Seeking Alpha, Taking Risk: Evidence from Non-Executive Pay in U.S. Bank Holding Companies

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Abstract

We investigate whether incentives provided to non-executives in U.S. bank holding companies (BHCs) in 2003-2006 are related to BHC risk and BHC value during the crisis of 2007-2009. To this end, we introduce measures of non-executive incentives based on the elasticity of BHC compensation, net of executive pay, to BHC performance. We find that higher non-executive compensation elasticity is associated with higher subsequent BHC risk and lower subsequent BHC value. These effects are robust to controlling for executive incentives. We also document that the association between non-executive incentives and BHC risk is mainly driven by incentives specific to peer group performance. Overall these findings support the hypothesis that bank competition for non-executives was largely responsible for the distortions in bank compensation and the accumulation of long-term risks that emerged during the crisis.

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1. Introduction

Following the 2007-2009 financial crisis, there has been considerable academic discussion of bank compensation and its impact on bank risk-taking. At the core of this discussion has been the claim that bank compensation has incentivized excessive risk-taking by rewarding "fake alpha" (Rajan, 2008, 2010)—the undertaking of investments that delivered high short-term returns but had huge underlying risks, which later emerged during the crisis. Notably, the existing literature has largely focused on *executive* compensation (see, for example, Bebchuk and Spamann, 2010; Cheng, Hong, and Sheinkman, 2010; Fahlenbrach and Stulz, 2011; and Bhagat and Bolton, 2013),[2] on the assumption that "top executives are the most important agents in setting firm and investment policies" (Cai, Cherny, and Milbourn, 2010). Under this assumption, the compensation of middle bank managers or "non-executives"—both loan officers and other sales managers such as traders—has been largely described as the product of endogenous organizational choices and, therefore, an issue of second order importance.

In this paper, we challenge this view, as we provide evidence that non-executive pay incentives and bank competition for non-executive services might be the elephants lurking in the wings of the debate on bank compensation and excessive risk-taking. We first introduce cross-sectional proxies that allow us to offer a systematic examination of banks' non-executive incentives before the crisis (i.e., over 2003-2006) and document that such incentives played a significant *and* independent role in promoting higher bank risk and lower bank value during the crisis (i.e., over 2007-2009). After that, our main new finding is to show that the identified positive relationship between non-executives incentives and higher bank risk is largely dependent on incentives that are driven by peer group performance rather than individual bank performance. Indeed, the evidence that pre-crisis non-executive incentives were not just the internal by-product of executive appetite for higher risk

[2] The evidence on the relationship between executive incentives and bank risk-taking is mixed. For example, Bebchuk and Spamann (2010) argue that compensation for short-term performance tends to lead to increases in the risk exposure of banks. Cheng et al. (2010) also document a positive relationship between executive compensation and bank risk-taking. Similarly, Bhagat and Bolton (2013) find that incentives to executives before the crisis promoted excessive bank risk-taking. On the other hand, Fahlenbrach and Stulz (2011) find that banks exhibiting executive incentives that were aligned with shareholder interests performed worse during the crisis. These results suggest that a possible correlated-omitted factor—such as non-executive compensation—may have influenced bank risk-taking.

raises the crucial question of what was the ultimate cause of the fake alpha problem, i.e., banks rewarding high short-term employee performance without accounting for potential long-term losses. Drawing on the insights of a handful of recent theoretical studies (Acharya, Pagano, and Volpin, 2013; Thanassoulis, 2012; Bannier, Feess, and Pachkam, 2013)[3], we hypothesize that bank competition for middle managers, which we proxy by estimating peer group effects, largely shaped non-executive incentives and their impact on bank risk-taking. Our findings confirm that hypothesis and corroborate the theory developed in Acharya et al. (2013) that bank competition introduces a negative contractual externality in bank compensation policies. Allowing middle managers to transfer to competitors before the potential losses of high-risk, high-return investments materialize, competition for non-executive services constrains any bank's ability to adopt incentive schemes that can lead to the revelation of non-executive types over time.

In our empirical analysis of non-executive incentives in banking institutions, we specifically focus on U.S. bank holding companies (BHCs), since these organizations are required by the Federal Reserve to file quarterly FR Y-9C reports that include detailed financial information (see Ellul and Yerramilli, 2013). From these reports, we are able to obtain data on BHCs' total compensation and performance, which we use to construct our measures of non-executive incentives. To overcome the lack of public information on non-executive pay, we infer the structure of a given BHC's non-executive incentives from the variations that occur within that BHC's performance. To this end, we introduce two main elasticity measures, computed over the period 2003-2006, which estimate how a given BHC readjusts (i) total salary, bonus, and net benefits, i.e., *cash compensation*, and (ii) total stock and option grants, i.e., *stock compensation*—with each measure net of executive pay—given the variation that occur in that BHC's total interest income *(TII)*. We specifically choose *TII* over other potential measures of BHC performance, such as, for example, total income *(TI)* or net interest income *(NII)*, because *TII* offers the advantage of being less dependent on idiosyncratic bank features and prior risk choices, yielding performance estimates that are more homogenous across banks. We also remark that while

[3] The anecdotal evidence of banks' compensation practices also suggests that the fear of losing middle managers to competitors played a crucial role in determining non-executive pay incentives (Smith, 2009; Tett, 2009; Rajan, 2010; Bijlsma, Boone, and Zwart, 2012).

we introduce elasticity measures for both non-executive cash compensation and non-executive stock compensation, we largely focus on the former measure since in our sample of BHCs 98 percent of non-executive compensation is provided in the form of cash. This implies that any impact non-executive incentives had on BHC risk was largely driven by the cash component of such compensation.

In order to estimate BHC risk, we use three main risk measures, computed over the period 2007-2009: (i) *Tail Risk,* defined as the marginal expected shortfall measure (MES) introduced in Acharya, Pedersen, Philippon and Richardson (2010); (ii) *Aggregate Risk*, defined as the standard deviation of a given BHC's weekly return over the calendar year (see Ellul and Yerramilli, 2013), and (iii) *Z-Score*, defined as the natural logarithm of the ratio of the sum of ROA and a BHC's capital ratio to the standard deviation of the BHC's ROA (with higher *Z-Scores* being associated with higher bank stability and vice versa).[4] Next, in order to verify whether the association between a given BHC's pre-crisis non-executive incentives and that BHC's risk exposures during the crisis points to efficient or inefficient prior risk-taking, we estimate BHC values over 2007-2009 using two main measures of interest: (i) *Tobin's Q*, defined as the ratio of a given BHC's market value of assets over that BHC's book value of assets, following Fama and French (1992), and the (ii) *Market-to-Book* ratio, defined as the ratio of the market value of equity to the book value of equity. The choice of computing non-executive incentive before the crisis and both BHC risk and BHC value during the crisis is aimed at avoiding concerns of potential correlated-omitted variable specifications that may cause spurious correlation between non-executive incentives, on the one hand, and risk-taking and firm value, on the other. Indeed, it seems reasonable to assume that financial markets and financial firms were unable to anticipate the effects of the crisis and adjust non-executive incentives to reflect such anticipation.

Merging the data on BHCs' non-executive incentives before the financial crisis and risk exposure and firm value during the crisis delivers a sample of 77 BHCs.[5] For this sample, we begin our analysis by examining

[4] In robustness analysis, we also verify that our results hold for additional measures of BHC risk, including equity beta (defined as the coefficient estimate from the Lintner model of the CAPM using weekly data for 104 weeks ending at the end of the fiscal year), implied stock volatility (i.e., *Implied Volatility*, defined as the average annual implied volatility for standardized call options of 90 days maturity), and an alternative specification of *Tail Risk* (considering the MES during the 10 percent worst stock-return days for the S&P 500, rather than the 5 percent worst-days considered in Acharya et al., 2010).

[5] Our original sample includes 88 BHCs for which we are able to obtain data on (i) total cash and stock compensation, (ii)

the impact of our main measure of non-executive incentives, *Cash Compensation Elasticity*, on BHC risk. Across all the measures of risk that we employ, we find that higher *Cash Compensation Elasticity* is associated with higher BHC risk. Economically, this effect is also significant across all our measures of risk. Since our first motivation in investigating BHCs' non-executive incentives is to verify whether such incentives played an independent role in influencing BHC risk or, instead, were largely the result of internal choices made by top-executives, the main control we include in our risk regressions is for executive incentives. As main measures of interests to compute executive incentives before the crisis,[6] we employ *CEO Delta*, which estimates the sensitivity of CEO compensation to stock price, and *CEO Vega*, which estimates the sensitivity of CEO compensation to stock return volatility.[7] Unlike non-executive incentives, executive incentives have an inconsistent effect on BHC risk. We interpret this evidence as delivering two important insights. First, non-executive incentives appear to have played a significant and independent role in promoting excessive bank risk-taking. Second, the inefficiencies in bank compensation policies that were exposed during the crisis cannot be entirely blamed on poor or opportunistic decision-making by top bank executives.

Moving from these results, we proceed to verify our main additional hypothesis that peer-group effects, which we use as a proxy to capture bank competition, largely drove the identified positive association between higher non-executive incentive elasticity and increased BHC risk. As a first test to this hypothesis we disentangle our main elasticity measure, *Cash Compensation Elasticity*, into two additional elasticity measures, which are designed to estimate how a BHC's non-executive cash compensation elasticity—and its impact on BHC risk—varies in relation to positive relative performance (i.e., the BHC performing better than its peer group) and

executive stock and cash compensation (so to isolate the non-executive cash/stock component of total compensation), and (iii) measures of risk, firm value, and control variable. However, because of subsequent delisting (due to either acquisitions by other entities or liquidation), only 77 BHCs in our sample have available data for risk-taking and measures of firm value over the full 2007-2009 time period. These 77 BHCs represent our final sample, although in robustness tests we also include the eleven delisted BHCs.

[6] In our main analysis, both *CEO Delta* and *CEO Vega* are estimated as averages over the time period 2003-2006, in order to employ homogenous estimation periods for executive and non-executive incentives. In robustness tests, we also compute *CEO Delta* and *CEO Vega* as averages during the crisis (i.e., 2007-2009) and find that our results do not change.

[7] In robustness test, we also employ alternative measures of executive incentives, *Executive Cash Compensation Elasticity* and *Executive Stock Compensation Elasticity*, which are estimated replicating the same empirical methodology that we use to compute non-executive incentives. These alternative estimates aim at delivering more homogenous measures for executive and non-executive incentives. Importantly, our results do not change when we replace *CEO Delta* and *CEO Vega* with *Executive Cash Compensation Elasticity* and *Executive Stock Compensation Elasticity*.

negative relative performance (i.e., the BHC performing worse than its peer group). We denominate these measures *Cash Compensation Elasticity+* and *Cash Compensation Elasticity-*. Remarkably, *Cash Compensation Elasticity+* has a positive statistically and economically significant impact on BHC risk across all our measures of risk. In contrast, *Cash Compensation Elasticity-* has no statistically or economically significant impact on BHC risk. Consistent with Acharya et al. (2013) we interpret this finding as suggesting that bank competition constrains BHCs' compensation policies. In a highly competitive market, banks are induced to adopt pay packages that are more sensitive to positive variations in relative performance, but do not readjust compensation elasticity accordingly upon negative relative performance, which results in an overall "convexification" of non-executive pay and greater incentives for excessive risk-taking.

We next verify whether bank competition exerts any *direct* role in shaping non-executive incentives and their impact on BHC risk. To this end, we further disentangle *Cash Compensation Elasticity* into *Cash Compensation Elasticity-Market* and *Cash Compensation Elasticity-Bank*. The former variable measures elasticity with respect to peer group's performance (i.e., average peer group's *TII*), while the latter measures elasticity with respect to individual BHC performance (defined as the residual of the peer group's *TII*). Confirming our hypothesis that non-executive incentives were largely driven by market factors, the effect of *Cash Compensation Elasticity-Market* on BHC risk dominates the effect of *Cash Compensation Elasticity-Bank* across all our measures of risk. Lending further support to that hypothesis, the effect of *Cash Compensation Elasticity-Market* on BHC risk is sustained when interacted with *Employee Turnover*, a variable that estimates employee mobility over 2003-2006 and that we employ as a proxy for more intense bank competition.

