independent variable of interest Credit Rating measures the probability of default. I expect better Credit Rating to be associated with higher proportion of CEO incentives. Michiels et al. (2013) explain that a lower credit rating increases agency costs to which the firm responds by increasing the pay-for-performance to closely tie the CEO's wealth to the value of the firm. Ryan and Wiggins (2001) find that firms use options to encourage the manager to take risks. One of the goal of my thesis is to infer causality from the Credit Rating to the structure of the executive compensation. Therefore, I lag Credit Rating to take into account the time necessary for corporate governance to adjust its compensation policy.

Consistent with prior studies, I include several control variables in the model to account for other factors that might affect the Chief Executive's compensation scheme. I use three variables to control for the firm's characteristics. The first is Leverage. I expect a negative relationship between the leverage ratio and the fraction of CEO incentive pay. Brealey, Myers and Allen (2011) mention that by monitoring to protect its loan, the lender also protects shareholders' interest. Moreover, Ryan and Wiggins (2001) corroborate John and John (1993) findings that high levels incentives exacerbate the equity-debt agency conflict.

Indeed, they notice that pay-for-performance compensation provides incentives to choose risky projects at the expense of bondholders.

The second variable is Growth Opportunity captured by the Market-to-Book ratio. A high M/B indicates that a large portion of the firm's value is derived from future investments (rather than from existing assets). More intangible assets makes the firm less transparent and therefore makes monitoring of management more difficult (Rayan et al., 2000; Himmelberg, Hubbard, and Palia, 1999). Therefore, I expected the Market-to-Book ratio to have a positive sign.

I expect the coefficient on the third variable, Firm Size, to have a positive. Indeed, Chief Executives of larger firms perform more complex operations hence increasing the possibility of agency conflicts.

The fourth and fifth variables I add are Industry and Year to capture industry and time trends respectively. I expect a positive sign for Year to reflect the notion that CEO incentives have become more linked to performance since the 1980s (Frydman and Saks, 2010; Kaplan, 2013).

In addition to theses firm's variables, I take into account some of the CEO's characteristics.[7] The Managerial Horizon Hypothesis posits a non-linear relationship between CEO Age and incentives. Indeed, there is a conflict of interest between the younger and older CEOs' short-term managerial horizon, and the firm's long-term investment horizon. Rayan et al. (2000) propose that younger CEOs have the incentives to focus on short-term outcomes to build their reputations, and older CEOs have the incentives to choose projects that pay off before retirement. Finally, I include an indicator to control for CEO changes. I expect intensified principal-agent problem when a firm appoints new CEO because of greater uncertainty. Indeed, it is easier for the firm to monitor the behavior of a longer-tenured CEO with whom the board is more familiar.

[7]Gender is not included in the analysis because our sample contains only four firm-year observations where the CEO is a woman. Notwithstanding, and thanks to the transformation in the Fixed-Effect model, gender like all the other CEO-effects (education, race, etc.) are controlled for.

3 Data

Rauh and Sufi (2010) provide a clean set of data on credit rating and capital structure for about publicly-traded firms over the period 1996 through 2006. The sampling universe for the random sample includes non-financial firms from Compustat database with a long-term issuer credit rating in at least one year from 1996 to 2006.[8] The sample is limited to companies with at least two consecutive years of data. The final sampling universe includes 1,889 rated firms, from which the authors randomly sample 305.

I use this random sample as the starting point. Thanks to the firm's unique identifier, I am able to construct a corresponding dataset from Execucomp database containing information about the CEOs. I then merge both datasets. Table 1 summarizes the data.

3.1 Dependent Variable

In my analysis, I focus on the CEO incentives as a proportion of CEO total compensation. I define incentives as the sum of bonuses, restricted stock grants and options granted. Murphy (2012) finds that stock option and restricted stock form the major component of the executive compensation in the U.S.[9] I use the ratio of CEO incentives to total compensation because the level of this proportion captures the corporate policy with regards to the CEO's compensation package.[10]

Table 1 indicates that in a typical year, the mean of CEO incentive compensation is 61% and the median is at 68%. The detailed distribution of CEO incentive compensation is illustrated in Fig. 1.

Fig. 2 shows the evolution of CEO incentive-pay over time. First, there was an increasing trend from 1996 to 2001. In 2001, the median of CEO incentives reached its peak at 75%. Then, it indicates a decreasing trend from 2004 onwards. Frydman and Saks (2010) note that since the 1950s, both stock options and other forms of incentive pay have become larger

[8]Firm-year observations that are in Chapter 11 proceedings are excluded because in such situation, some of relevant data are not recorded in Compustat (Rauh and Sufi, 2010).

[9]Brealey, et al.(2011) find that CEOs in the US receive over three times the pay of German CEOs and almost ten times the pay of Japanese CEOs. They also emphasize that a large and increasing fraction of CEO compensation in the US comes from variable bonuses, stock options, and other long-term incentives.

[10]In Execucomp, Total compensation (TDC1) = annual salary + bonus and other annual pay + the value of restricted stock granted + the Black-Scholes value of options granted + long-term incentive payouts + all other compensation.

shares of total compensation over time.

3.2 Independent Variables

There are many alternative methods of measuring credit risk: credit scoring models, credit scorecards, bond yield spreads, credit default swap spreads, etc. However, Kisgen (2007) notes that since their first issuance in 1909, credit ratings have been widely regarded by investors, regulators, public media, suppliers, financial counterparties, and customers as primary indicators when assessing the credit risk of firms. I therefore choose credit ratings as a proxy for credit risk.

There are three principal rating services: Moody's, Standard & Poor's, and Fitch.[11] I use S&P ratings for data availability considerations.[12] According to S&P, bond ratings are judgment about firms' financial and business prospects in general, and in particular they reflect the probability of default. There is no fixed formula by which ratings are calculated. Nevertheless, Brealey, et al.(2011) find that investment bankers, bond portfolio managers, and others who follow the bond market closely can get a fairly good idea of how a bond will be rated by looking at few key numbers such as the firm's debt ratio, the ratio of earnings to interest, and the return to assets.

