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CEO Inside Debt Compensation and European Banks' Default Risk: Evidence from GMM Panel Analysis

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ABSTRACT

This paper examines the impact of chief executive officer (CEO) inside debt compensation on bank default risk by using the two-step system generalised method of moments (GMM). The selected sample features 30 European banks, with 180 observations from 2007 to 2012. Merton's distance was used as a default model (DD), showing that increased inside debt compensation positively influences bank distance to default. This analysis indicates that debt-like compensation limits bank risk and encourages executives to reduce risk and improve bank stability. Additional further analysis shows that increased CEO inside debt holding is associated with a lower probability of insolvency. These findings support the argument that inside debt compensation is among the more effective tools seeking to align CEO incentives with debtholders' incentives. In this way, it provides empirical support for European regulators and other related responsible parties seeking ways to improve the resilience of European banks.

INTRODUCTION

The most recent credit crisis has generated great debate about the ineffective corporate governance mechanisms. Many accusations have been at level and the structures of executive compensation in the banking sector. Executive compensation, as a corporate governance mechanism, is primarily designed to address agency problems; nevertheless, it may contribute to excessive risk-taking incentives, thus weakening financial stability and triggering global economic disasters. Credit crises thus naturally place the incentives generated executive compensations under additional scrutiny (Bhagat and Bolton, 2014).

Several recent studies have discussed the effect of debt-based compensation ("inside debt") on risky policy decisions. Due to its time-bound nature, debt-based compensation is expected to mitigate the

conflict between the executive and debtholders and to induce the executive to adopt more conservative behaviours. According to agency theory, the pay-off of inside-debt compensation is that it exposes managers to losses, making them more similar to creditors with regard to risk (Sundaram and Yermack, 2007; Cassell et al., 2012).

Default risk often depends on executives' risk-taking, and the relevant CEO compensation contract is an essential determinant factor driving firm investment decisions and financial policies. The components of this contract are assumed to shape manager's risk-taking incentives (Srivastav et al., 2018). However, despite its importance, relatively little is known about how inside debt compensation affects the riskiness of banks.

The pursuit of sound compensation practices to guarantee the financial stability of the banking sector has become a priority for regulators and bank supervisors worldwide. However, the existing empirical evidence on the role of inside debt is limited and contradictory. Examining how incentives such as inside debt holding influence banks' default risk is thus fundamental, particularly with regard to whether executive compensation induces managers to avoid excessive risk that might otherwise harm economic and bank safety.

This study thus provides two key contributions to the literature on executive compensation and default risk. First, while several studies have already analysed the relationship between inside debt and firm risk, this study is the first to consider a sample from the European banking sector using both a market based measure of default risk (Distance to Default) and an accounting based measure (Z-score). Second, this study uses system GMM, which addresses endogeneity issues caused by omitted variables and unobserved heterogeneity.

The empirical results in this work show that using inside debt compensation in the banking sector results in lower default risk, based on higher distance to default. The same association held when Z-score was used as a measure of bank default risk, suggesting that greater inside debt holding contributes to higher bank stability.

LITERATURE REVIEW

Despite a growing body of literature suggesting that inside debt holding curbs managers' excessive risk-taking, whether and how inside debt holding affects default probability thus remains an important open question. The majority of empirical research studies on the impact of inside debt holding emerged only after 2006 (Sheikh, 2019). This is because before 2006, there was no requirement to provide the actual present value debt-based compensation.

Several studies have, however, investigated the implications of CEO inside debt holding outside the banking industry (Cassell et al., 2012; Freund et al., 2018; Kabir et al., 2013). Cassell et al. (2012) documented a robust inverse association between managers inside debt compensation and the volatility of stock returns using a sample S&P 1500 index. They also found that larger CEOs inside debt lowered firm risk and reduced bankruptcy risk. Using a sample of 237 US firms, Sundaram and Yermack (2007) empirically showed that higher inside debt holding encouraged CEOs to become more conservative in behaviours, reducing default risk. Similarly, Borah et al. (2020) provided evidence that nonfinancial firms awarding managers more inside debt compensation had less cost of debt, lower default risk, and relatively better performance. Lee et al. (2021) concluded that CEOs with inside debt in nonfinancial firms largely reduced those firms' idiosyncratic risk and R&D investment risk. However, they also suggested that inside debt provides less motivation for a CEO to reduce a firm's systematic risk. Likewise, Sheikh (2019) used a sample of nonfinancial firms to produce evidence that inside debt holdings influence managerial risk-taking decisions and reduce firms' future risk. Kabir et al. (2013) observed that using debt-like compensation in UK nonfinancial firms generated risk-avoiding incentives by reducing borrowing costs. These studies provide empirical evidence that confirms the agency theory prediction of an inverse relationship between CEO inside debt holding and managerial risk-taking in nonfinancial firms. In contrast, Li and Zhao (2020) showed that inside debt compensation in UK firms did not induce risk-averse managerial behaviour. They thus argued that managers used inside debt to minimise their income tax liabilities, removing any linkage between executives inside debt compensation and risk-taking incentives.