As noted above, non-executive stock compensation has a largely residual magnitude in our sample of BHCs. Nevertheless, the results that we obtain on the effect of *Stock Compensation Elasticity* on BHC risk are noteworthy. BHCs with higher *Stock Compensation Elasticity* present lower BHC risk, suggesting that the use of stock compensation to remunerate middle bank managers might mitigate incentives for excessive bank risk-taking. A possible explanation to reconcile the evidence we obtain on *Cash Compensation Elasticity* and *Stock Compensation Elasticity* is that equity-based compensation, especially in the form of restricted stock or other forms

of deferred compensation, is more likely to internalize the long-term effects of high risk-taking as future stock value is likely to reflect such effects.

Our conclusive step is to verify that BHCs with higher *Cash Compensation Elasticity* exhibited lower firm value during the crisis, as measured by both *Tobin's Q* and the *Market-to-Book* ratio, indicating that bank competition for non-executive services produced incentives for inefficient risk-taking. On the contrary, *Stock Compensation Elasticity* has a positive impact on BHC value, consistent with our finding that remunerating banks' middle managers with equity compensation might help to reduce inefficient risk-taking.

Given the empirical challenges posed by the difficulty of estimating non-executive incentives and distinguishing their effects on bank risk-taking from that of executive incentives, as well as the challenges arising in the choice of peer groups, we provide substantial robustness analysis to corroborate our results. Specifically, we produce three main robustness tests. First, we consider an alternative estimation approach for the choice of peer groups with the aim of further addressing the difficulty of identifying peer group effects (Manski, 1993). Second, we present a GMM estimation aimed at tackling the residual concerns of correlated-omitted variables that arise in our analysis of the association between BHCs' non-executive incentives and BHC risk. Third, and last, we present alternative choices for our independent variables (i.e., elasticity measures), dependent variables (i.e., measures of BHC risk), and control variables. We confirm that the results we obtain throughout all these tests are isomorphic to those we obtain in the main analysis.

The remainder of the paper proceeds as follows. Section 2 discusses the related literature. Section 3 describes the data and empirical methodology. Section 4 presents the descriptive statistics and discusses the results of our analysis. Section 5 provides robustness analysis. Section 6 briefly concludes.

2. Related Literature

Our paper relates to several strands of literature. First, it relates to the banking literature on loan officers' incentives and loan quality. Because of limitations in available cross-sectional data, this literature has examined loan officers' incentives by using either experimental data (Cole, Kanz and Klapper, 2012; Agarwal

and Wang, 2009; and Agarwal and Ben-David, 2012) or data from a single lender (Hertzberg, Liberti and Paravisini, 2010; Berg, Puri, and Rocholl, 2012; Gee and Tzioumis, 2012). The common result of these studies is that loan officers' incentives influence the quality of loans produced by banks and subsequent default rates. We add to these studies by introducing novel cross-sectional proxies that allow us to develop a systematic examination of the incentives provided to bank middle managers, including both loan officers and other sales managers such as traders.

Second, our paper contributes to the literature on bank risk-taking. In examining the determinants of bank risk-taking, prior studies have focused on deposit insurance and competition (Keeley 1990; Hellmann, Murdock, and Stiglitz, 2000; Demirguc-Kunt and Detragiache, 2002), ownership structure and banking regulation (Laeven and Levine, 2009), bank size (Demsetz and Strahan, 1997), bank franchise value (Demsetz, Saidenberg, and Strahan, 1997), monetary policy (Landier, Sraer, and Thesmar, 2011), creditor rights (Houston, Lin, Lin and Ma, 2010), and risk management (Ellul and Yerramilli, 2013). To the best of our knowledge, we are the first to empirically analyze how non-executive incentives affect bank risk-taking and bank value.

Third, our findings are consistent with the small but growing theoretical literature that examines the relationship between bank competition for employee services and compensation incentives. Thanassoulis (2012) finds that bank competition in the labor market generates a negative externality that drives up bonuses paid to bankers (i.e., both top-executives and non-executives), increasing the risk that a default event may occur even upon smaller investment losses. In the same line of investigation, Acharya et al. (2013) find that bank competition for managerial (i.e., both executive and non-executive) services creates a negative *contractual* externality in bank compensation policies inducing banks to reward short-term performance without accounting for the build-up of tail risks. Bannier et al. (2013) obtain a similar result, showing that competition for bankers results in larger bonus components in banker pay and, therefore, excessive risk-taking incentives.

We contribute to these studies in two important ways. First, we disentangle the effect of non-executive incentives from that of executive incentives on bank risk-taking, showing that the former set of incentives, on the one hand, was largely driven by bank competition and, on the other, had a major *and* independent role in

promoting excessive risk taking in banks. Second, we provide empirical support to the claim that bank competition was the root problem of the inefficiencies in bank compensation that emerged during the crisis and, in particular, to the theory developed in Acharya et al. (2013) that bank competition engendered a negative contractual externality in bank compensation policies.

Finally, we contribute to the literature that examines the effect of employee stock ownership plans (ESOPs) on firm value. Testing for such effect among non-financial firms, Bova, Kolev, Thomas and Zhang (2012) find that firms adopting ESOPs exhibit lower risk. Consistently, we find that the use of equity-based compensation to remunerate middle bank managers is negatively related to inefficient bank risk-taking. In accordance with Core and Guay (2001) and Oyer and Schaefer (2005), who find that broad-based equity ownership helps retaining employees, we interpret this result as suggesting that an important benefit of equity-based compensation in the banking sector is to discourage excessive employee mobility. On the one hand, equity-based compensation, especially when provided in the form of restricted stock or other deferred forms, incentivizes employees to remain with a given employer in order not to lose long-term rewards. On the other, payments in stock and the like can better internalize the potentially detrimental long-term effects of high risk-taking because future stock prices are likely to incorporate those effects.

3. Data and Methodology

3.1. Data

We collect data from several sources. Our main data source is the Bank Regulatory database of the Federal Reserve Bank of Chicago, which collects information on the FR Y-9C reports that BHCs are required to file quarterly with the Federal Reserve. Such reports include information on BHCs' balance sheets and income statements, from which we are able to obtain data on both BHC employee compensation and BHC performance. In order to determine the list of public firms within the initial list of BHCs covered by the Bank Regulatory database, we use the link provided by the Federal Reserve Bank in New York to the CRSP database. Merging data from these databases, we obtain a sample of 330 BHCs that are public firms for an estimation period of sixteen quarters over four years—from 2003 to 2006.

Because FR Y-9C reports only contain information on total quarterly payments to BHC employees (i.e., including *both* executives *and* non-executives), we proceed in the following way to disentangle *non-executive* compensation for each BHC. First, we use the ExecuComp database to obtain data on *top executive* compensation—both executive cash compensation (i.e., salary, bonus, and net benefits) and executive stock compensation (i.e., stock and options). More specifically, since ExecuComp data on executive pay are provided on an annual, rather than quarterly basis, for each BHC we first pro-rate annual executive compensation data on a quarterly basis.[8] We do this for both the cash component and the stock component of executive pay. Then, for each quarter and each BHC, we subtract the cash/stock component of executive compensation from the BHC's total cash/stock compensation.[9]

Because the ExecuComp database does not have available information for all the 330 BHCs in our sample, the inclusion of data on executive pay significantly reduces our sample size, causing it to shrink to 88 BHCs. Further, because we estimate BHC risk and BHC value over the period 2007-2009 and during that period 11 BHCs were delisted (either being liquidated or acquired by another BHC), only 77 BHCs in our initial sample have available data for risk-taking and firm value proxies over the full 2007-2009 period. These 77 BHCs represent our final sample, although in robustness test we also include the eleven delisted banks.[10]

To compute estimates of BHC risk over 2007-2009, we use three main measures of risk: *Tail Risk*, *Aggregate Risk* (both being used in Ellul and Yerramilli, 2013), and *Z-Score*. *Tail Risk* is based on a measure proposed by Acharya et al. (2010), which they refer to as the marginal expected shortfall (MES). In a given year the MES is defined as the negative of the average return on a given BHC's stock during the 5 percent worst days for the S&P 500. *Aggregate Risk* is defined as the standard deviation of a given BHC's weekly excess

[8] In pro-rating BHC executive compensation, we assume that such compensation—both in the cash component and stock component—follows the same quarterly patterns of total BHC compensation. An example will illustrate. In 2004, the quarterly cash compensation component of Citigroup's total compensation was 10% in the first quarter, 20.1% in the second quarter, 29.6% in the third quarter, and 40.3% in the fourth quarter. Assuming the same compensation pattern for executive compensation, we split annual executive cash compensation in the same quarterly proportions and then subtract it from total compensation to derive quarterly non-executive cash compensation.

[9] In robustness analysis, we also verify that our results on non-executive compensation elasticity are robust to assuming that executive compensation is paid in a lump sum in the last (i.e., fourth) calendar quarter each year rather than quarterly.

[10] We show the list of all the BHCs in our study (i.e., including the 11 BHCs that were delisted in 2007-2009) in Appendix Table 1.

return (i.e., weekly return on the BHC's stock less the weekly return on the S&P 500) over the calendar year. *Z-Score* is defined as the natural logarithm of the ratio of the sum of ROA and bank capital ratio to the standard deviation of bank ROA, with higher *Z-score* values implying greater bank stability. To compute *Tail Risk* and *Aggregate Risk*, we use data on stock returns from the CRSP database. For the *Z-score*, instead, we use data from the Compustat Quarterly data file.

To compute estimates of BHC value over 2007-2009, we use two main measures: *Tobin's Q*, which we define following Fama and French (1992) as the ratio of a given BHC's market value of assets over the BHC's book value of assets, and the *Market-to-Book* ratio, which we define as the ratio of the market value of equity to the book value of equity. For both these measures of interest, we obtain data from the Compustat Quarterly data file and the CRSP database.

Lastly, as concerns the control variables we employ in our analysis, we use the ExecuComp database to obtain data on our main controls, *CEO Delta* and *CEO Vega*, over the period 2003-2006. As in Core and Guay (2002), we compute these variables by applying the Black-Scholes valuation formula to the option component of executive compensation. In addition, we use data from the Bank Regulatory database to compute several control variables that may influence BHC risk independently from non-executive incentives, including *Tier 1/Capital Assets*, BHC *Size*, BHC *ROA*, *Deposit/Assets*, *Loans/Assets,* B*ad Loan/Assets, Non-Int. Income/Income, UW Assets/Assets, Derivative Trading/Assets,* and *Derivative Hedging/Assets* (all defined in Table 1). Lastly, we also use the Bank Regulatory database to obtain 2003-2006 data on *Employee Turnover* (defined in Table 1), which we use as a proxy for the intensity of BHC competition for non-executive services and which we employ both as a control and an interaction term.

3.2. Elasticity Measures

Methodologically, the first step in our analysis is the estimation of non-executive compensation incentives in BHCs prior to the financial crisis, i.e., over 2003-2006. Because of limitations in available data, we are required to infer the structure of each BHC's non-executive compensation incentives from the variations that occur within that BHC's aggregate compensation (i.e., including both executive *and* non-executive compensation). To this end, we introduce two main elasticity measures that estimate how a given BHC

readjusts: (i) total salary, bonus, and net benefits compensation (*Cash Compensation Elasticity*) and (ii) total stock compensation (*Stock Compensation Elasticity*)—with each measure net of the corresponding executive pay component—given the variation occurring in *total interest income* (*TII*), which we use as a proxy for BHC performance.