In the main analysis, the multiple ratings are collapsed into 4 levels, captured by dummy variables: rated A or higher (the base category), rated BBB, rated BB, and B or lower rating.[13] In an alternative specification, I use a two-level classification scheme indicated by a dummy variable: Investment-Grade for corporations rated BBB or better (the base category), and Speculative-Grade for those rated BB or worse. Using Speculative-Grade instead of the four-category Credit Rating allows to evaluate the difference between investment-grade and junk bond status. Indeed, getting below this threshold is a game changer because commercial banks, many pension funds, and other financial institutions are not allowed to

[11]The "Big three" credit agencies control approximately 95% of the ratings business. The SEC has been concerned about the power they wield. Brealey et al. (2011) report that the SEC has since approved five new services: Dominion Bond (2003), A.M. Best (2005), Egan-Jones Rating (2007), Japan Credit Rating Agency (2007), and Ratings and Investment Information (2007).

[12]Also, Rauh and Sufi (2010) found that Moody's and S&P downgrades are highly correlated.

[13]S&P assigns more that twenty credit rating categories where the highest-quality bonds are rated AAA and D is the lowest rating. Kuang et al. (2013) results were robust to combining ratings and using fewer rating classes.

invest in bonds unless they are investment-grade (Brealey, Myers and Allen, 2011).

Figure 3 illustrates the Credit Rating distribution. On average over the period of time, firms rated A or higher comprise 22% of the sample. Firms rated BBB or rated BB represent 26% and 29% respectively. The remaining 23.8% is made up of firms rated B or lower. Figure 4 shows the evolution of credit rating across time. It indicates that for the first two years, the median rating was BBB while the rest of the period from 1998 to 2006 has median rating of BB.[14]

Figure 5 shows the evolution of Credit Rating across time for 16 randomly selected firms. Half of theses firms experienced credit rating deteriorations during the late 1990s and early 2000s. Kuang et al. (2013) note that rating agencies have tightened up their evaluation criteria and provided less optimistic assessments since early 2000s accounting scandals.

Figure 6 shows the distribution of CEO Incentive Compensation across credit quality. The higher the firm is rated, the greater is the proportion of the CEO's incentives. Indeed, on average, the CEO of a firm rated A or higher receives a little more than 66% of his pay in form of incentives. Regarding firms rated BBB or BB, their CEO's incentive-pay comprise respectively 63% and 60% of the total compensation. For companies that have a B or lower rating, the typical CEO gets incentives which proportion is less than 58%.

In this paper, I account for three firm's control variables (collected from Compustat) and control for two CEO's characteristics (variables collected from Execucomp).

Let's start with firm's characteristics. Leverage is the ratio of Total Debt to Total Capitalization.[15] In a typical year, the average company in the sample has total debt that represents 50% of its total capital. Growth Opportunity is captured by the ratio of Market Value to Book Value (M/B).[16] The market is selling each $1 of net worth for $1.84. I take into account firm size proxied by Ln of sales revenues.[17] I use industry code SIC 2-digit. The industry of reference is SIC 10 (Metal Mining). For example, SIC 45 is Transport by air, and SIC 58 is Eating and drinking places. The highest frequency is SIC 49 "Electric, Gas and Sanitary Services" (201 firm-year observations). The lowest frequency is SIC 65 "Real

[14]The results from the regressions excluding the first two years 1996 and 1997 are not significantly different from the regressions results which account for the full period of time.

[15]Total Capitalization = Total Debt + Shareholder's Equity.

[16]Note that to reduce the effects of outliers, Growth opportunity is winsorized 1%(Rauh and Sufi, 2010).

[17]The natural logarithm transformation reduces the impact of outliers and correct for non normality.

Estate" (2 firm-year observations). The base year is 1996.

Regarding CEO's variables, over the period of time, the CEO is 56 years old on average with the youngest being 36 years old and the oldest 90 years old. The variable New CEO is a dummy that takes the value one when the executive is new to the position. In a typical year, 17% of all the CEOs are new to the position. The standard deviation of New CEO is 38%.

4 Results

I estimate the models using two specifications of the main independent variable (Credit Rating and Speculative-Grade) and three estimation strategies: Ordinary Least Squares (OLS), Random-Effects (RE) and Fixed-Effects (FE). The main regressions are displayed in Table 2 and Table 3. The results are clear and consistent across all six specifications regardless of which version of the main independent variable I use. All other factors held constant, the Chief Executive's incentive-based compensation is on average significatively higher in low-rated firms compared to high-rated firms.

Let's begin with the control variables. The time dummies are significant and positive in years 2001 and 2004 in table 2, column (1) and in years 2001, 2002 and 2004 in table 2, column (2) indicating a trend toward a higher proportion of CEO incentives over our sample period. In accordance with Ryan (2001), Firm Size is a significant determinant of the proportion of CEO incentives with the expected positive coefficient. Leverage and Growth Opportunity are significant. Leverage has the expected negative coefficient while the coefficient on Growth Opportunity is positive as expected. CEO Age is not significant and CEO Age (squared) is significant (at the 10% level) and negative. These results indicate that in our sample, the age of the CEO does not significantly affect the proportion of incentive compensation. The dummy New CEO is significant and has a positive coefficient. This suggests that compared to executives who have been CEOs for some time, newly appointed CEOs receive a greater proportion of incentives. Looking at standardized beta coefficients indicates that among the explanatory variables, Firm Size has the greatest impact on the incentive-intensity of CEO compensation.[18]

[18]A standardized beta coefficient represents the change in the dependent variable associated with a stan-

I have two versions of the Credit Rating variable. The first one has four levels, indicated by dummy variables: rating A or above, which is the base category, rating BBB, rating BB, and rating B or below. The second has two levels, indicated by a dummy variable: Investment-Grade (BBB or above), which is the base category, and Speculative-Grade (below BBB).