In the context of financial firms, Srivastav et al. (2018) found that bank default risk is lower when CEOs have higher inside debt incentives. Bennett et al. (2015) found that, during last credit crisis, higher inside debt-based compensation rates corresponded with lower risk of default. Bekkum (2016) also showed that higher top-management inside debt holdings reduce banks risk and provide risk-reducing incentives.

More recently, Bhabra and Hossain (2024) provided empirical evidence that inside debt compensation in US firms plays a vital role in mitigating firm risk. The same conclusion holds for insurance firms; Milidonis et al. (2019) showed that debt-based compensation in the insurance sector lowers CEOs' incentives to take risks.

Another strand of empirical studies investigated how inside debt compensations influences risky investments and financial policies and risk management strategies. For example, Srivastav et al. (2014) showed that CEOs' debt-based compensation in US banks led to lower default risk probability and aligned their incentives with those of debtholders. They also found a positive association between inside debt holdings and reductions in payouts to preserve cash and reduce bankruptcy risk. Belkhir and Boubaker (2013) identified a positive relationship between managers inside debt and risk management using derivatives in US banking industry.

In contrast, several prior studies also document mixed results or provide different conclusions on the effect of inside debt compensation on firm risk. Boyallian and Ruiz-Verdu (2018) showed no association between debt-based compensation and bank risk across large US financial firms during financial crises. Similarly, Duong et al. (2021) found insignificant and mixed results regarding whether holding a higher ratio of inside debt induces CEOs to introduce risk mitigation.

This study extends the literature by investigating the extent to which inside debt holding among CEOs affects bank default risk within the EU. Bekkum (2016) and Bennett et al. (2015) both focused on US banks and highlighting the need for more studies on the impact of inside debt on bank default risk in other contexts. Further, the mixed results emerging from the empirical studies thus have highlighted that the role played by inside debt in alleviating firm risk requires further research. The current study is thus based on the related idea that the inverse relationship between inside debt holdings and risk reduction can be critically captured through examining the likelihood of bankruptcy or default risk.

2. DATA, VARIABLES, AND METHODOLOGY

2.1 Sample

The sample used in this study was extracted from publicly listed European banks for the period 2007 to 2012. The sampling commenced at the end of fiscal year 2007 based on the fact that data on the value of CEO inside debt compensation became available only after 2006 (Srivastav et al., 2014). Post-July 2006, the compulsory disclosure of the present value of inside debt compensation required by the Securities and Exchange Commission increased the transparency and level of details in annual reports (Eisdorfer et al., 2015).[1] This has facilitated more research on the implications of inside debt compensation for managers (Milidonis et al., 2019; Borah et al., 2020).

An initial sample consisting of 55 European banks' data from 2007 to 2012 was first used, with all banks publicly listed at least in one of the main European market indices (EU-27). Restrictions were imposed in cases on data non-availability for at least one year, excluding all banks with missing data for variables included in computing risk indicators to calculate risk measures accurately. Finally, following Freund et al. (2018) and Jiang et al. (2024) only bank CEOs who had been disclosed as having non-zero inside debt were included, to control for any possible bias. This left 30 banks remaining, for 180 bank-year observations.

[1] The SEC only adopted the mandatory disclosure of executive pension pay in 2007; before 2007, pension values were calculated using elaborate actuarial methods (Vallascas and Hagendorff, 2013).

Publicly traded banks were selected because banks are heavily leveraged firms where debt represents a large percentage of the capital structure. This makes debt agency conflict between agents and debtholders in indebted firms more critical (Bekkum, 2016).