There are several reasons why we choose *TII* as measure of BHC performance over other possible performance measures, including *total income* (*TI*), *net interest income* (*NII*), or *net income* (*NI*). As compared to *TI*, *TII* offers the advantage of being less dependent on idiosyncratic bank features and, therefore, yielding performance estimates that are more homogenous across banks. Indeed, *TI* also includes income from activities that do not earn interest, which tend to be more diversified across banks. In contrast, TII only includes interest income-activities, which are common to the generality of banks.[11] For this reason, a measure of non-executive compensation elasticity based on *TII* seems better able to capture common trends in BHCs' non-executive compensation policies than a measure of elasticity based on *TI*.

Computing non-executive compensation elasticity based on *NII* (or *NI*), rather than *TII*, is also more likely to generate biased estimates for two reasons. First, because both *NII* and *NI* also include expenses, such measures might reflect individual accounting policies, failing to provide a viable common estimate to evaluate BHC performance. Second, although there are common accounting practices across BHCs, because a bank's expenses are the product of heterogeneous capital structures, NII and NI are more likely to be influenced by bank-specific features (and, in particular, a bank's cost of capital).

To estimate *Cash Compensation Elasticity* and *Stock Compensation Elasticity*, we estimate the following regression:

$$\ln\left(\frac{Comp_{it}}{Comp_{it-1}}\right) =$$

$$\alpha_i + \beta_{i1,TII}^{Comp} \times ln\left(\frac{TII_{it}}{TII_{it-1}}\right) + \beta_{i2,TII}^{Comp} \times ln\left(\frac{EMP_{it}}{EMP_{it-1}}\right) + \beta_{i3,TII}^{Comp} \times ln\left(\frac{MCAP_{it}}{MCAP_{it-1}}\right) + \delta_1 \times Q_{4t} + \varepsilon_{it} \qquad (1).$$

[11] In our sample of BHCs the average share of *TII* from *TI* is equal to 80.2 percent, confirming that activities that earned interest were the major source of income for BHCs before the crisis.

In Equation (1), $Comp$ alternatively denotes: (i) C, indicating a given BHC's cash compensation in quarter *t*, net of the BHC's executive cash compensation in quarter *t*, or (ii) S, indicating the BHC's stock compensation in quarter *t*, net of the BHC's executive stock compensation in quarter *t*. The variable *EMP* denotes the number of the BHC's employees in quarter *t*, and the variable *MCAP* denotes the BHC's market capitalization in quarter *t*. We use the log difference of each of these variables across subsequent quarters to estimate the change in that variable.[12] Hence, depending on the specific variable denoted by the superscript $Comp$, the coefficient $\beta_{i1,TII}^{Comp}$ will indicate either *Cash Compensation Elasticity* ($\beta_{i1,TII}^{C}$)[13] or *Stock Compensation Elasticity* ($\beta_{i1,TII}^{S}$). We control for both changes in the BHC's number of employees (*EMP*) and market capitalization (*MCAP*) to verify that the variations in the BHC's compensation are not driven by these variables.[14] We also control for an indicator variable for the fourth calendar quarter, Q_{4t}, on the assumption that most of the variation in both cash compensation and stock compensation is due to payouts occurring in the last calendar quarter.[15]

We also emphasize here that while we develop measures for both *Cash Compensation Elasticity* and *Stock Compensation Elasticity*, in the empirical analysis we largely focus on the former elasticity measure, since the cash compensation component of non-executive pay is largely dominant in our sample of BHCs—with 98% of non-executive pay being provided in the form of salary, bonus, and net benefits, and only 2% being, instead, provided in the form of stock payments.

3.3. Peer Group Choice

The second step in our empirical methodology is the choice of each BHC's peer group. Indeed, since we pose that bank competition for non-executive services played a crucial role in influencing non-executive pay

[12] In robustness analysis, we also revisit this empirical design to permit annual (i.e., Q_{t-3} to Q_t) rather than quarterly (i.e., Q_{t-1} to Q_t) changes in the variables of interest.
[13] As concerns estimations of *Cash Compensation Elasticity*, we assume that they are largely driven by variations in bonuses, rather than salaries, relative to *TII*. This is because—at least anecdotally–salaries fluctuate less than bonuses in response to changes in performance.
[14] Excluding these variables does not materially change the R-squared for these regressions. We interpret this to mean that the main dynamic is between the measures of compensation and the measures of performance.
[15] In robustness analysis, we also calculate Equation (1) by including additional indicator variables for the second and third calendar quarters.

incentives and bank risk-taking, the choice of peer groups is of fundamental importance in developing our analysis. In this respect, the difficulty of identifying peer group effects—a concern referred to as the "reflection problem"—poses a crucial challenge (see Manski, 1993). This problem arises because it is possible that *both* peer group-specific and residual bank performance (i.e., what we term bank-specific performance) be driven by a latent factor—for example, an industry characteristic or the level of specialization across peer group members—which also influences non-executive compensation policies in any of the peer group members. As long as such latent variable is present and not controlled for, inferences about non-executive compensation elasticity might be biased.

A potential solution to overcome this problem is to choose a different peer group for different banks in our sample, that is, select *heterogeneous* peer groups (see Bramoulle, Djebbari, and Fortin, 2009). Intuitively, heterogeneity in peer group choice allows us to use the performance of the "peer's peer" as a relevant instrument to capture the peer group performance of any given BHC in our sample. An example is useful to further illustrate this point. Suppose that bank A_1's peer group includes banks A_2 and B_1, while bank B_1's peer group includes banks B_2 and A_1. The performance of bank B_2 can be viewed as an instrument that meets both the relevance and exclusion conditions for valid instruments (Leary and Roberts, 2012). Indeed, bank B_2's performance is both (i) *relevant* for bank A_1's performance, because it influences the performance of that bank's direct peer, i.e., bank B_1, and (ii) *exclusive*, because it achieves its effect on bank A_1's performance only through the bank's peer group.

As illustrated through several examples in Figure 1, in order to incorporate heterogeneity in peer group choice we proceed as follow. At the beginning of our estimation period (i.e., the end of the fourth quarter of 2002), we define a geographical peer group for each BHC in accordance with its headquarters' location. For each BHC, we then include in its peer group five other banks whose headquarters are located in either the same state or neighboring states. For example, in Citigroup's peer group we include five other BHCs headquartered in the state of New York—JP Morgan Chase & Co., Metlife Inc., National City Corp., Bank of New York Mellon Corp., and M&T Bank Corp. If more than five BHCs fit our peer group criterion, we select the five largest among them. If, instead, there are less than five BHCs fitting our peer group criterion we select additional

BHCs from neighboring states.[16] Finally, if a BHC receives no peers among the 77 BHCs in our sample according to either of the above criteria, we place such a BHC into one of five distinct regions, based on that BHC's headquarter location. The regions we employ are Northeast, Southeast, Midwest, Northwest, and Southwest (all defined in Figure 1). We then use the five largest BHCs with headquarters in these regions as that BHC's peer group.

3.4. Relative Bank Performance

Having established a choice for the peer groups, we next proceed to verify how non-executive pay incentives at the individual BHC's level "reacts" to peer group performance. Consistent with our hypothesis that bank competition largely influences BHCs' non-executive compensation policies, our aim here is to understand whether, and to what extent, a given BHC's relative performance (i.e., that BHC's performance relative to the average performance of other BHCs in its peer groups) matters in determining non-executive pay incentives. To this end, we decompose our main elasticity measure, *Cash Compensation Elasticity*, as calculated in Equation (1), into two additional measures: *Cash Compensation Elasticity+*, which estimates positive relative performance, i.e., how a given BHC readjusts cash incentives to middle managers when that BHC performs better than its peer group, and *Cash Compensation Elasticity-*, which estimates negative relative performance, i.e., how a given BHC readjusts cash incentives to middle managers when that BHC performs worse than its peer group.

Equation (2) modifies Equation (1) with $Comp = C$ so to consider this additional empirical design:

$$\ln\left(\frac{C_{it}}{C_{it-1}}\right) = \alpha_i + \beta^{C}_{i1,TII+} \times ln\left(\frac{TII_{it}}{TII_{it-1}}\right) \times I_{it,TII+} + \beta^{C}_{i1,TII-} \times ln\left(\frac{TII_{it}}{TII_{it-1}}\right) \times I_{it,TII-} +$$

$$\beta^{C}_{i2,TII} \times ln\left(\frac{EMPi_t}{EMP_{it-1}}\right) + \beta^{C}_{i3,TII} \times ln\left(\frac{MCAP_{it}}{MCAP_{it-1}}\right) + \delta_1 \times Q_{4t} + \varepsilon_{it} \quad (2),$$

[16] For example this is the case of Northern Trust Corp. (headquartered in Illinois), in whose peer group we include both other banks headquartered in Illinois and a bank from a neighboring state. As shown in Figure 1, the peer group for Northern Trust Corp. includes the following banks: Wintrust Financial Corporation, First Midwest Bancorp DE, Corus Bankshares Inc., Privatebancorp Inc., and Marshall & Ilsley Corp. Among these five banks, the first four are all headquartered in Illinois, while Marshall & Ilsley Corp. is headquartered in Wisconsin.

where $I_{it,TII+}$ denotes an indicator variable that is equal to one if $ln\left(\frac{TII_{it}}{TII_{it-1}}\right) > \overline{\ln\left(\frac{TII_t}{TII_{t-1}}\right)}$ (i.e., the quarter t performance of bank *i* is above the peer group average) and zero otherwise, $I_{it,TII-}$ denotes an indicator variable that is equal to one minus $I_{it,TII+}$, and (iii) $\beta^C_{i1,TII+}$ and $\beta^C_{i1,TII-}$ indicate the coefficients for *Cash Compensation Elasticity+* and *Cash Compensation Elasticity-* respectively.

3.5. Bank-Specific v. Peer-Specific Effects

In the prior section, we have presented an empirical design that aims at verifying whether bank competition constrains the choice of individual BHCs in determining non-executive incentives through the channel of relative performance. In this section we expand that line of investigation by introducing an empirical design that aims at verifying whether bank competition, as captured by average peer group performance, plays any *direct* role in shaping non-executive incentives. To this end, we disentangle *Cash Compensation Elasticity* into two additional elasticity measures that are designed to capture the sensitivity of non-executive pay to two different components of performance: *Cash Compensation Elasticity-Market*, capturing sensitivity to peer-specific performance and *Cash Compensation Elasticity-Bank*, capturing sensitivity to bank-specific performance.

To implement this test, we modify Equation (1) for $Comp = C$ to allow for the inclusion of two distinct performance measures: peer group-specific changes in *TII* and BHC-specific changes in *TII*, using the following regression:

$$\ln\left(\frac{C_{it}}{C_{it-1}}\right) = \alpha_i + \beta^C_{i1,M,TII} \times \overline{\ln\left(\frac{TII_{it}}{TII_{it-1}}\right)} + \beta^C_{i1,i,TII} \times \ln\left(\widetilde{\frac{\mathrm{TII}_{\mathrm{it}}}{\mathrm{TII}_{\mathrm{it-1}}}}\right)$$

$$+ \beta^C_{i3,TII} \times \ln\left(\frac{\mathrm{EMP_{it}}}{\mathrm{EMP_{it-1}}}\right) + \beta^C_{i4,TII} \times \ln\left(\frac{\mathrm{MCAP_{it}}}{\mathrm{MCAP_{it-1}}}\right) + \delta_1 \times Q_{4t} + \varepsilon_{it}, \quad (3),$$

where $\overline{\ln\left(\frac{TII_t}{TII_{t-1}}\right)} = \frac{1}{N}\sum_{i=1}^{N}\frac{TII_{it}}{TII_{it-1}}$ is the average change in *TII* for the peer group from quarter *t-1* to quarter *t* (defined as an equally-weighted average of BHC-specific change in *TII* in the corresponding group), $\ln\left(\widetilde{\frac{\mathrm{TII}_{\mathrm{it}}}{\mathrm{TII}_{\mathrm{it-1}}}}\right)$ is the BHC-specific change in *TII* from quarter *t-1* to quarter *t* (defined as the residual from a regression of $ln\left(\frac{TII_{it}}{TII_{it-1}}\right)$ on $\overline{\ln\left(\frac{TII_{it}}{TII_{it-1}}\right)}$), and $\beta^C_{i1,M,TII}$ and $\beta^C_{i1,i,TII}$ are the coefficients for *Cash Compensation Elasticity-*

Market and *Cash Compensation Elasticity-Bank* respectively. Importantly, the choice of these specifications for the distinct performance measures underpinning the estimation of *Cash Compensation Elasticity-Market* and *Cash Compensation Elasticity-Bank* imposes that the peer group-specific and the BHC-specific components of performance be orthogonal (i.e., uncorrelated).