The main equation is shown in Table 2, column (1). My main independent variable of interest, lagged Speculative-Grade, has a positive coefficient of about 0.05 that is significant at the 5% level: relative to investment-grade firms, speculative-grade firms have their CEO incentive compensation higher by about five percentage points. Also, Table 3, column (1) reveals that compared to firms rated A or above, the CEO incentives in firms rated BB are higher by six percentage points. Moreover, CEOs in firms rated B or below receive a proportion of incentives that is higher by five percentage points compared to the proportion of incentives received by CEOs in firms rated A or above. The Random-Effects regressions, shown in Table 2, column (2) tells the same story as the OLS: a higher proportion of the CEO incentive by about six percentage points when comparing firms rated investment-grade to firms rated speculative-grade. Again, the Random-Effects model in. Table 3, column (2) shows that comparing corporations rated A or above to corporations rated BB, and comparing those rated A or above to those rated B or below, the CEO incentives is higher by 8% points and 12% points respectively. Finally, considering the Fixed-Effects regressions, they mirror the results of the Random-Effects model. In table 2, column (3), Speculative-Grade is significant at the 10% level, with a coefficient of 0.0576. Also, in table 3, column (3) both Rating BB and Rating B or below are still significant (at the 5% level and 1% level) with coefficients 0.109 and 0.208 respectively.

The results of Hausman specification test indicate that Fixed-Effects estimates are not statistically different from Random-Effects estimates (The overall statistic has $p = 0.7842$). Therefore, the Random-Effects specification is the most appropriate model for my study because it provides efficient estimators.

dard deviation change in the independent variable. This transformation allows the comparison of the impacts of variations amongst the different independent variables.

5 Discussion

My thesis is closely related to several debates in corporate-finance literature regarding credit rating and executive compensation structure. My goal is to determine whether credit risk has an impact on corporate governance. I use a large sample of rated public firms observed between 1996 and 2006. My analysis suggests that, holding all other factors constant, on average low-credit-quality firms have a higher incentive-based CEO compensation compared to high-credit-quality firms. Precisely, compared to firms rated investment-grade, Chief Executives in firms rated speculative-grade get on average higher incentive compensation by about six percentage points. Additionally, comparing firms rated A or above to firms rated BB, and also comparing those rated A or above to those rated B or below, the CEO incentive-pay is on average higher by 8% points and 12% points respectively. This means that credit ratings assigned to firms by rating agencies affect the corporate compensation policy.

I apply a three-fold strategy to ensure these results are robust. First, I lag the independent variable of interest and use two different specifications (credit rating and speculative-grade). Second, I add seven variables to control for firm's and CEO's characteristics. Third, to help correct for omitted variables and autocorrelation, I estimate three models: the Pooled, the Random-Effects and Fixed-Effects. This allows me to conduct a Hausman specification test, which determines that the Random-Effects model is the most appropriate for my panel.

I find that relative to the situation in high-rated firms, the board of directors in low-rated firms designs executive's compensation plans with higher proportion of incentives. What would explain the differences in the structure of the executive compensation between these high-rated firms and low-rated firms ? The main hypothesis is that assigning a lower credit rating signals that the firm's probability of default is higher. In turn, this exacerbates the principal-agent problem between the shareholders and the Chief Executive. Indeed, a higher bankruptcy risk may result in the executive acting in his/her own best interest to the detriment of the shareholders' best interest.[19] Finally, to alleviate these heightened agency costs, the board of directors in low-rated firms aligns CEOs' and shareholders' interests by

[19] In 2001, the notorious collapse of energy giant Enron was amplified in part because facing the prospect of bankruptcy, managers engaged in elaborated accounting fraud to mislead investors.

increasing the proportion of equity-based compensation.

As in Ryan and Wiggins (2001) and Kuang et al. (2013), I show that the proportion of CEO incentives are higher in larger firm. Unlike Ryan and Wiggins (2001), I do not find that a significant impact of the CEO's age on the proportion of CEO's incentive-pay. However, I find a novel determinant of CEO's incentives, namely the extent to which appointing a new Chief Executive affects the proportion of incentives. My analysis suggests that compared to firms where the Chief Executive is maintained, the firms that appoint a new Chief Executive provide him/her with a more incentive-intensive compensation by about three percentage points.

My conclusion about the managerial compensation policy in lower-credit-quality firms appears to be at odds with that of Kuang et al. (2013) who evaluate the significance of credit ratings in the design of the CEO compensation. Their conclusion is that the greater the firms' concerns about their credit rating the more aggressively they will reduce manager's incentives. By contrast, I find that the corporate compensation policy of firms with low credit ratings provides a higher incentive-based pay for their CEO relative to situation of firms with high credit ratings. However, the two studies differ in significant ways. First, Kuang et al. (2013) do not set up incentives as a fraction of total compensation to capture corporate executive compensation policy. Instead they use log of incentives.[20] Second, they analyse options and stocks separately. Third, instead of comparing the situation for investment-grade rated firms and speculative-grade rated firms, Kuang et al. (2013) look at the effects of downgrades to the lower edge of the investment-grade category.

Given the recent major scandals in part due to inaccurate ratings, one direction for future research is to investigate whether in their assessment, credit rating agencies account for all relevant factors including executive characteristics.[21] Another interesting question is whether a Chief Executive who receives a higher proportion of incentives actually achieves a higher value of the firm compared to a Chief Executive with a lower incentive-based compensation.

[20]They use two measures for incentives: vega and delta. The former is the option's sensitivity to underlying instrument's volatility and the latter is option's sensitivity to underlying instrument's price.

[21]Examples include the 2001 Enron and WorldCom bankruptcies and, especially the 2007-8 subprime mortgage crisis.

References

Alali, Fatima, Asokan Anandarajan, and Wei Jiang (2012). "The Effect of Corporate Governance on Firm's Credit Ratings: Further Evidence Using Governance Score in the United States". In: *Accounting & Finance* 52.2, pp. 291–312. ISSN: 1467-629X. DOI: 10.1111/j.1467-629X.2010.00396.x. (Visited on 02/22/2017).