2.2 Inside debt measure

Edmans and Liu (2011) theoretically proposed a ratio of CEO's debt-based compensation relative to equity-based compensation, scaled by the firm's debt to equity ratio as a measure for CEO inside debt incentives. They explained that the conflict between debtholders and shareholders can be alleviated if the CEO holds debt and equity in proportions similar to the firm's overall equity ratio; CEO incentives are thus more aligned with debtholders than shareholders when the ratio is greater than one. Following previous empirical studies, inside debt in this work is defined as CEOs' debt holding relative to the value of equity-based compensation (Sheikh, 2019; Erkan and Nguyen, 2021; Cassell et al., 2012; Bekkum, 2016), divided by bank debt to equity ratio:

$$\text{inside debt} = \frac{\text{CEO Inside debt /CEO equity}}{\text{Bank debt /bank equity}} \quad \text{..... (1)}$$

The CEOs inside debt benefit is the sum of any defined benefit pension and deferred compensation (Srivastav et al., 2014; Milidonis et al., 2019; Sheikh, 2019). CEO equity is measured as the CEO's stocks and stock-option holding value, calculated by multiplying the number of stocks held by the stock price at the end of the year to calculate the value of the CEO stocks. The Black-Scholes model is thus used to value CEO stock options. Bank debt value is the sum of the firm's current and long-term liabilities (Bekkum, 2016). Bank equity is the value of the outstanding shares at the end of the fiscal year. The ratio of CEO debt-based compensation to equity based-compensation is divided by the bank debt to equity ratio to capture the relative fraction of executive inside debt and equity-based wealth (Srivastav et al., 2014). Data on executives' debt-based (defined benefit pensions and deferred compensation) were manually collected using bank annual reports. CEO stock and stock options were also hand-collected using yearly annual reports.

2.3 Bank default risk measures

This paper examines the ways in which inside debt compensations influence European banks risk, based on two measures of default risk. The first is Merton's (1974) distance to default model, which the banking literature uses as a market-based measure suitable as an indicator of default probability (Gropp et al., 2006). The Merton's model measures likelihood of default as the number of standard deviations by which the market value of assets exceeds the default point (Kato and Hagendorff, 2010). As a market-based measure of bank fragility, it outperforms other indicators such as debt and CDS spreads (Gropp et al., 2006).

The higher the positive distance from the default of firm value to firm liabilities, the lower the default risk (Gropp et al., 2006), with a higher distance to default indicating better bank stability. The distance to default is calculated using data drawn from DataStream and the bankss' annual reports as follows:

$$DD_t = \frac{\ln(V_{A;t}/L_t) + (rf - 0.5\sigma^2{}_{A;t})T}{\sigma_{A;t}\sqrt{T}} \quad \text{.....(2)}$$

where VA_t is the banks' market value of assets; L_t is the book value of debt; rf is the risk-free rate is the risk-free rate; $\sigma A,_t$ is the annualized volatility of assets; T is time to maturity; and σE is the historical volatility of banks' equity.

Z-score was used as the second measure for bank risk (distance from insolvency) to facilitate more robust analysis. Z-Score measures a bank's distance from insolvency such that a lower Z-score suggests more bank risk (Bhagat and Bolton, 2014; Milidonis et al., 2019). Z-scores were calculated as follows:

$$\text{Z-score} = \frac{\text{ROA}+[\frac{\text{Equity}}{\text{Assets}}]}{\sigma\ \text{ROA}} \quad \text{..... (3)}$$

where ROA is the bank's return on assets at the end of the year, while σROA is the standard deviation of ROA. Higher value Z-scores signal more bank stability; following previous studies, this study took the log transformation of the Z-scores to manage the fact that the distributions of the raw Z-scores of banks are skewed (Minhat and Abdullah, 2016).

2.4 Measuring control variables

Bank characteristics include Charter value, Leverage, Size, and ROA. Many previous banking studies have control for these bank characteristics. Each bank's Charter value was used to control for investment opportunities as a determinant of future return. Charter value is defined as the MV of assets to the BV of assets at the end of the year (Coles et al., 2006; Srivastav et al., 2018). Leverage was used as a control for the amount of balance sheet expansion that rationally enables the firm to increase profits through accepting more risk. The debt ratio (BV of debt to BV of assets) was used to measure this. A higher leverage level is a financial policy choice that typically increases bank risk and increases the probability of default (Vallascas and Hagendorff, 2013). Bank Size was also used as a control variable. Number of sales represents one of the most common ways to measure firm size (Coles et al., 2006), and this analysis thus included the sales logarithms as a bank size measure.