3.6. BHC Risk

Having established measures of non-executive pay incentives over the time period 2003-2006, both in their bank-specific and peer-specific components, the subsequent step is to verify the impact of those measures on BHC risk during the financial crisis, i.e., over 2007-2009. To this end, we relate our elasticity measures to three main measures of BHC risk: *Tail Risk*, *Aggregate Risk*, and *Z-Score*.

To study the impact of *Cash Compensation Elasticity*, we perform the following risk regression:

$$BHC\ \ Risk_{i,t} = \alpha_1 + \alpha_2 \times \beta^{C}_{i1,TII} + \alpha_3 \times X_{i,2003-2006} + \varepsilon_{it} \quad (4),$$

with $t \in \{2007, 2008, 2009\}$ and $X_{i,2003-2006}$ denoting the matrix of our control variables measured as averages in 2003-2006, including, as main controls, *CEO Delta* and *CEO Vega*. Indeed, controlling our risk regressions for executive incentives is of fundamental importance, as our first, and preliminary, research question is whether the impact, if any, of non-executive incentives on bank risk taking is independent from executive incentives (see Section 3.7 below).

Next, in order to evaluate the role played by relative bank performance in driving the relationship between non-executive incentives and BHC risk, we consider an additional regression in which we study the separate impact of *Cash Compensation Elasticity+* ($\beta^{C}_{i1,TII+}$) and *Cash Compensation Elasticity-* ($\beta^{C}_{i1,TII-}$) on BHC risk:

$$BHC\ \ Risk_{i,t} = \alpha_1 + \alpha_2 \times \beta^{C}_{i1,TII+} + \alpha_3 \times \beta^{C}_{i1,TII-} + \alpha_4 \times X_{i,2003-2006} + \varepsilon_{it} \quad (5).$$

Further, in order to estimate the interaction between bank competition for middle managers (i.e., peer group factors), non-executive incentives, and BHC risk, we consider an additional regression, in which we study

the separate impact of *Cash Compensation Elasticity-Market* ($\beta^{C}_{i1,M,TII}$) and *Cash Compensation Elasticity-Bank* ($\beta^{C}_{i1,i,TII}$) on BHC risk:

$$BHC\ \ Risk_{i,t} = \alpha_1 + \alpha_2 \times \beta^{C}_{i1M,TII} + \alpha_3 \times \beta^{C}_{i1i,TII} + \alpha_4 \times X_{i,2003-2006} + \varepsilon_{it} \quad (6).$$

In Equations (4)-(6), the dependent variable, *BHC Risk*$_{i,t}$, is measured starting in the first quarter of 2007 and ending in the fourth quarter of 2009. Our main explanatory variables, *Cash Compensation Elasticity*, *Cash Compensation Elasticity+*, *Cash Compensation Elasticity-*, *Cash Compensation Elasticity-Market*, and *Cash Compensation Elasticity-Bank* are, instead, estimated over the period 2003-2006. Importantly, this empirical design permits us to address concerns of potential correlated-omitted variable specifications that may cause spurious correlation between non-executive incentives and risk-taking. Indeed, it seems reasonable to assume that financial markets and financial firms were unable to anticipate the effects of the crisis and adjust non-executive incentives to reflect such anticipation.

Lastly, to further investigate the relationship between bank competition, non-executive incentives, and BHC risk we verify the interacted impact of *Cash Compensation Elasticity-Market* ($\beta^{C}_{i1,M,TII}$) and E*mployee Turnover*, which we employ as a proxy for more intense bank competition, on BHC risk. Since available data from the Bank Regulatory Database on BHCs' employee turnover only report the net effect of new hires and fires on the total number of BHC employees, we estimate *Employee Turnover* by computing the ratio of the standard deviation of the quarterly change in the number of BHC employees over the absolute value of the interquartile range of this change in 2003-2006. More precisely, we estimate $Turnover_i = \frac{1}{|Q_{3,i}-Q_{1,i}|}\left[\frac{\sum_{q=1}^{16}(\Delta E_{i,q}-\overline{\Delta E_{i,q}})^2}{16-1}\right]^{0.5}$, where $Q_{3,i}$ and $Q_{1,i}$ correspond to the third and the first quartile of the quarterly change in the number of a BHC's employees (i.e., $\Delta E_{i,q}$), i indexes BHCs, and q denotes the calendar quarters in 2003-2006. In the interaction analysis we include controls that are analogous to those employed in Equation (6).

3.7. Firm Value Regressions

The conclusive step in our empirical analysis of the relationship between non-executive pay incentives, bank competition for middle managers, and bank risk-taking is to verify whether non-executive incentives led

to efficient or inefficient bank risk-taking, that is, risk-taking that increased or reduced bank value during the crisis years (i.e., 2007-2009). To this end, we first study the same relationship appearing in Equations (4) and (6) for BHC value, as measured by *Tobin's Q*. Additionally, because in banks the market value of assets may substantially deviate from the market value of equity due to their intrinsic high leverage, we also study the effect of non-executive pay incentives on an alternative measure of firm value, the *Market-to-Book* ratio, which mitigates related concerns as it estimates the ratio of the market value of equity to the book value of equity.

3.8. Control Variables

In selecting our set of control variables, our major concern is that factors other than non-executive incentives might influence changes in BHC risk and BHC value. Since the existing literature largely describes non-executive incentives as a by-product of endogenous organizational choices driven by top bank executives, we are particularly concerned that executive incentives could have primarily influenced BHC risk and BHC value during the crisis. Finding a confirmation for this alternative hypothesis would indeed negate both the role played by non-executive incentives in promoting excessive bank risk-taking and that of bank competition in shaping those incentives.

Our main controls are for two measures of executive compensation incentives: *CEO Delta*, which estimates the sensitivity of CEO compensation to stock price, and *CEO Vega*, which estimates the sensitivity of CEO compensation to stock return volatility. Specifically, we employ average *CEO Delta* and average *CEO Vega* estimated before the crisis (i.e., over the period 2003-2006), as we need a contemporaneous estimation period for verifying the impact of executive incentives onto non-executive incentives.

In addition to *CEO Delta* and *CEO Vega*, we also control our regressions for several variables that aim at capturing determinants of BHC risk (and, therefore, BHC value) that are independent from non-executive incentives. These variables are measured over the period 2003-2006.

First, we include a control variable for bank size (*Size*), since larger banks are more likely to benefit from various forms of governmental support while in financial distress and, therefore, may be more inclined to engage in excessive risk-taking than smaller banks.

Second, we control for past bank profitability (*ROA*), since banks that have previously failed to achieve targeted returns may be more inclined to undertake riskier investments.

Third, we control for several balance-sheet ratios, including: (i) total deposits to total assets (*Deposit/Assets*)—since, similar to larger banks, banks with more deposit-funding may also receive preferential government support upon financial distress and, therefore, be more prone to take excessive risk at the margin; (ii) Tier-1 capital to total assets (*Tier-1 Cap/Assets*)—since banks that are less well capitalized tend to be more exposed to insolvency when faced with high loan default rates and, therefore, could exhibit more conservative preferences in their investment policy; (iii) past bad loans to total assets (*Bad Loans/Assets*)—since historic bad loan performance is likely to negatively affect a bank's propensity to take more risk; and, (iv) following Ellul and Yerramilli (2013), total loans to total assets (*Loans/Assets*).[17]

Fourth, we control for the impact of the diversification of bank activities, since the level of a bank's risk-taking may change with the kind of activities that bank pursues. Our main control is for the share of non-interest income from total income (*Non-Int. Income/Income*), since banks with larger income from activities that do not earn interest may be viewed as more diversified than banks focusing on interest-income activities. We also control for the ratio of underwriter assets to total bank assets (*UW Assets/Assets*) and the ratio of insurance assets to total bank assets (*Ins. Assets/Assets*), since the built-in diversification of banks engaged in multiple lines of business may make such banks more willing to take on risk. Finally, we include as controls the ratio of derivative products trading to total bank assets (*Derivative Trading/Assets)* and derivative hedging to total bank assets (*Derivative Hedging/Assets*), since higher derivative trading points to greater risk-taking, while higher derivative hedging relates to stronger risk management and, in expectation lower risk-taking (see Ellul and Yerramilli, 2013).

[17] There is a caveat on the inclusion of *Loan/Assets* in the set of our control variables. Because loan portfolio size may well correlate to other measures of BHC size that we employ, a control for *Loan/Assets* may be redundant. However, we include this variable in the analysis in order to make our work consistent with, and comparable to, the work of Ellul and Yerramilli (2013).

4. Descriptive Statistics and Results

4.1. Descriptive Statistics for the Main Variables

We start our empirical analysis with Table 1, where we present definitions of the key variables that we employ in the investigation of BHCs' non-executive compensation policies, including (i) risk variables, (ii) elasticity measures, and (iii) control variables.

In Table 2, we then present descriptive statistics for our main explanatory, dependent, and control variables. Starting with the statistics for elasticity measures, the average estimate for our key explanatory variable, *Cash Compensation Elasticity*, is 0.98, meaning that a one percent increase in total interest income (*TII*) within a quarter is rewarded with nearly one percent quarterly increase in non-executive salary and bonus compensation (that is, with nearly the same increase per quarter as the increase in bank revenues). We note that there is very little variation in this estimate, with standard deviation only being 0.04. Since the absence of variation in our key independent variable may cause our results to be sensitive to outliers in the sample distribution, we hence Winsorize all elasticity measures, including *Cash Compensation Elasticity*, at 1% in each tail of their distributions.

Next, we observe that the elasticity measures that are based on bank relative performance, *Cash Compensation Elasticity+* and *Cash Compensation Elasticity-*, have different averages, at 0.99 and 0.92 respectively. This result seems to indicate that positive relative performance (i.e., a BHC performing better than its peer group) has a larger impact on non-executive incentives than negative relative performance (i.e., a BHC performing worse than its peer group). Consistent with this, we also find that in a one-directional t-test of the null hypothesis that *Cash Compensation Elasticity+* and *Cash Compensation Elasticity-* are equal at the bank level, the null is rejected with a t-statistics of 2.93, implying that *Cash Compensation Elasticity+* is greater than *Cash Compensation Elasticity-* at the 1% confidence level. We interpret these results as suggesting that while better-performing BHCs tend to reward their middle managers more than the average peer group compensation, BHCs that perform worse than their peer group still tend to reward their middle-managers in line with the average peer group compensation. Consistent with Acharya et al. (2013), we suggest that a possible explanation

for this evidence might be that BHCs anticipate that managers can always obtain their reservation utility by moving to a competitor in a competitive labor market where performance is based on short-term results. If this is the case, BHCs could be "forced" to match average peer group compensation to avoid losing their employees to competitors even upon negative relative performance.