Ashbaugh-Skaife, Hollis, Daniel W. Collins, and Ryan LaFond (2006). "The Effects of Corporate Governance on Firms' Credit Ratings". In: *Journal of Accounting and Economics*. Conference Issue on Implications of Changing Financial Reporting Standards 42 (1–2), pp. 203–243. ISSN: 0165-4101. DOI: 10.1016/j.jacceco.2006.02.003. (Visited on 02/23/2017).

Bolton, Patrick and Xavier Freixas (2000). "Equity, Bonds, and Bank Debt: Capital Structure and Financial Market Equilibrium under Asymmetric Information". In: *Journal of Political Economy* 108.2, pp. 324–351. URL: http://econpapers.repec.org/article/ucpjpolec/v_3a108_3ay_3a2000_3ai_3a2_3ap_3a324-351.htm (visited on 07/08/2017).

Bolton, Patrick, Xavier Freixas, and Joel Shapiro (2012). "The Credit Ratings Game". In: *The Journal of Finance* 67.1, pp. 85–111. ISSN: 1540-6261. DOI: 10.1111/j.1540-6261.2011.01708.x. (Visited on 02/03/2017).

Boubakri, Narjess and Hatem Ghouma (2010). "Control/Ownership Structure, Creditor Rights Protection, and the Cost of Debt Financing: International Evidence". In: *Journal of Banking & Finance* 34.10, pp. 2481–2499. ISSN: 0378-4266. DOI: 10.1016/j.jbankfin.2010.04.006. (Visited on 02/22/2017).

Brealey, Richard A., Stewart C. Myers, and Franklin Allen (2011). *Principles of Corporate Finance*. Google-Books-ID: T9y4SgAACAAJ. McGraw-Hill/Irwin. 944 pp. ISBN: 978-0-07-131417-6.

Cameron, A. and Pravin Trivedi (2010). *Microeconometrics Using Stata, Revised Edition*. Stata Press Books. StataCorp LP. URL: http://econpapers.repec.org/bookchap/tsjspbook/musr.htm (visited on 07/08/2017).

"CEO Compensation" (2010). In: *Annual Review of Financial Economics* 2.1, pp. 75–102. DOI: 10.1146/annurev-financial-120209-133958. (Visited on 02/22/2017).

Coase, R. H. (1937). "The Nature of the Firm". In: *Economica* 4.16, pp. 386–405. ISSN: 1468-0335. DOI: 10.1111/j.1468-0335.1937.tb00002.x. (Visited on 08/03/2017).

Conyon, Martin J. (2014). "Executive Compensation and Board Governance in US Firms". In: *The Economic Journal* 124.574, F60–F89. ISSN: 1468-0297. DOI: 10.1111/ecoj.12120. (Visited on 02/23/2017).

Core, John E. and Wayne R. Guay (2002). *The Other Side of the Trade-Off: The Impact of Risk on Executive Compensation: A Revised Comment*. SSRN Scholarly Paper ID 292955. Rochester, NY: Social Science Research Network. URL: https://papers.ssrn.com/abstract=292955 (visited on 02/23/2017).

Demirtas, K. Ozgur and Kimberly Rodgers Cornaggia (2013). "Initial Credit Ratings and Earnings Management". In: *Review of Financial Economics* 22.4, pp. 135–145. ISSN: 1058-3300. DOI: 10.1016/j.rfe.2013.05.003. (Visited on 02/23/2017).

Dittmann, Ingolf, Ko-Chia Yu, and Dan Zhang (2016). *How Important Are Risk-Taking Incentives in Executive Compensation?* SSRN Scholarly Paper ID 1176192. Rochester,

NY: Social Science Research Network. URL: https://papers.ssrn.com/abstract=1176192 (visited on 02/22/2017).

Edmans, Alex and Qi Liu (2011). "Inside Debt". In: *Review of Finance* 15.1, pp. 75–102. ISSN: 1572-3097. DOI: 10.1093/rof/rfq008. (Visited on 08/05/2017).

Executive Compensation: An Overview of Research on Corporate Practices and Proposed Reforms - Faulkender - 2010 - Journal of Applied Corporate Finance - Wiley Online Library (2017). URL: http://onlinelibrary.wiley.com/doi/10.1111/j.1745-6622.2010.00266.x/full (visited on 02/22/2017).

Fahlenbrach, Rüdiger and René M. Stulz (2011). "Bank CEO Incentives and the Credit Crisis". In: *Journal of Financial Economics* 99.1, pp. 11–26. ISSN: 0304-405X. DOI: 10.1016/j.jfineco.2010.08.010. (Visited on 02/22/2017).

Frydman, Carola and Raven E. Saks (2010). "Executive Compensation: A New View from a Long-Term Perspective, 1936–2005". In: *The Review of Financial Studies* 23.5, pp. 2099–2138. ISSN: 0893-9454. DOI: 10.1093/rfs/hhp120. (Visited on 02/23/2017).

Golbe, Devra L. and Ingmar Nyman (2013). "How Do Share Repurchases Affect Ownership Concentration?" In: *Journal of Corporate Finance* 20, pp. 22–40. ISSN: 0929-1199. DOI: 10.1016/j.jcorpfin.2012.11.002. (Visited on 07/08/2017).

Graham, John R., Si Li, and Jiaping Qiu (2012). "Managerial Attributes and Executive Compensation". In: *The Review of Financial Studies* 25.1, pp. 144–186. ISSN: 0893-9454. DOI: 10.1093/rfs/hhr076. (Visited on 07/12/2017).

Greene, William H. (2012). *Econometric Analysis*. Pearson Education, Limited. 1228 pp. ISBN: 978-0-273-75356-8.

Himmelberg, Charles P., R. Glenn Hubbard, and Darius Palia (1999). "Understanding the Determinants of Managerial Ownership and the Link between Ownership and Performance". In: *Journal of Financial Economics* 53.3, pp. 353–384. ISSN: 0304-405X. DOI: 10.1016/S0304-405X(99)00025-2. (Visited on 08/02/2017).

Hogg, Robert V., Joseph W. McKean, and Allen Thornton Craig (2013). *Introduction to Mathematical Statistics*. Google-Books-ID: xFlVYAAACAAJ. Pearson. 694 pp. ISBN: 978-0-321-79543-4.