Finally, a proxy for bank profitability was found by using ROA as a control variable. Previous literature on the relationship between executive compensation and default risk suggests that high profits enable banks to retain more earnings, enlarge their capital, and increase the distance to default (lowering default risk). On the other hand, high profitability may indicate high levels of risk-taking, increasing default risk. Following the previous literature, bank profitability was measured using return on assets (Bekkum, 2016; Milidonis et al., 2017; Freund et al., 2018). Data on all bank characteristics were mainly obtained from the DataStream database.

CEO characteristics included CEO Cash-based compensation, equity-based compensation, and CEO age and tenure. Previous studies have used CEO cash compensation (summing annual salary and cash bonus) to proxy for CEO outside wealth and risk aversion levels (Sheikh, 2019; Lee et al., 2021). Cash compensation is thus the dollar value of the base salary and bonuses the CEO earns during a given fiscal year. Cash compensation was scaled as a percentage of total CEO compensation.

The previous literature was again followed to calculate the vega-to-delta ratio as a control variable for the relative CEO risk-taking incentive (Roger, 2002; Erkan and Nguyen, 2021). The vega is the CEO stock options' sensitivity to stock return volatility (Sheikh, 2019), while the delta is the sensitivity of the stocks and options to changes in the price of the firm's stock overall (Coles et al., 2006). According to Roger (2002), the CEO incentives can be captured better using this ratio than using the vega and delta individually.

CEO personal characteristics that may be related to career concerns, such as age and tenure are also included. Older CEOs may be expected to be incentivised to decrease risk as the have fewer years left in the firm before retirements. However, Vallascas and Hagendorff (2013) suggested that older CEOs face less regulatory scrutiny as compared to their younger counterparts; potentially leading to more risk-taking behaviours. Tenure was used as a proxy for the CEO's risk aversion level, based on the expectation that CEO tenure should have an inverse relationship with bank risk (Coles, 2006). Longer executive tenure should encourage managers to undertake less risky behaviours. Tenure is based on the number of years the CEO has acted in that position (Bennett et al., 2015; Boyallian and Ruiz-Verdu, 2018).

2.5 Estimation method

To investigate how inside debt compensation affect default risk, a two-step generalised method of moment (GMM) approach, as adopted by many previous empirical studies (Sheikh, 2019; Bennett et al., 2015), was undertaken. Specifically, the approach used by Arellano and Bover (1995) and Blundell and Bond (1998) was adopted, in which the GMM model is an instrumental variable estimator that treats dependent variables as endogenous. GMM model uses lagged dependent and independent variables as instruments and is considered one of the most reliable dynamic panel models, particularly for short panel and endogenous explanatory variables (Flannery and Hankins, 2013).

The instrument in the GMM estimator is internal instrument obtained within the panel (Blundell and Bond 1998). GMM controls for unobserved heterogeneity in the distance to default risk and considered one of the most reliable dynamic panel models, particularly for short panel and endogenous explanatory variables (Vallascas and Hagendorff, 2013).

Following previous studies (Bennett et al., 2015; Milidonis et al., 2019; Lee et al., 2021), the association between CEO inside debt and bank default risk was explored using the following model:

$$Risk_{it} = \beta 0 + \beta 1 inide\text{-}debt_{it} + \beta 2 Leverage_{it} + \beta 3 Charter_{it} + \beta 4 Size_{it} + \beta 5 ROA_{it} + \beta 6 Age_{it} + \beta 7 Tenure_{it} + \beta 8\ Vega\text{-}to\text{-}delta_{it} + \beta 9\ Cash_{it} + \mu_t + \acute{\varepsilon}_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

3. EMPIRICAL ANALYSIS AND RESULTS

3.1 Main results

Table 1 reports the correlations among explanatory variables. The correlation test results imply that multicollinearity is not a concern in this analysis. This were also confirmed with another multicollinearity diagnostic test, using the variance inflation factors (VIF) to ascertain the absence of multicollinearity for these variables. The VIF value for all variables was less than 2.5 verifying the absence of multicollinearity problems.