Further, in line with our conjecture that market factors play a dominant role in shaping non-executive pay, we find that the bank specific component of non-executive incentives becomes negligible once it is isolated from the peer-specific component, with *Cash Compensation Elasticity-Market* being nearly 0.97 and *Cash Compensation Elasticity-Bank* only being 0.18. Consistent with this, we also find that in a one-directional t-test of the null hypothesis that *Cash Compensation Elasticity-Market* and *Cash Compensation Elasticity-Bank* are equal at the bank level, the null is rejected at the 1% confidence level (t-statistic is 14.02), implying that *Cash Compensation Elasticity-Market* is higher than *Cash Compensation Elasticity-Bank*.

To visually illustrate the results concerning our main independent variables, *Cash Compensation Elasticity* and *Cash Compensation Elasticity-Market*, we show scatter plots diagrams in Figure 2. In Scatter Plot A of Figure 2, we relate changes in each BHC's non-executive cash compensation to changes in that BHC's *TII*. We find that this relationship presents a nearly complete pass-through of changes in *TII* to changes in non-executive cash compensation (i.e., the cash compensation to non-executives changes by the same proportion as the changes in *TII*). In Scatter Plot B of Figure 2, we observe a similar pattern in relation to the peer-specific component of non-executive cash compensation, with changes in a BHC's average peer group TII being paired with nearly the same changes in that BHC's peer-specific component of non-executive cash compensation.[18] The similarity between the two patterns is again consistent with our conjecture that *Cash Compensation Elasticity* is likely to be linked to *Cash Compensation Elasticity-Market*.

[18] In Appendix Figure 1, we also show the histograms of *Cash Compensation Elasticity* and *Stock Compensation Elasticity*. We note the two-peaked distribution for *Stock Compensation Elasticity*, reflecting the fact that a number of BHCs in our sample did not offer stock compensation to their employees (either in the form of stock ownership plans or stock option plans).

Continuing with the summary statistics presented in Table 2, concerning our dependent variables, the average *Market-to-Book* ratio is higher than the average *Tobin's Q*, which is unsurprising given the high level of leverage on which banks operate.

Lastly, the estimates for our main controls, *CEO Vega* and *CEO Delta*, are in line with those previously noted in the literature (and, in particular, Core and Guay, 2002). Similarly, averages for our additional controls, which largely replicate those appearing in Ellul and Yerammilli (2013), are in line with those obtained in their study, although we compute our controls for a different sample period.

4.2. Correlations among Key Variables

In Table 3, we list the Pearson pair-wise correlations for our key variables. We start in Panel A of Table 3 by presenting correlations for elasticity measures. We observe a positive and significant correlation of 0.90 between *Cash Compensation Elasticity* and *Cash Compensation Elasticity-Market*, which is again in line with the hypothesis that market factors, rather than factors playing out at the individual bank level, shaped non-executive incentives before the crisis. The positive and significant correlation of 0.16 between *Cash Compensation Elasticity+* and *Cash Compensation Elasticity-Market* is also consistent with that hypothesis.

Next, in Panel B of Table 3, we present correlations between elasticity measures and, respectively, measures of BHC risk and our main controls, *CEO Vega* and *CEO Delta.* Concerning the correlation of non-executive pay elasticity and BHC risk, we note that *Cash Compensation Elasticity* and *Aggregate Risk* are positively and significantly correlated at 0.13. Consistently, the correlation of *Cash Compensation Elasticity* and *Z-Score* is negative and significant at -0.33 (since lower *Z-Score* values imply higher BHC risk).

To visually illustrate the univariate results of Table 3, in Figure 2, Scatter Plot C we present six sub-diagrams for the relationships between *Cash Compensation Elasticity* and *Cash Compensation Elasticity-Market,* on the one hand, and our measures of BHC risk (*Tail Risk*, *Aggregate Risk,* and *Z-Score*), on the other. In all six sub-diagrams, we note a positive slope of the regression of risk and non-executive compensation incentives, implying that higher levels of *Cash Compensation Elasticity*, as well as higher levels of *Cash Compensation Elasticity-Market*, lead to higher BHC risk across all our measures. Further, the patterns for the sub-diagrams that use

Cash Compensation Elasticity-Market are very similar to those that use *Cash Compensation Elasticity*, suggesting that market factors not only might have played a fundamental role in shaping non-executive incentives, but also in influencing the relationships between those incentives and bank risk-taking.

4.3. Results

In Tables 4 to 8, we present the results of the series of multivariate tests we perform to uncover the link between BHC non-executive incentives and BHC risk and BHC value.

4.3.1. Non-Executive Compensation and BHC Risk

Table 4 introduces our main multivariate results about the impact of pre-crisis (i.e., 2003-2006) non-executive incentives—as estimated by our key elasticity measure, *Cash Compensation Elasticity*—and BHC risk during the crisis (i.e., 2007-2009). Specifically, in Table 4 as in Tables 5 through 7, we show multivariate results for *Tail Risk* in Column (1), *Aggregate Risk* in Column (2), and *Z-Score* in Column (3). In Table 4, as in the following Tables discussed in this section, we use robust standard errors that are cluster-adjusted at the bank level to incorporate the correlation of regression residuals across the time period 2007-2009 for a given bank, as elasticity measures not vary within that period (Petersen, 2009).

Confirming that non-executive compensation incentives were an important source of the excessive bank risk-taking that emerged during the financial crisis, in Table 4 we document positive and statistically significant relationships between *Cash Compensation Elasticity* and our measures of BHC risks.[19] For example, in Column 2, we record a positive coefficient of 0.147 for *Aggregate Risk*, with a t-statistics of 4.84. Similarly, in Column 3, we find a negative and significant association between *Cash Compensation Elasticity* and *Z-Score*, implying higher bank instability. Economically the effect of *Cash Compensation Elasticity* on all three measures of BHC risk also is substantial. Specifically, BHCs with *Cash Compensation Elasticity* that is one standard deviation

[19] Our analysis in Table 4 is further supported by the analysis in Appendix Table 4 that uses alternative measures of BHC risk in the crisis years (2007-2009). We relate first *Cash Compensation Elasticity* to two additional measures of BHC risk: the volume of private mortgage-backed-securities-to-assets ratio (*Private MBS/Assets*), which we use as proxy for exposure to risky securities, and the ratio of bad loans to total assets (*Bad Loans/Assets*). We find that firms with high *Cash Compensation Elasticity* tend to have larger portfolio of MBS securities, at a statistically significant level with a t-statistics of 8.87. Similarly, *Cash Compensation Elasticity* is positively related to *Bad Loans/Assets* at a statistically significant level.

higher than the average exhibit (i) a 20.51% standard deviation increase in *Tail Risk*,[20] (ii) a 40.99% standard deviation increase in *Aggregate Risk*, and (iii) a 23.72% standard deviation decrease in *Z-Score*.

In controlling these results for executive incentives, we obtain that both *CEO Delta* and *CEO Vega* have an inconsistent effect on BHC risk. For example, *CEO Vega* appears to be an insignificant determinant of risk measured as either *Tail Risk* or *Aggregate Risk*. Similarly, *CEO Delta* appears to be an insignificant determinant of risk measured as *Aggregate Risk*. Importantly, this suggests that non-executive incentives played an independent role in influencing excessive bank risk-taking prior to the crisis and that their impact on BHC risk cannot be explained as being just a by-product of executive incentives.

4.3.2. Non-Executive Compensation, BHC Relative Performance, and BHC Risk

Table 4 shows that, unlike executive incentive, non-executives incentives had a consistent positive impact on bank risk-taking before the crisis. In line with our first, and preliminary, research hypothesis, we interpret this evidence as indicating that the inefficiencies in non-executive bank compensation that emerged during the crisis, i.e., the "fake alpha" problem, cannot be fully blamed on poor or opportunistic executive decision-making. Instead, the ultimate cause of such problem seems to rest on exogenous, rather than endogenous, factors, consistent with our additional research hypothesis that bank competition for middle bank managers played an essential role in shaping non-executive incentives and their relationship with bank risk-taking.

Moving further in the investigation of the role played by bank competition, in Table 5 we verify the impact of elasticity measures based on relative bank performance, *Cash Compensation Elasticity+* and *Cash Compensation Elasticity*, on BHC risk. If our conjecture about the role played by market factors is correct, we should find that the impact of non-executive incentives on BHC risk is conditioned by a BHC's relative performance. In particular, since a BHC's relative positive performance seems to have a larger impact on non-

[20] For each estimated coefficient, in Table 4 as in the following tables discussed in this section, the economic significance is calculated by multiplying the coefficient estimate by the standard deviation of the elasticity measure at hand times $\sqrt{12}$, and then divided by the standard deviation of the dependent variable. Note that we multiply elasticity measures by $\sqrt{12}$ to capture the aggregate impact of these measures on BHC risk over the period 2007-2009, i.e., all 12 quarters. Following this algorithm, for example, the economic significance for *Tail Risk* in Table 4 was calculated as follows: $20.51\% = 0.061 * 0.033 * \sqrt{12}/0.034$.

executive incentives than a BHC's negative relative performance (see Table 2), we should find that this asymmetry in non-executive incentives leads to a convexification of non-executive compensation policies that positively impacts BHC risk.

The results we present in Table 5 support these predictions. When we relate *Cash Compensation Elasticity+* and *Cash Compensation Elasticity-* to measures of BHC risk, we obtain that *Cash Compensation Elasticity+* has a positive significant impact on BHC risk across all our measures of risk. Economically, this impact is high. For example, BHCs with *Cash Compensation Elasticity+* that is one standard deviation above the average exhibit: (i) a 48.29% standard deviation increase in *Tail Risk*, (ii) a 67.42% standard deviation increase in *Aggregate Risk*, and (iii) a 17.28% standard deviation decrease in *Z-Score*. Instead, *Cash Compensation Elasticity-* has no statistically or economically significant impact on BHC risk in any of the regressions shown in Table 5.

The fact that only *Cash Compensation Elasticity+* has an impact on BHC risk, while *Cash Compensation Elasticity-* is insignificant reflects the asymmetric constraints that arise out of bank competition in the labor market for any BHC's non-executive compensation policy. On the one hand, competition among BHCs demands non-executive incentives that are more sensitive to a BHC's relative positive performance. On the other, however, it does not necessarily demand non-executive incentives that are more sensitive to negative variations in relative performance, as BHCs anticipate that middle managers can always move to a competitor if their outside option is not matched by their current employer. The overall result of these asymmetric constraints is thus a convexification of non-executive compensation policies that leads to greater incentives for excessive risk-taking.

4.3.3. BHC Risk and Incentives to Peer group-Specific vs. Bank-Specific Performance

In Table 6, Panel A, we take a step forward and verify whether market factors play any *direct* role in shaping BHCs' non-executive compensation incentives and their impact on BHC risk. We do so by estimating the impact of elasticity measures reflecting the peer-specific and bank-specific components of non-executive incentives, *Cash Compensation Elasticity-Market* and *Cash Compensation Elasticity-Bank*, on our measures of BHC risk.

Our results in Table 6, Panel A, confirm that non-executive incentives are largely driven by peer-specific performance, with residual bank-specific performance having, instead, very limited influence on such incentives. Indeed, while *Cash Compensation Elasticity-Market* increases BHC risk in any of the specifications of risk we employ, *Cash Compensation Elasticity-Bank* appears to have no significant impact on BHC risk. Further, the effect of *Cash Compensation Elasticity-Market* appears sustained if we exclude *Cash Compensation Elasticity-Bank* from the analysis (i.e., the regression in Equation (6) of Section 3.6). In terms of economic significance, the impact of *Cash Compensation Elasticity-Market* on BHC risk also is substantial. For example, banks with a *Cash Compensation Elasticity-Market* that is one standard deviation above the average exhibit: (i) a 30.61% standard deviation increase in T*ail Risk*, (ii) a 42.20% standard deviation increase in *Aggregate Risk*, and (iii) a 18.96% standard deviation decrease in *Z-Score*.[21]

Continuing along the same line of investigation, in Panel B of Table 6, we estimate the interacted impact on BHC risk of *Cash Compensation Elasticity-Market* (for the peer-specific component of non-executive incentives) and *Employee Turnover*, which we employ as a proxy for more intense bank competition for non-executive services. Indeed, if bank competition for non-executive services has an independent and major impact on non-executive incentives and BHC risk, we should find that such impact increases when *Employee Turnover* is higher.