Huang, Yu-Li and Chung-Hua Shen (2015). "Cross-Country Variations in Capital Structure Adjustment—The Role of Credit Ratings". In: *International Review of Economics & Finance* 39, pp. 277–294. ISSN: 1059-0560. DOI: 10.1016/j.iref.2015.04.011. (Visited on 01/28/2017).

Jiraporn, Pornsit, Pandej Chintrakarn, and Yixin Liu (2012). "Capital Structure, CEO Dominance, and Corporate Performance". In: *Journal of Financial Services Research* 42.3, pp. 139–158. ISSN: 0920-8550, 1573-0735. DOI: 10.1007/s10693-011-0109-8. (Visited on 02/22/2017).

John, Teresa A. and Kose John (1993). "Top-Management Compensation and Capital Structure". In: *The Journal of Finance* 48.3, pp. 949–974. ISSN: 0022-1082. DOI: 10.2307/2329022. JSTOR: 2329022.

Kaplan, Steven N. (2013). "CEO Pay and Corporate Governance in the U.S.: Perceptions, Facts, and Challenges". In: *Journal of Applied Corporate Finance* 25.2, pp. 8–25. ISSN: 1745-6622. DOI: 10.1111/jacf.12013. (Visited on 02/23/2017).

Kisgen, Darren J. (2007). "The Influence of Credit Ratings on Corporate Capital Structure Decisions". In: *Journal of Applied Corporate Finance* 19.3, pp. 65–73. ISSN: 1745-6622. DOI: 10.1111/j.1745-6622.2007.00147.x. (Visited on 07/14/2017).

Kuang, Yu Flora and Bo Qin (2013). "Credit Ratings and CEO Risk-Taking Incentives". In: *Contemporary Accounting Research* 30.4, pp. 1524–1559. ISSN: 1911-3846. DOI: 10.1111/1911-3846.12005. (Visited on 02/22/2017).

Liu, Yixin and Pornsit Jiraporn (2010). "The Effect of CEO Power on Bond Ratings and Yields". In: *Journal of Empirical Finance* 17.4, pp. 744–762. ISSN: 0927-5398. DOI: 10.1016/j.jempfin.2010.03.003. (Visited on 02/22/2017).

Manso, Gustavo (2013). "Feedback Effects of Credit Ratings". In: *Journal of Financial Economics* 109.2, pp. 535–548. ISSN: 0304-405X. DOI: 10.1016/j.jfineco.2013.03.007. (Visited on 02/03/2017).

Michiels, Anneleen et al. (2013). "CEO Compensation in Private Family Firms: Pay-for-Performance and the Moderating Role of Ownership and Management". In: *Family Business Review* 26.2, pp. 140–160. ISSN: 0894-4865. DOI: 10.1177/0894486512454731. (Visited on 02/22/2017).

Murphy, Kevin J. (2012). *Executive Compensation: Where We Are, and How We Got There*. SSRN Scholarly Paper ID 2041679. Rochester, NY: Social Science Research Network. URL: https://papers.ssrn.com/abstract=2041679 (visited on 07/14/2017).

Nicholson, Walter and Christopher M. Snyder (2012). *Microeconomic Theory: Basic Principles and Extensions*. Google-Books-ID: ZGNxrLRYLF4C. Cengage Learning. 786 pp. ISBN: 978-1-111-52553-8.

Nini, Greg, David C. Smith, and Amir Sufi (2012). "Creditor Control Rights, Corporate Governance, and Firm Value". In: *The Review of Financial Studies* 25.6, pp. 1713–1761. ISSN: 0893-9454. DOI: 10.1093/rfs/hhs007. (Visited on 02/22/2017).

Park, Cheol (2000). "Monitoring and Structure of Debt Contracts". In: *The Journal of Finance* 55.5, pp. 2157–2195. ISSN: 1540-6261. DOI: 10.1111/0022-1082.00283. (Visited on 07/08/2017).

Ross, Stephen A. (1973). "The Economic Theory of Agency: The Principal's Problem". In: *The American Economic Review* 63.2, pp. 134–139. ISSN: 0002-8282. JSTOR: 1817064.

Ryan Jr., Harley E. and Roy A. Wiggins III (2001). "The Influence of Firm- and Manager-Specific Characteristics on the Structure of Executive Compensation". In: *Journal of Corporate Finance* 7.2, pp. 101–123. ISSN: 0929-1199. DOI: 10.1016/S0929-1199(00)00021-3. (Visited on 02/23/2017).

Verbeek, Marno (2012). *A Guide to Modern Econometrics*. Google-Books-ID: 4UTeOZDyoeUC. John Wiley & Sons. 497 pp. ISBN: 978-1-119-95167-4.

Weber, Joseph (2006). "Discussion of the Effects of Corporate Governance on Firms' Credit Ratings". In: *Journal of Accounting and Economics*. Conference Issue on Implications of Changing Financial Reporting Standards 42 (1–2), pp. 245–254. ISSN: 0165-4101. DOI: 10.1016/j.jacceco.2006.02.002. (Visited on 02/23/2017).

Wooldridge, Jeffrey M. (2008). *Introductory Econometrics: A Modern Approach*. Google-Books-ID: 64vt5TDBNLwC. Cengage Learning. 889 pp. ISBN: 978-0-324-58162-1.

6 Tables

Table 1: Summary statistics

	Mean	Median	SD	Minimum	Maximum	Obs.
CEO Incentive Compensation	.6149046	.6781239	.2618487	0	1	1476
A or above	.2165118	0	.4119796	0	1	1829
BBB	.259158	0	.4382923	0	1	1829
BB	.2859486	0	.4519886	0	1	1829
B or below	.2383816	0	.4262102	0	1	1829
Debt/Capital	.5024357	.4778724	.3425317	-.0480456	2.935569	2453
Market/Book	1.848879	1.419685	1.364043	.7398499	9.167283	2453
Ln(Sales)	7.040891	7.09045	1.771518	-1.634756	12.72214	2452
CEO Age	56.40119	57	7.626408	36	90	1508
New CEO	.1707317	0	.3763496	0	1	2501

This table shows summary statistics for a random sample of 305 rated firms for the period 1996-2006.
I start with the dataset from Rauh & Sufi (2010). I then combine it with additional data from Execucomp.