Table 1. Correlations between variables

Variables	1	2	3	4	5	6	7	8	9	10	11	VIF
(1) Distance to default	1											1.51
(2) Z-score	0.0067	1										1.46
(3) inside debt	**0.2350***	0.0776	1									1.14
(4) Leverage	0.0833	0.1188	-0.0651	1								1.41
(5) Charter	**-0.4583***	**0.4323***	**-0.2005***	-0.0416	1							1.59
(6) Size	0.0859	-0.0329	**0.1653***	0.0487	-0.1213	1						1.49
(7) ROA	**-0.1574***	**0.4987***	**-0.2247***	**0.3935***	**0.4736***	-0.0749	1					1.98
(8) CEOage	**0.1969***	-0.052	-0.0056	-0.0571	-0.1238	**0.3129***	-0.0935	1				1.35
(9) CE-Otenure	-0.0547	0.0414	-0.0254	**0.1480***	-0.0287	-0.0286	**0.1659***	**0.3062***	1			1.23
(10) Vega-to-delta	0.1086	-0.0143	0.0686	-0.0311	-0.0586	0.0396	0.0079	-0.0292	-0.0225	1		1.27
(11) Cash-comp	0.1217	0.0783	**0.0601**	**0.2149***	-0.0942	**-0.3369***	0.0391	0.0067	-0.0243	**-0.4017***	**1**	1.65

* Indicates significance at the 5 % level
Source: own

A positive and significant correlation between inside debt and default risk (0.2350; at p<5%) emerged, which suggests preliminary support for a positive relationship between the main dependent and independent variables (inside debt increase distance to default ratio and lower default risk). The correlation between distance to default and control variables is also consistent with theoretical predictions.

Table 2 presents the results of GMM model of the relationship between inside debt and distance to default. Before interpreting the primary variables of interest, several tests were conducted to verify the validity of the dynamic panel model. The P-value of the Hansen test for over-restriction was greater than 0.05, suggesting that the instrumental variables are not correlated with the residuals. No over-identification restrictions were thus detected, rejecting the hypothesis that the instruments are irrelevant.

The insignificant probability values of AR2 prove that the momentary conditions of the model are met, despite the rejection of the first-order autocorrelation hypothesis (AR1). These results do, however, confirm that the diagnostic tests are satisfactory. It is possible to estimate system GMM via a one step or a two-step approach. However, the two step GMM system lowers bias and corrects standard errors (Vallascas and Hagendorff, 2013).

Table 2. CEO inside debt compensation and bank default risk using Merton's distance to default model

Variables	*Model (1)*	*Model (2)*	*Model (3)*
inside debt	0.0438492	0.070626	0.0622577
	(0.0180628)**	(0.0304742)**	(0.0261787)**
Leverag	2.10154		-2.489759
	(4.258287)		(8.832683)
Charter	-7.151442		-6.769154
	(1.426042)***		(1.714809)***
Size	0.6296277		-0.460015
	(0.1208732)***		(0.7484999)
ROA	0.8144829	0.1474824	0.9312117
	(0.4589098)*	(0.4710743)	(0.5051351)*
Age		1.285811	5.120402
		(0.5195924)	(2.952458)*
Tenure		0.3823403	0.6062627
		(0.670456)	(0.7987087)
Vega-to-delta		1.65397	1.068666
		(1.80885)	(1.192386)
Cash		1.703627	-2.982404
		(2.578192)	(2.258235)
Crisis dummy			4.849499
			(2.022473)**
Hansen J-statistic	13.92237	13.98068	13.47805
Prob(J-statistic)	0.125113	0.123014	0.127545
AR1 (p-value)	0.0076	0.0036	0.0028
AR2 (p-value)	0.3721	0.2561	0.3431

Source: own

In Table 2, the results of the GMM model derived from the main specification described in (Eq.1) are offered. In all three columns, the dependent variable is Merton's distance of default, while the main variable of interest is CEO inside debt. The first column of Table 2 shows the relationship between inside debt (using CEO debt-based compensation as a percentage of equity based compensation, divided by the bank debt to equity ratio) and default risk, controlling for bank characteristics. The second column controls for CEO characteristics. Column 3 reports the comprehensive regression results that include both bank and CEO characteristics. Inside debt was expected to positively influence (risk-reducing) the default distance. As inside debt represents unsecured and unfunded rewards and exposes managers to similar risk and insolvency treatment as outside creditors, inside debt holding should, theoretically, incentivise executives to avoid risk (Sundaram and Yermack, 2007; Borah et al., 2020).