The results we obtain in Table 6, Panel B, confirms that the impact of *Cash Compensation Elasticity-Market* on BHC risk is stronger when *Employee Turnover* is higher. This impact also is economically substantial. For example, a one standard deviation increment in *Employee Turnover* amplifies the impact of *Cash Compensation Elasticity-Market* on (i) *Tail Risk* by 29.11%, (ii) *Aggregate Risk* by 22.95%, and (iii) *Z-Score* by 13.2%.

[21] Remarkably, the estimated economic magnitudes for the impact of *Cash Compensation Elasticity-Market* on BHC risk in Table 6, Panel A are higher than the estimated economic magnitudes for the impact of *Cash Compensation Elasticity* on BHC risk in Table 4. Again, this confirms our hypothesis that *Cash Compensation Elasticity* is largely driven by *Cash Compensation Elasticity-Market*.

4.3.4. Non-Executive Stock Compensation and BHC Risk

So far, our empirical analysis has focused on investigating the effect of the cash component of BHCs' non-executive compensation incentives. As note in Section 3.2, the rational for focusing on *Cash Compensation Elasticity* as our main explanatory variable is that the 98% of total non-executive compensation in our sample of BHCs was in the form of cash compensation. This implies that the effects of BHCs' non-executive compensation on BHC risk were largely driven by the cash component of such compensation, with the stock component only having a marginal effect on BHC risk.

Nonetheless in estimating the impact of *Stock Compensation Elasticity* on BHC risk, we obtain noteworthy results, which we present in Table 7. The coefficient for the impact of *Stock Compensation Elasticity* is significant and negative for *Tail Risk* and *Aggregate Risk*, meaning that BHCs with higher *Stock Compensation Elasticity* tend to present lower BHC risk. These results translate in the following economic effects. BHCs with a *Stock Compensation Elasticity* that is one standard deviation above the average exhibit a 21.18% standard deviation decrease in T*ail Risk* and a 39.91% standard deviation decrease in *Aggregate Risk*.

While the magnitude of the stock compensation component of non-executive incentive is such that these results do not change our main hypothesis about the distortions introduced in non-executive incentives by bank competition, they suggest that equity compensation involves dynamics that are very different from those involved by cash compensation. In particular, a possible explanation to reconcile the evidence we obtain as to the impact of *Cash Compensation Elasticity* and *Stock Compensation Elasticity* on BHC risk is that equity-based compensation is more likely to internalize the potential detrimental effects that higher risk-taking may have in the long term because future stock value will tend to reflect those effects. At the same time, the use of equity-based compensation, especially when provided in the form of restricted stock or other deferred forms, is also likely to disincentivize excessive employee mobility (as long-term rewards are foregone when the employee moves to a competitor) and, therefore, reduce the scope for the negative externality engendered by bank competition on bank non-executive compensation policies.

4.3.5. Effect on BHC Value

The results we obtain in the risk regressions of Tables 4 through 7 deliver two important insights. First, they document that pre-crisis non-executive incentives had an independent positive significant effect on BHC risk during the crisis. Second, they lend empirical support to the view that bank competition in the labor market was the root cause of the distortions in bank compensation that emerged during the crisis. That analysis, however, does not provide us with an answer as to whether BHC risk was efficient (i.e., value increasing) or inefficient (i.e., value decreasing). In order to address this issue, in Table 8, we test for the effect of non-executive incentives on bank value as measured by both *Tobin's Q* and the *Market-to-Book* ratio.

The results we obtain show that BHCs with higher *Cash Compensation Elasticity* have lower firm value, as measured by both *Tobin's Q* and the *Market-to-Book* ratio. Specifically, BHCs with *Cash Compensation Elasticity* that is one standard deviation above the average exhibit a 12.95% lower level of *Tobin's Q* and a 13.06% lower level of *Market-to-Book* ratio.[22] Instead, *Stock Compensation Elasticity* has a positive significant impact on BHC value in the *Market-to-Book* ratio regressions and a marginally significant positive impact on BHC value in the *Tobin's Q* regressions. This is consistent with our results of Table 7 showing that *Stock Compensation Elasticity* seems to reduce BHC risk.

In addition to the results shown in Table 8, we also estimate separate regression to verify the impact of *Cash Compensation Elasticity-Market* and *Cash Compensation Elasticity-Bank* on BHC value. While we do not show these results to save space, we report that the estimates for the impact of *Cash Compensation Elasticity-Market* on BHC value are similar to those reported in Table 8 for *Cash Compensation Elasticity*. In contrast, the estimates for *Cash Compensation Elasticity-Bank* are insignificant.

Overall, this evidence is consistent with the theory we empirically explore in our analysis that links bank competition, non-executive incentives, and bank risk-taking. On the one hand, the results we obtain in

[22] Similar to what we did for the relationship between *Cash Compensation Elasticity* and BHC risk, in Appendix Table 4 we also relate *Cash Compensation Elasticity* to two additional measures of BHC value: BHC profitability (*BHC ROA*) and BHC stock returns (*BHC Stock Returns*), defined as the buy-and-hold return on the BHC's stock over the calendar year. We find that *Cash Compensation Elasticity* is negatively related to both BHC *ROA* and BHC *Stock Returns,* consistent with the results we obtain in Table 8 by estimating BHC value through *Tobin's Q* and the *Market-to-Book* ratio.

Table 8 for *Cash Compensation Elasticity* (combined with the additional results we obtain for *Cash Compensation Elasticity-Market* and *Cash Compensation Elasticity-Bank*) confirm that bank competition played a largely dominant role in shaping distorted non-executive incentives that promoted the undertaking of inefficient risk-taking. On the other, the results of Table 8 about *Stock Compensation Elasticity* confirm that equity-based compensation has the potential to internalize the long-term externalities of excessive risk-taking and promote the undertaking of more efficient levels of BHC risk.

5. Robustness Tests

In this section we present our robustness analysis, proceeding in three parts. First, we introduce an alternative estimation approach to address the reflection problem that arises in peer group choice (see Sections 3.3 and 3.5). Second, we present a GMM estimation aimed at addressing residual correlated-omitted variable concerns that may affect our investigation of the relationship between BHCs' non-executive incentives and BHC risk. Third, we present alternative choices for our (i) independent variables (i.e., elasticity measures), (ii) dependent variables (i.e., measures of BHC risk) and (iii) control variables.

5.1 Reflection Problem

As described in Section 3.5, the reflection problem, arising from the difficulty of estimating the factors that *cause* the correlation between non-executive pay incentives among peer banks, poses the main challenge for our choice of peer groups.[23] Indeed, the simultaneity of non-executive compensation behavior in BHCs belonging to the same peer group makes it difficult to separate endogenous from exogenous effects in the context of linear-in-means models, such as the one that we use in Equation (3) of Section 3.5. In order to address this problem, in Equation (3) we take two steps. First, we adopt a heterogeneous peer group choice. Second, we separate (i.e., orthogonalize) the measures of peer-specific and bank-specific performance.

[23] Three distinct effects may influence identified correlations (see Manski, 1993): (i) *exogenous* effects—in our case, the effect that exogenous peer group *characteristics* have on the compensation policy of any peer group members; (ii) *endogenous* effects—in our case, the effect that peer group *compensation policies*' choices may have on the compensation policy of any of the peer group members, due to, for example, the competition for middle managers in the market; and (iii) *correlated* effects—in our case, the effect caused by the fact that BHCs in the same peer group might compensate their employees similarly because they operate in a common environment and are subject to the same environmental factors.

A residual concern with that methodology is whether the orthogonalization of our performance measures is sufficient to address the identification of the peer-specific and bank-specific components of each BHC's performance, as there is no formal diagnostic test to this purpose. In order to tackle this residual concern, as well as to provide a supplementary test for addressing the reflection problem, we replicate here the approach for identifying peer group effects of Bramoulle et al. (2009). Specifically, we estimate the *cross-elasticity* of quarterly non-executive cash compensation with respect to peer group cash compensation over 2003-2006 and verify whether the sufficient conditions described by Bramoulle et al.(2009) for peer group effects identification are met.

In this new empirical design, we preserve the estimation window of sixteen quarters during 2003-2006 we used in Equation (3):

$$\ln\left(\frac{C_{it}}{C_{it-1}}\right) = \alpha + \beta^{C}_{i1,M,TII} \times \overline{\ln\left(\frac{TII_{it}}{TII_{it-1}}\right)} + \beta^{C}_{i1,i,TII} \times ln\left(\frac{TII_{it}}{TII_{it-1}}\right) + \gamma^{C}_{i1,TII} \times \overline{\ln\left(\frac{C_{it}}{C_{it-1}}\right)} +$$

$$+\beta^{C}_{i2,TII} \times ln\left(\frac{EMP_{it}}{EMP_{it-1}}\right) + \beta^{C}_{i3,TII} \times ln\left(\frac{MCAP_{it}}{MCAP_{it-1}}\right) + \delta_1 \times Q_{4t} + \varepsilon_{it} \quad (7),$$

where Q_{4t} is the indicator variable for the fourth calendar quarter, $\overline{\ln\left(\frac{C_{it}}{C_{it-1}}\right)} = \frac{1}{N}\sum_{i=1}^{N}\frac{C_{it}}{C_{it-1}}$ is the peer-specific equally-weighted average growth of cash compensation from quarter *t-1* to quarter *t*, and $\gamma^{C}_{i1,TII}$ is the coefficient for *Cash Compensation Cross-Elasticity*.

We emphasize that in order to capture the cross-elasticity of a BHC's cash compensation with respect to its peer group, in Equation (7) we substitute the bank-specific residual component of performance, appearing in Equation (3), $\ln\left(\frac{\widetilde{TII}_{it}}{TII_{it-1}}\right)$, with two components, $\overline{\ln\left(\frac{C_{it}}{C_{it-1}}\right)}$ and $\ln\left(\frac{TII_{it}}{TII_{it-1}}\right)$, which respectively capture the peer group's average cash compensation changes and the BHC's changes in *TII*. As in Equation (3), we estimate the model in Equation (7) with heterogeneous peer groups for each BHC. However, here we also verify that the conditions for heterogeneity meet the specific identification conditions set in Bramoulle et al. (2009).[24]

[24] The specific identification conditions are noted in Proposition 1 of Bramoulle et al. (2009). The sufficient conditions

Since *Cash Compensation Cross-Elasticity* measures the sensitivity of each BHC's cash compensation policy to the compensation policy of that BHC's peer group in 2003-2006, we expect to find a positive and significant coefficient, in line with our hypothesis that bank competition for middle managers largely shaped BHC's non-executive compensation policies.

We show multivariate analysis for the impact of *Cash Compensation Cross-Elasticity* on BHC risk in Table 9 (specifically, we show results for *Tail Risk* in Column (1), *Aggregate Risk* in Column (2), and *Z-Score* in Column (3)).[25] In line with our hypothesis, we find that *Cash Compensation Cross-Elasticity* has a positive, and significant, impact on BHC risk across all our measures of risk, hence confirming the major role played by peer group factors in shaping non-executive incentives and their impact on BHC risk.