Table 2: Main regression results using Speculative-Grade.

	OLS	RE	FE
Speculative-Grade (Lagged)	0.0512**	0.0575**	0.0576*
	(0.0210)	(0.0245)	(0.0307)
Debt/Capital	-0.0919***	-0.0885***	-0.0957**
	(0.0270)	(0.0312)	(0.0396)
Market/Book	0.0187***	0.0204**	0.0217**
	(0.00656)	(0.00794)	(0.0109)
Ln(Sales)	0.0533***	0.0586***	0.0681***
	(0.00745)	(0.0106)	(0.0244)
CEO Age	0.0121	0.0120	0.0194
	(0.00884)	(0.0111)	(0.0142)
CEO Age (squared)	-0.000150**	-0.000151	-0.000217*
	(0.0000753)	(0.0000966)	(0.000124)
New CEO	0.0353*	0.0306*	0.0288
	(0.0193)	(0.0175)	(0.0183)
Constant	-0.0283	-0.0651	-0.340
	(0.288)	(0.368)	(0.444)
Observations	957	957	957

Dependent variable = CEO Incentive Compensation (fraction).

Main independent Variable = Lagged Speculative-Grade. Omitted category: Investment-Grade.

Industry and Year dummies are omitted.

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Main regression results using Credit Rating.

	OLS	RE	FE
BBB (lagged)	0.00431	0.0318	0.0551
	(0.0213)	(0.0283)	(0.0413)
BB (lagged)	0.0552**	0.0814**	0.109**
	(0.0267)	(0.0340)	(0.0484)
B or below (lagged)	0.0498	0.122**	0.208***
	(0.0373)	(0.0477)	(0.0688)
Debt/Capital	-0.0913***	-0.0974***	-0.117***
	(0.0275)	(0.0318)	(0.0405)
Market/Book	0.0190***	0.0207***	0.0201*
	(0.00669)	(0.00800)	(0.0108)
Ln(Sales)	0.0534***	0.0657***	0.0749***
	(0.00816)	(0.0115)	(0.0245)
CEO Age	0.0123	0.0134	0.0211
	(0.00892)	(0.0113)	(0.0143)
CEO Age (squared)	-0.000152**	-0.000162*	-0.000232*
	(0.0000760)	(0.0000975)	(0.000124)
New CEO	0.0354*	0.0319*	0.0305*
	(0.0194)	(0.0175)	(0.0183)
Constant	-0.0397	-0.168	-0.442
	(0.295)	(0.377)	(0.466)
Observations	957	957	957

Dependent variable = CEO Incentive Compensation (fraction).

Main independent variable = Lagged Credit Rating. Omitted category: A or above.

Industry and Year dummies are omitted.

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

7 Figures

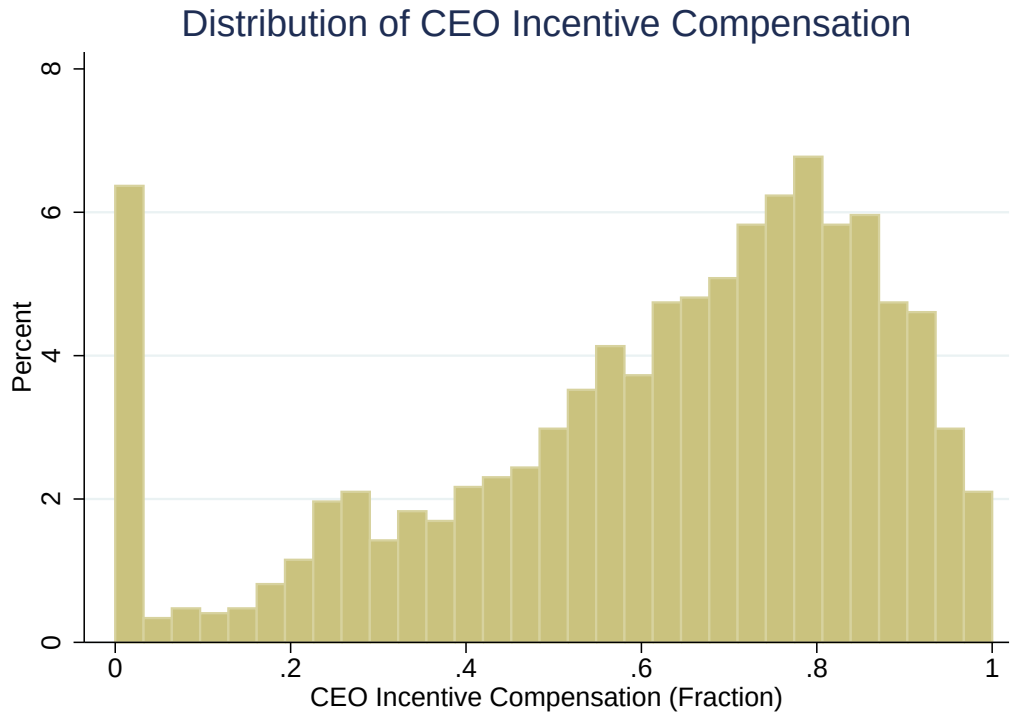


Figure 1: The distribution across firm-years of CEO Incentive Compensation.