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

The GMM estimation results confirmed the initial expectations. Column (1) reports on the results that control for firm characteristics. A significant positive association between inside debt and bank default risk

(coefficient=0.0438; p< 5%) emerged. The inside debt ratio in all columns is positive and statistically significant, indicating that the higher the debt compensation, the lower the bank default risk (increased distance to default). The same process was repeated in column (2) as in column (1), including only CEO characteristics as control variables. This generated consistent results, with the analysis showing that CEO inside debt and distance to default have strong positive association (coefficient=0.0932; p< 1%).

In Column (3), the results of the whole model are tabulated, giving qualitatively similar results. A positive and high significant correlation was found between inside debt and distance to default. The results presented in Table 2 thus imply that CEOs inside debt compensation is more likely to reduce bank risk by increasing distance to default probability. More debt-based compensation could thus increase CEO risk aversion to the extent where it could reduce the bank's default probability. As a result, a CEO with higher deferred pay levels would be more likely to prefer less risk-taking behaviours and to exhibit more decisions aligned with the interests of debtholders.

Several interesting results for control variables also emerged. The results for bank size matched results from previous studies supporting the argument that large banks are more diversified and better able to manage risk (Vallascas and Hagendorff, 2013).

The results in Table 2 further indicate that growth opportunities negatively affect bank distance to default. Coefficients of Charter value are positive and significant at the 1% level across all models, implying that higher growth opportunities are associated with lower distance to default (higher risk). This finding is consistent with the positive linkage suggested in the literature between growth opportunities and risk level (Coles et al., 2006; Sheikh, 2019).

The coefficient signs for age were positive and significant, indicating that older CEOs are more likely to avoid risk and adopt a conservative strategy (Vallascas and Hagendorff, 2013). The positive and insignificant coefficients of other CEO compensation variables imply that cash and incentives from equity-based compensation reduce managerial risk aversion and increase bank risk, however. CEO tenure and vega-to-delta ratio were also insignificant, and the results for bank profitability measured using ROA were as expected. The positive and significant sign for ROA implies that higher bank profitability lowers bank risk (increased distance to default).

These results provide empirical evidence supporting the idea that inside debt compensation aligns the incentive of CEOs with those of debtholders by reducing the overall bank default probability. This evidence is robust across different model specifications, confirming that inside debt compensation increases risk reduction behaviours, resulting in a higher distance from default.

3.2 Additional Robustness Tests

Alternative Proxy for Default Risk

This section discusses the various robustness tests applied in order to investigate whether the results continue to hold when using alternative default risk proxy. In particular, the Z-score, a common accounting measure used in the literature for distance to insolvency, was applied. All analyses were re-run using the Z-score to assess the robustness of the prior results. Z-score captures the probability of a negative return that increases the chance of default. When the bank Z-score is high, it has relatively higher return to payoff its debt liability, which lower default risk.

The results are presented in Table 3. Overall, the results obtained regarding the association between inside debt holding and Z-score were similar to those in Table 2. This offers support for a positive linkage between inside debt and Z-score. In particular, the coefficient on inside debt is positive and significant at the 10% level. This finding suggests that an increase in CEO inside debt compensation increases the bank's Z-score risk (reduces insolvency risk). CEO tenure is significant at the 10% level. The positive relationship between CEO tenure and Z-score shows that, as the CEO remains in office longer, the bank's Z-score increases (risk reduces).

Overall, tables 2 and 3 show that inside debt positively impacts banking sector stability in Europe. The results from the GMM model indicate that any increase in inside debt compensation will lead to a higher distance to default and a higher Z-score.