5.2. System GMM Analysis

An additional potential concern with the empirical design presented in Tables 4 through 7 is the possibility that *both* pre-crisis BHCs' non-executive incentives and BHCs' risk exposures observed during the crisis reflect the level of BHC *specialization* in a particular product line (e.g., subprime loans). Indeed, it is possible that banks that specialized in, for example, subprime loans origination and distribution, offered stronger non-executive incentives before the crisis and, as a result, were more exposed to risk during the crisis. In order to exclude the possibility that a correlated-omitted variable (and the associated estimation bias) may affect our empirical results, we use an approach based on a system GMM estimation in a sample that extends

require that (i) $\gamma^{C}_{i1,TII} + \beta^{C}_{i1,M,TII} \times \beta^{C}_{i1,i,TII} \neq 0$ and that (ii) matrices I, G, and G^2 are linearly independent in order for the coefficients in the Equation (3) to be identifiable, where I is an identity matrix of dimensions 88 x 88 (we include in the peer group selection all 88 BHCs in our original sample) and matrix G has dimensions of 88 x 88 and includes the following elements: $G_{ij} = 1/5$ (i.e., $1/n$ where n is the size of the peer group) if the BHC *i* has the BHC *j* in its peer group, and zero otherwise. We confirm that the requirements of Proposition 1 are met in our peer group choice. Note that we cannot perform a similar test for the coefficient estimates appearing in Equation (3), hence the need to perform the estimation of Equation (7).

[25] We present descriptive statistics for *Cash Compensation Cross-Elasticity* in Appendix Table 2. In Panel A of Appendix Table 2, the average *Cash Compensation Cross-Elasticity* is 0.44 with a standard deviation of 1.15. This implies that a BHC's non-executive cash compensation policy is substantially driven by its peer group's non-executive compensation policy, as, for example, a percent increase in the peer group's cash compensation translates, on average, in a 0.44% increase in a BHC's non-executives cash compensation policy. In Panel B of Appendix Table 2 we also recognize that there is a statistically significant positive correlation of *Cash Compensation Cross-Elasticity* with *Cash Compensation Elasticity-Market* as well as with *Stock Compensation Elasticity*. Further, in Panel C of Appendix Table 2, we note, first, a negative and statistically significant correlation of *Cash Compensation Cross-Elasticity* with *Z-Score* at -0.251 and, second, a positive and statistically significant correlation of *Cash Compensation Cross-Elasticity* with both *CEO Delta* and *CEO Vega*.

from 1994 through 2010 (i.e., 68 calendar quarters) (see Arellano and Bond, 1991; Arellano and Bover, 1995; and Blundell and Bond, 1998).[26]

In order to be consistent with our prior analysis in Tables 4 through 9, we restrict our sample in the GMM analysis to include only the 77 banks appearing in our final sample. As dependent variables, we use our three measures of risk (i.e., *Tail Risk*, *Aggregate Risk*, and *Z-Score*), calculated quarterly. The key explanatory variable is *Cash Compensation Elasticity*, obtained from overlapping estimation windows of four years.[27] We also include the annual values of CEO *Delta*, CEO *Vega*, and all the other controls we use in Table 4—except for *BHC Size* and *BHC ROA* that are, instead, used as instruments along with year indicator variables. We choose *BHC Size* and *BHC ROA* as excluded instruments, as we find that these variables are important factors to determine *Cash Compensation Elasticity*, while they are poorly correlated with both *Tail Risk* and *Aggregate Risk* in the estimation period 1994-2010. This implies that *BHC Size* and *BHC ROA* are likely to be both relevant and exclusive instruments for non-executive compensation incentives. We also note that all independent variables are pre-determined, i.e., calculated as of the quarter preceding the quarter of observation for BHC risk.[28] Lastly, we include firm fixed-effects as a key control in order to capture any unobserved time-invariant variation in firm characteristics, which allows us to study the effect of changes in *Cash Compensation Elasticity* on changes in BHC risk.

Following Blundell and Bond (1998), we estimate the following equation:

$$BHC\ Enterprise\ Risk_{it} = a_1 + a_2 \times b^{C}_{i1,TII} + a_3 \times X_{i,t-1} + f_i + \varepsilon_{it} \quad (8),$$

where $i \in (1, \dots, N)$ indexes BHCs, $t \in (1, \dots, T)$ indexes quarters (with fixed T), f_i is an unobservable firm-specific effect (e.g., BHC specialization, as noted above), and $\varepsilon_{it} = \propto * \varepsilon_{it-1} + \nu_{it}$.

[26] In the GMM analysis we only consider *Cash Compensation Elasticity*, and not also *Cash Compensation Elasticity-Market* and *Cash Compensation Elasticity-Bank*, as our goal is not to verify the validity of our main hypothesis over the time period 1994-2010, but rather to ascertain that the results attaining our key explanatory variable, *Cash Compensation Elasticity*, are not subject to a correlated-omitted variable bias.

[27] For example, the first estimation window goes from the first quarter of 1991 to the fourth quarter of 1994, the second goes from the second quarter of 1991 till the first quarter of 1995, and so on.

[28] These results are presented in Appendix Table 3.

In order to apply the GMM estimator we impose the following moment conditions:[29]

$$E(f_i) = 0,\ E(\varepsilon_{it}) = 0,\ E(f_i \times \varepsilon_{it}) = 0, \text{ for all } i \text{ and all } t, \tag{8.1}$$

$$E(\varepsilon_{it} \times \varepsilon_{is}) = 0, \text{ for all } i \text{ and for all } t \neq s, \text{ and} \tag{8.2}$$

$$E(Enterprise\ Risk_{it} \times \varepsilon_{is}) = 0 \text{ for all } i \text{ and all } t \geq 2. \tag{8.3}$$

Our results are shown in Table 10. We find a statistically significant effect of *Cash Compensation Elasticity* on BHC risk, in particular when measured as *Tail Risk*. We also remark that the coefficient estimates for our control variables, and, in particular, *CEO Delta* and *CEO Vega*, are in line with prior estimates appearing in Tables 4 through 7 and also consistent with the estimates reported by Ellul and Yerramilli (2013).

5.3. Robustness with Alternative Estimates of Non-executive Compensation Elasticity

A further concern with our key explanatory variable, *Cash Compensation Elasticity* is that our results might be an artifact of the four-year (2003-2006) estimation window we used in Equation (1) of Section 3.2, meaning that those results might not be robust to the selection of an alternative estimation window. That same concern also affects the variables that we use to disentangle specific components of *Cash Compensation Elasticity* (i.e., *Cash Compensation Elasticity+*, *Cash Compensation Elasticity-*, *Cash Compensation Elasticity-Market* and *Cash Compensation Elasticity-Bank*), as the regressions we use to estimate those variables in Equation (2) and (3) are based on our main regression in Equation (1). A secondary concern that may affect the estimation window length, and the corresponding available degrees of freedom to estimate elasticity measures is the inclusion of a quarterly indicator for the last calendar quarter, i.e., Q_{4t}. In order to address these concerns, in this section we present a series of additional robustness tests that examine alternative measures for *Cash Compensation Elasticity* (and for the other elasticity estimates that disentangles its specific components), as we both vary the length of our estimation period and include more quarterly dummies in Equation (1).

[29] The above conditions are sufficient to identify and estimate the coefficients if $T \geq 3$ (which is the case in our panel). The estimation is in first differences.

5.3.1. Estimates over 2003-2006 with no Quarterly Indicator

We start with the simple case of an estimation period of sixteen quarters over four years, i.e., from 2003 to 2006 excluding the fourth quarter indicator (i.e., Q_{4t}) from Equation (1).

By implementing these modifications, we obtain that our results in Tables 4 through 8 with the modified estimate for *Cash Compensation Elasticity, Cash Compensation Elasticity+*, *Cash Compensation Elasticity-*, *Cash Compensation Elasticity-Market*, and *Cash Compensation Elasticity-Bank* are stronger.

5.3.2. Estimates over 2001-2006 with Three Quarterly Indicators

We move next to an alternative estimation window of twenty-four quarters (or six years), i.e., from 2001 to 2006, where we also include in Equation (1) three quarterly indicator dummies, i.e., Q_{1t}, Q_{2t}, and Q_{3t}. We set Q_{1t} equal to one for the first calendar quarter and zero otherwise (we defined accordingly the other two indicator variables). We further modify Equation (1) so to include three quarterly indicators and an intercept (we include only three quarterly dummies in order to be able to estimate the intercept). The three quarterly indicators are included to the purpose of capturing seasonal effects in the compensation policies of any given BHC in our sample.

By implementing these modifications, we obtain that our results for Tables 4 through 8 are similar to those reported in our main analysis. However, when we estimate *Cash Compensation Elasticity* including the three quarterly indicator variables, the impact of this variable on BHC risk as appearing in the specifications of Table 10 (i.e., the GMM analysis) becomes weaker. While we still find significant estimates for all our measures of risk, in the case of *Aggregate Risk* and *Z-Score* they only are significant at the 10% confidence level.

Finally, we also consider an estimation of Equation (1) over six years with only one quarterly dummy, (with the quarterly dummy being defined as equal to one for the last quarter and zero otherwise). Again, we find that our results are comparable in terms of statistical significance to the results of Tables 4 through 8.

5.3.3. Changes from Q_t to (i) Q_{t-2}, (ii) Q_{t-3}, or (iii) Q_{t-4}

In Table 4, we only consider quarterly variations from Q_{t-1} to Q_t to estimate the impact of non-executive compensation elasticity on BHC risk, as we deem the estimation of elasticity based on that temporal

lag to be the most conservative. To verify whether the impact of our elasticity measures on BHC risk changes based on the time lag that is considered, here we also study elasticity estimates that are based on quarterly variations from Q_{t-2} to Q_t, Q_{t-3} to Q_t,, and Q_{t-4} to Q_t.

We find that elasticity estimates based on quarterly variations from Q_{t-2} to Q_t and Q_{t-4} to Q_t have a less significant impact on BHC risk than elasticity estimates based on quarterly variations from Q_{t-1} to Q_t.[30] Instead, elasticity estimates based on quarterly variations from Q_{t-3} to Q_t have a stronger impact on BHC risk than elasticity estimates based on quarterly variations from Q_{t-1} to Q_t. Hence, the overall results that we obtain when we study variation in BHCs' non-executive incentive policies over longer periods (e.g., changes over two, three or four quarters) suggest that BHC set non-executive incentives in a manner consistent with the time variation in performance, which results in a further increase in BHC risk.

5.3.4. Estimates with Alternative Executive Compensation Allocation

In our main tables, we disentangle non-executive compensation from a BHC's total compensation by pro-rating annual (stock or cash) executive compensation for each calendar quarter—as data on executive compensation are only reported annually in the ExecuComp database—following the same quarterly proportions that are available for total (cash or stock) compensation from the Bank Regulatory database. For each quarter, we then subtract the (cash or stock) executive compensation component from a BHC's total (cash or stock) compensation. A potential concern with this approach is that firms, and especially banks, tend to reward their top executives with annual bonuses and/or annual stock and option grants at the end of each fiscal year, rather than providing such benefits in the same proportions throughout the calendar quarters (as is, instead, common for non-executives). In order to reflect that circumstance, we hence re-calculate our elasticity measures (i.e., *Cash Compensation Elasticity, Cash Compensation Elasticity-Market, Cash Compensation Elasticity-Bank, Cash Compensation Elasticity+, Cash Compensation Elasticity-,* and *Stock Compensation Elasticity*) assuming that executive compensation is paid only in the last (i.e., fourth) quarter.

[30] The impact of *Cash Compensation Elasticity* on both *Tail Risk* and *Aggregate Risk* estimated over Q_{t-2} to Q_t or Q_{t-4} to Q_t becomes significant at the 10% confidence level.

By implementing this change in the estimation of our elasticity measures, we find that the results about the impact of such measures on both BHC risk and BHC value (as specified from Tables 4 through Table 8) are isomorphic to the results we obtain in our main analysis.

5.4. Additional Measures of BHC Risk

Analogously to what we did for our independent variables, in this section we consider whether our results on the impact of non-executive pay incentives on BHC risk are affected by the choice of our dependent variables by considering alternative measures of BHC risk.