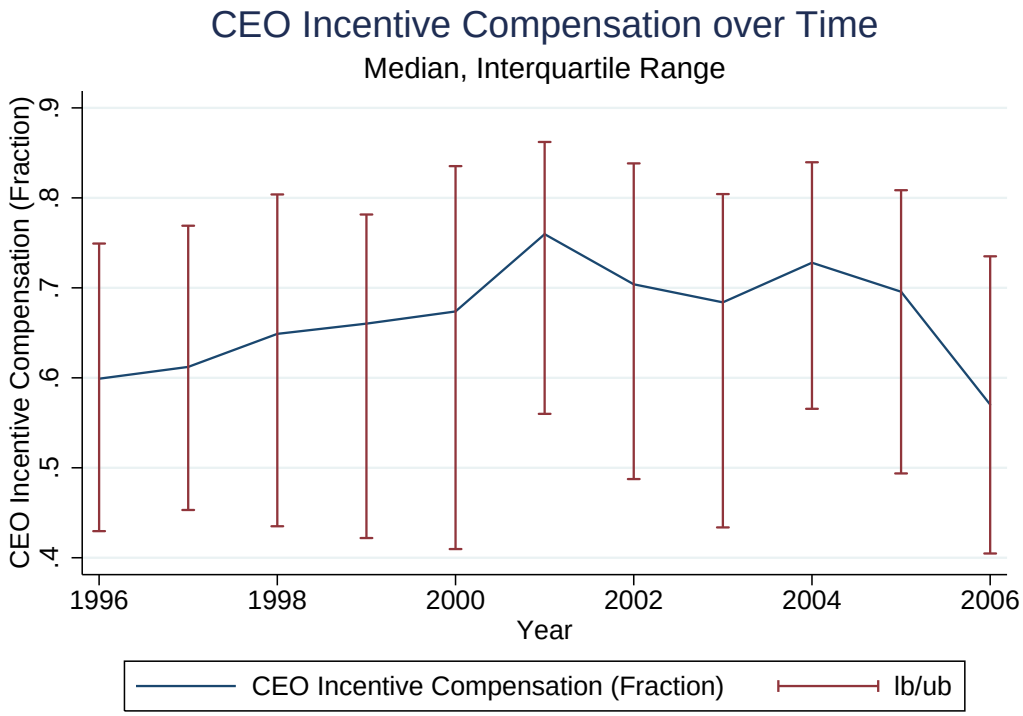


Figure 2: The distribution of CEO Incentive Compensation across time.

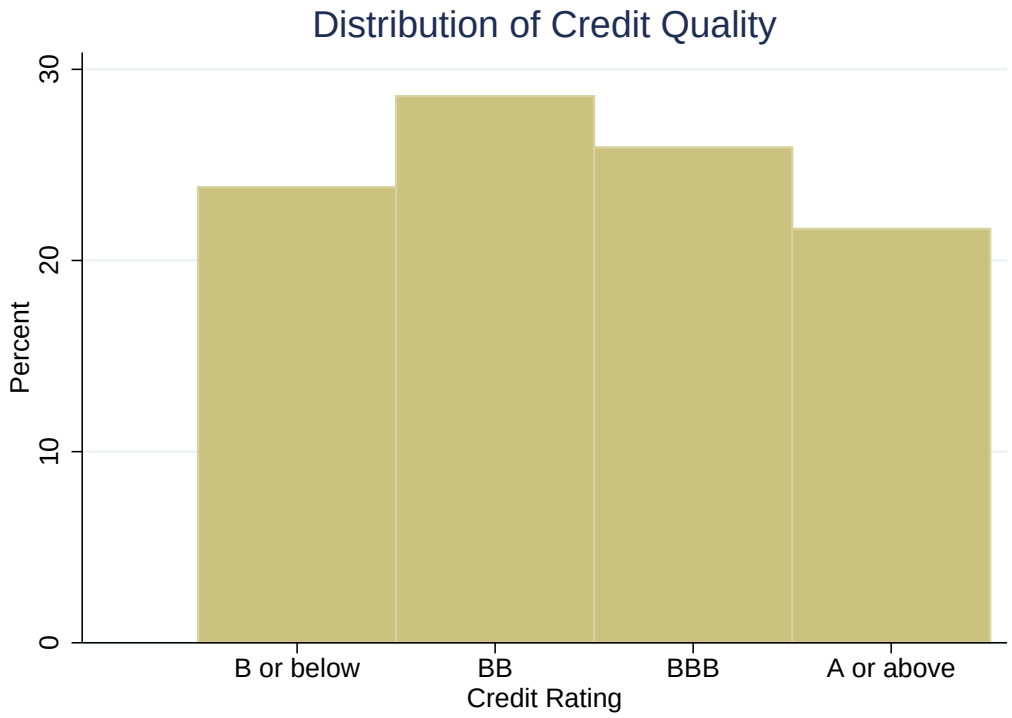


Figure 3: The distribution across firm-years of the Credit Rating.