Table 3. CEO inside debt compensation and bank insolvency risk using Z-score

Variables	*Model (1)*	*Model (2)*	*Model (3)*
inside debt	0.0155539	0.0143054	0.0146536
	(0.0084673)*	(0.008309)*	(0.0081208)*
Leverage	0.5435042		0.2827596
	(1.321135)		(1.338327)
Charter	0.251708		0.2696788
	(0.2728464)		(0.2506293)
Size	-0.0201489		0.1155052
	(0.0256476)		(0.2593663)
ROA	-0.2267491	-0.1280384	-0.2239558
	(0.1529161)	(0.1813984)	(0.1815608)
Age		-0.0749566	-0.6330934
		(0.1329017)	(1.081561)
Tenure		0.0926635	0.028396
		(0.1592494)	(0.0171985)*
Vega-to-delta		0.074711	0.2083326
		(0.5820265)	(0.5477808)
Cash		0.2456711	0.2760249
		(0.5064197)	(0.5918705)
Crisis dummy			0.9004077
			(0.221)
Hansen J-statistic	11.06355	12.98153	8.759197
Prob(J-statistic)	0.271378	0.235388	0.459793
AR1 (p-value)	0.0017	0.0028	0.0034
AR2 (p-value)	0.2441	0.3672	0.5261

Source: own

Alternative proxy for inside debt

The reported results in Tables 2 and 3 are based on the primary explanatory variable, CEO inside debt ratio. This section presents the results of employing an alternative measure of CEO inside debt. In accordance with the previous literature, an indicator variable that takes a value of one when CEO debt to equity ratio relative to bank debt to equity ratio is greater than one, and zero else, was applied (Borah et al., 2020). Table 4 shows the results of using this indicator variable to represent CEO inside debt.

Table 4. CEO inside debt compensation (alternative measure) and bank distance to default

Variables	*Model (1)*	*Model (2)*	*Model (3)*
inside debt	2.443006	2.140507	2.992691
	(0.7943703)***	(1.044194)**	(1.288384)**
Leverag	-8.416923		-17.83952
	(9.651574)		(11.79031)
Charter	0.9035268		0.3964802
	(0.7268161)		(0.9489506)
Size	0.5063529		-0.873637
	(0.1848395)		(1.008298)

ROA	0.1460413	1.314855	0.8696398
	(0.0850835)	(0.6831991)	(0.7602579)
Age		1.238693	6.130021
		(0.7291792)	(4.388279)
Tenure		0.5026178	1.095487
		(0.8253365)	(0.9916227)
Vega-to-delta		2.014532	1.192346
		(1.766037)	(2.345387)
Cash		2.065642	-0.0692637
		(3.278546)	(2.062575)
Hansen J-statistic	13.92237	13.98068	13.47805
Prob(J-statistic)	0.125113	0.123014	0.127545
AR1 (p-value)	0.0086	0.0037	0.0029
AR2 (p-value)	0.3621	0.2461	0.3431

Source: own

According to Table 4, the relationship between CEO inside debt and bank distance to default remains positive and significant at the 1% level. This finding confirms the notion that inside debt improves bank stability by increasing bank distance to default probability (reducing bank risk)[2].
Future empirical studies may wish to use a non-financial firm's sample to analyse the effect of CEO inside debt holding on firm default risk or focus on non-CEO executives. Moreover, future studies might usefully explore the connection between the default risk and a change in CEO position or the impact of CEOs leaving the job in relation to inside debt compensation.

CONCLUSION

Incentives from equity-based compensation have been the focus of several empirical studies, and the literature commonly discusses how equity-based compensation mitigates managers' risk aversion and aligns managers' incentives with those of shareholders. Debt-based compensation is expected to align managers' interests with debtholders' interests and thus to discourage risk-taking. This study therefore examined how CEOs inside debt holding influences bank default risk. The empirical evidence presented in this study supports the view that inside debt compensation increases managers' risk aversion and suggests that inside debt encourages CEOs to make more conservative choices. Evidence of a positive and significant impact from inside debt compensation on bank distance to default was observed, with more inside debt associated with lower default risk. Awarding the CEO inside debt compensation lowers bank insolvency risk, making CEO inside debt compensation a channel through which to mitigate excessive risk-taking.

The empirical evidence provided in this study highlights the usefulness of inside debt as part of the CEO optimal compensation contract, which should be noted by regulators and stakeholders. Finally, this study supports the theory that debt-based compensation is an effective tool to reduce the agency cost of debt, concluding that inside debt helps to increase bank stability. The study also highlights how managerial compensation plays a clear role in shaping managerial incentives, offering empirical support to policymakers interested in enhancing bank stability by shaping managerial incentives.

[2] Following Ozili (2017), year 2008 bank-observations were excluded for robustness check and to rule out that the last credit crisis is not driving the main results of this study. The results obtained after doing this are very similar. Theses results are not reported for the sake of brevity.

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