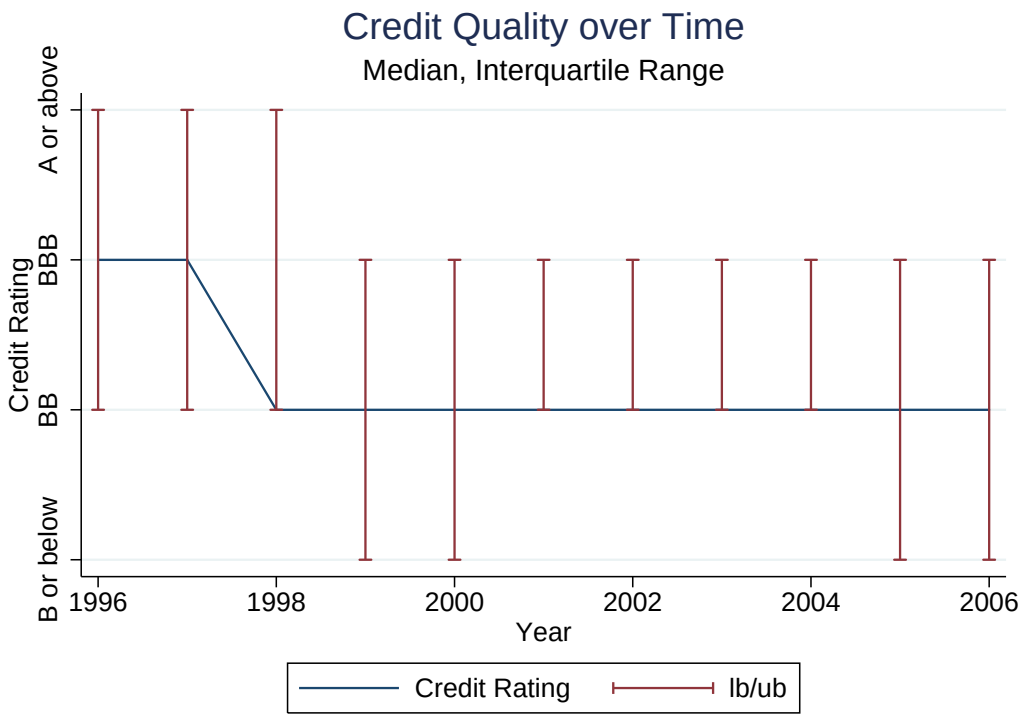
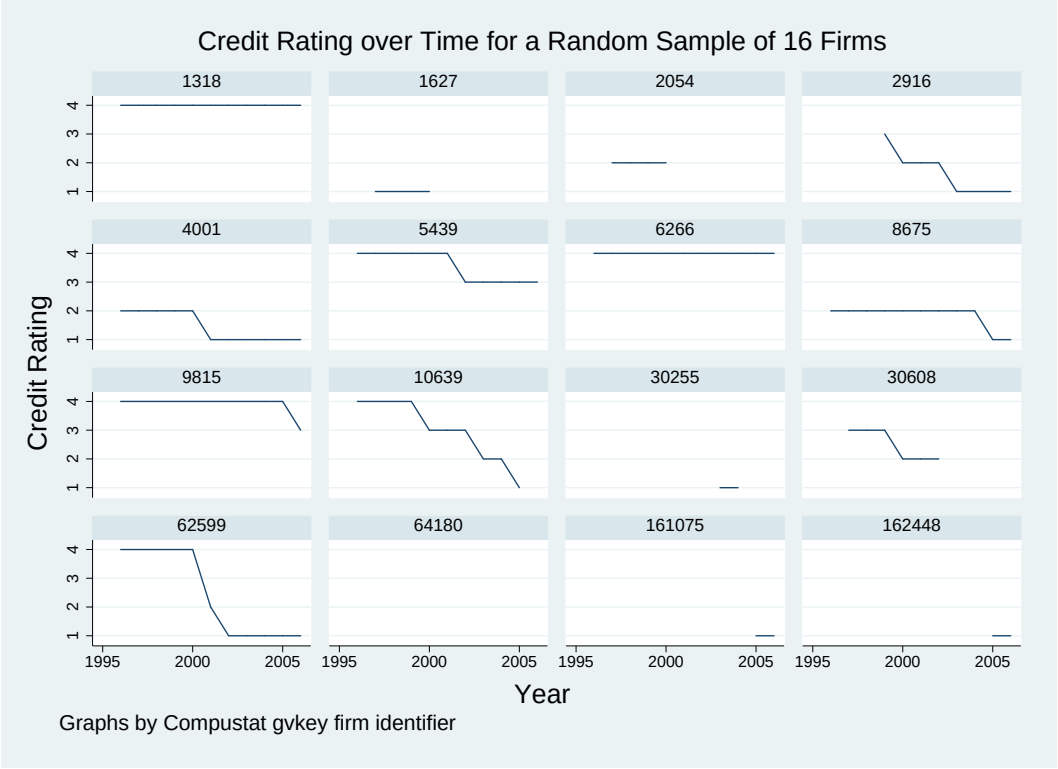


Figure 4: The distribution of Credit Rating across time.



Credit rating is a categorical variable: A or above = 4, BBB = 3, BB = 2 and B or below = 1.

Figure 5: The distribution of Credit Rating across time for 16 randomly selected firms.

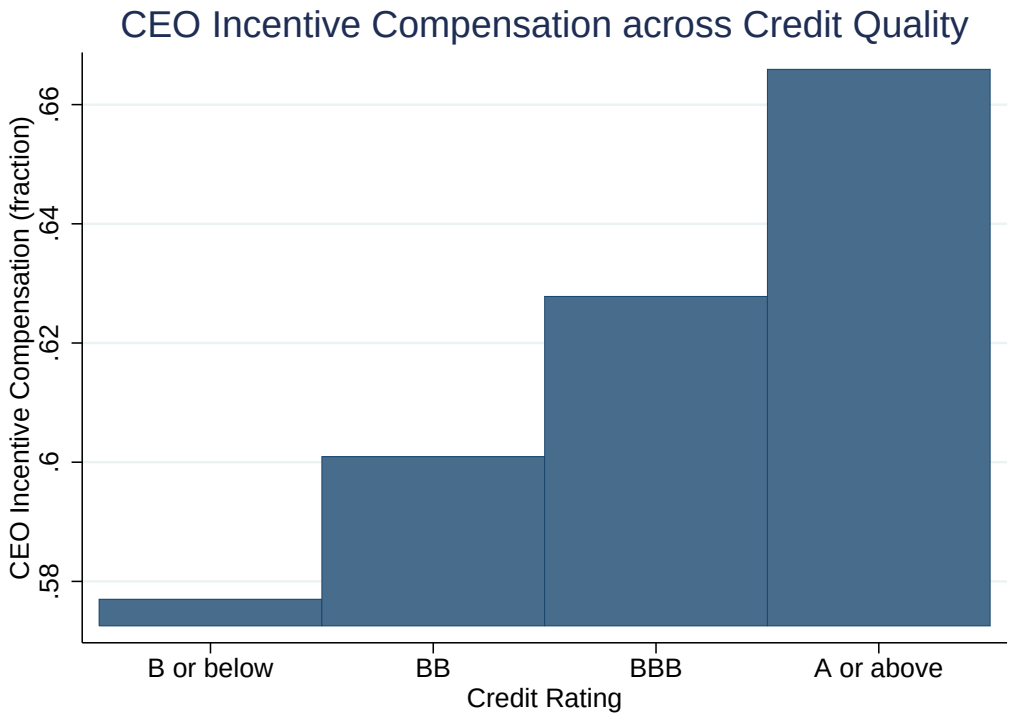


Figure 6: The distribution of Incentive Compensation across Credit Rating.