5.4.1. Equity Beta

We start by using equity beta as an additional measure of BHC risk, calculating it as the coefficient estimate from the Lintner model of the CAPM using weekly data for 104 weeks ending at the end of the fiscal year.[31]While equity beta is largely dependent on financial leverage, its use as an alternative measure of bank risk is reasonable as bank leverage is highly regulated.

Summary results for our estimates using equity beta and replicating the analysis of Tables 4 through Table 8 indicate that, overall, our prior results are consistent with results using equity beta. Nevertheless, such results are weaker. Starting with the analysis in Table 4, for example, the coefficient for *Cash Compensation Elasticity* that we obtain using equity beta as our dependent variable is 1.15 with a t-statistic of 3.06 (as compared to, for example, a coefficient estimate of 0.147 with a t-statistic of 4.84 for *Aggregate Risk*). Similarly, for the analysis in Table 5, the coefficient estimate for *Cash Compensation Elasticity+* in equity beta regressions is 1.61 with a t-statistic of 2.41 (as compared, for example, with a coefficient estimate of 0.133 with a t-statistic of 3.79 for *Aggregate Risk*). Still, for the analysis in Table 6, Panel A, the coefficient estimate for *Cash Compensation Elasticity-Market* with the dependent variable being equity beta is 1.72 with a t-statistic of 2.79 (as compared, for example, with a coefficient estimate of 0.135 with a t-statistic of 5.89 for *Aggregate Risk*). These results, however, are not surprising as equity beta is an estimate from a regression model and, therefore, an intrinsically noisier proxy for BHC risk than any of our main risk measures.

[31] The average equity beta in our sample of BHC for 2007-2009 is 1.21 with a standard deviation of 0.566.

5.4.2. Implied Volatility

Further, as an alternative measure of BHC Risk, we consider implied stock returns volatility (*Implied Volatility*), defined as the average annual implied volatility for standardized call options of 90 days maturity. We obtain data for *Implied Volatility* from the Option Metrics database, which estimates this measure by applying the Black-Scholes option pricing equation. Since that calculation imposes several distributional assumptions on the returns data, a concern with this measure is that it might be noisier than the measures reported in our main analysis. For this reason, we only use *Implied Volatility* as a robustness test.

Replicating the analyses in Tables 4 through Table 7, we observe that overall our results become weaker when BHC risk is measured as *Implied Volatility*. Nonetheless, the results obtained for the specifications in Table 4 and Table 6 remain comparable with those obtained through our main risk measures.

We further study implied volatility on standardized call options of 60 days maturity (as opposed to implied volatility on standardized call options of 90 days maturity), reporting that our results with this alternative specification are similar to those obtained with *Implied Volatility*.

5.4.3. Modified Tail Risk

Lastly, we explore an alternative specification of *Tail Risk*, redefining it to be the average return on each BHC's stock during the 10% worst days for the S&P 500—as opposed to the 5% worst days that is considered in Acharya et al. (2010). Using this modified specification of *Tail Risk*, we obtain results that are statistically stronger than the results we obtain in our main analysis using *Tail Risk* as defined in Acharya et al. (2010).

5.5. Alternative Measures of Executive Incentives

Another, and crucial, concern with our analysis is that we proxy executive incentives by using *CEO Delta* and *CEO Vega*, which are measures that intrinsically differ from the elasticity measures we use to estimate non-executive incentives. This circumstance may make the results we obtain for executive and non-executive incentives potentially incomparable, hence biasing our inference that non-executive, rather than executive, incentives played a major role in promoting excessive BHC risk-taking prior to the crisis. On top of this, *CEO*

Delta and *CEO Vega* only serve as proxies for CEO incentives, while there are other top executives who may play an important role in risk-taking decisions (e.g., Chief Financial Officer (CFO), Chief Operations Officer (COO), and Chief Information Officer (CIO)).

To address these concerns, we introduce elasticity measures for estimating the compensation incentives of the top management team as a group—using the aggregate cash and aggregate stock compensation for all top management executives, as reported in the ExecuComp dataset. To this end, first, we re-estimate Equation (1) with dependent variable being the quarterly pro-rated top management team compensation. Specifically, we pro-rate the annual aggregate cash compensation and the annual aggregate stock compensation to the top executives team in the same proportions as total cash and stock compensation. We term the elasticity estimates of interest as *Executive Cash Compensation Elasticity* and *Executive Stock Compensation Elasticity* respectively.[32] Second, we control the risk regressions of Equations (4), (5), and (6) for both *Executive Cash Compensation Elasticity* and *Executive Stock Compensation Elasticity,* in lieu of *CEO Delta* and *CEO Vega*.

Adopting this different methodology for estimating executive incentives, the results for the impact of non-executive incentives on BHC risk in the specifications from Table 4 to Table 7 are preserved, i.e., statistically significant.

5.6. Additional Controls

As additional controls, in our robustness test we include contemporaneous *CEO Delta* and *CEO Vega*, as it is possible that BHC risk depends on contemporaneous, rather than historic, executive incentives—for example, because past executive incentives have less influence on bank assets. To address this concern we replace the controls for averages *CEO Delta* and *CEO Vega* over 2003-2006 that appear in our main regressions with controls for 2007-2009 averages of *CEO Delta* and *CEO Vega*. In estimating *CEO Delta* and *CEO Vega*

[32] Concerning descriptive statistics for these measures, we obtain that the average *Executive Cash Compensation Elasticity* is 0.98 with a standard deviation of 0.196. Hence, while the average for *Executive Cash Compensation Elasticity* is similar to that of *Cash Compensation Elasticity*, the former has substantially higher variation. Second, we note that the correlation of *Cash Compensation Elasticity* and *Executive Cash Compensation Elasticity* is 0.167, statistically significant.

over this different time period, we observe that the 2007-2009 averages are substantially smaller than the averages in the pre-crisis period.

We find that including contemporaneous measures of executive incentives does not alter our main results. In particular, the significant impact of *Cash Compensation Elasticity* on BHC risk is preserved even with these different estimates.

Finally, we add additional controls for predetermined risk and predetermined *Tobin's Q*. Regarding the former, the concern is that risk may be "persistent", meaning that the banks that had the highest risk exposure during the crisis may be the same that had the highest risk before the crisis. This, in turn, could undermine our results about the effect of BHCs' non-executive incentives on BHC risk. However, when we control for historical BHC risk (as of the Q4 2006), our results on the relationship between non-executive incentives and BHC risk are nearly unchanged.

An argument similar to that of the persistency of bank risk-taking could be advanced for the relationship between any given BHC's 2007-2009 *Tobin's Q* and that BHC's pre-crisis valuation. Indeed, it is possible that poorly performing banks readjusted non-executive incentives before the crisis so to incentivize improved future performance. Such high-powered incentives could have exerted an autonomous role in promoting higher risk-taking and lowering *Tobin's Q* values. To rule out this effect, we control for past *Tobin's Q* and obtain that our results still maintain.

6. Conclusions

In this paper, we investigate the association between non-executive incentives in U.S. bank holding companies (BHCs) before the crisis and BHC risk and BHC value during the crisis. To this end, we introduce novel measures of compensation incentives to BHC non-executives based on the elasticity of BHC compensation—net of executive compensation—to BHC performance (as proxied by total interest income). In contrast to the conventional view that describes non-executive incentives as a second order problem

compared to executive incentives, we show that the former exerted a positive significant *and* independent impact on BHC risk. BHCs with higher compensation elasticity before the crisis exhibited both a higher BHC risk and a lower BHC value during the crisis. After that, our major new finding is to document that the identified positive relationship between non-executives incentives and higher bank risk is largely dependent on incentives that are driven by peer-group performance rather than individual bank performance.

Overall our results highlight that bank competition for middle managers, rather than endogenous organizational choices made by top executives, has provided the root problem of the distortions in bank compensation that emerged during the crisis. In particular, our analysis support the theory that bank competition has engendered a negative contractual externality in bank compensation, leading to a regime of excessive employee mobility under which no bank can implement compensation mechanisms that lead to the revelation of non-executive types over time (see Acharya, et al., 2013).

An immediate implication of our analysis of the relationship between bank non-executive incentives and excessive risk-taking is that focusing exclusively on executive compensation reform—as post-crisis financial regulatory interventions have done in both the United States and Europe—might be an imperfect method to reduce bank risk-taking. Because market forces largely drive the risk incentives underlying non-executive compensation, regulation designed to improve executive incentives may fail to fully solve the problem of excessive bank risk-taking even when successful.

A better policy strategy might consist in limiting bank competition for non-executive services. To this end, regulation should restrict employee mobility, for example, by introducing a tax on non-executive transfers (Acharya, et al., 2013; Besley and Ghatak, 2013). Since banks would internalize the related cost, this regulatory intervention would make competition for non-executive services more onerous, reducing the level of negative externality that competition produces on non-executive compensation policies. An analogous result could be achieved through the introduction of liability rules, for example in the form of claw-back provisions. Mimicking the rules recently introduced for executives by the Dodd-Frank Act, non-executive pay claw-backs could require

that bonus compensation paid to middle bank managers be recovered if the manager transfers to a competitor before a specified period of time is elapsed from the payment of the bonus.

Contractual solutions are also available to reduce the outside options of middle bank managers. The common feature shared by these solutions is the implementation of self-enforcing mechanisms that can make the middle manager's employment contract "relational" in the sense described by Levin (2003), i.e., make long-term cooperation with an employer valuable to middle managers. For example, new regulation could incentivize the use of long-term equity-based compensation, with a provision that future rewards will be forgone if the manager moves to another bank—consistent with the result we obtain about the beneficial effect of non-executive stock compensation to reduce inefficient bank risk-taking. At the same time, the introduction of a tax regime that made the use of long-term equity compensation less expensive than the use of cash compensation (i.e., salary and bonuses) would likewise be desirable.

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Figure 1:
Peer Group Examples

In Figure 1 we present examples of peer group choice for the 77 BHCs in our final sample. In selecting peer groups, we proceed as follows. At the beginning of our estimation period (i.e., the end of the fourth quarter of 2002), we define a geographical peer group for each BHC in accordance with its headquarters' location. For each BHC we include in its peer group *five* other BHCs whose headquarters are located in either the same state or neighboring states. If more than five BHCs fit our peer group criterion, we select the five largest among them. If, instead, there are less than five BHCs fitting our peer group criterion, we select additional BHCs from neighboring states. Finally, if a BHC receives no peers among the 77 BHCs in our sample according to either of the above criteria, we place such a BHC into one of five distinct regions, based on that BHC's headquarter location. The regions we employ are Northeast, Southeast, Midwest, Northwest and Southwest. We then use the five largest BHCs with headquarters in these regions as that BHC's peer group. The regions are defined as follows: *North-West Region*: Washington, Oregon, Idaho, Wyoming, Montana, North Dakota, and South Dakota. *South-West Region*: California, Nevada, Utah, Arizona, New Mexico, Colorado. *Mid-West Region*: Texas, Oklahoma, Arkansas, Tennessee, Missouri, Kansas, Nebraska, Iowa, Minnesota, Wisconsin, Michigan, Illinois, Indiana, Kentucky, Ohio, Kentucky. *North-East Region*: Maine, Vermont, New Hampshire, Massachusetts, New York, Rhode Island, Connecticut, Pennsylvania, New York, Delaware, Maryland, Virginia, West Virginia, North Carolina. *South-East Region*: Louisiana, Mississippi, Alabama, Georgia, Florida, South Carolina.

Bank	Peer Group
Associated Banc Corp *(headquartered in Green Bay, WI)*	*Marshall & Ilsley Corp New,* *U S Bancorp DEL,* *T C F Financial Corp,* *Northern Trust Corp,* *Wintrust Financial Corporation*
Central Pacific Financial Corp *(headquartered in Honolulu, HI)*	*Bank of Hawaii Corp,* *Wells Gargo & Co New,* *Charles Schwab Corp New,* *Unionbancal Corp,* *Citi National Corp*
Citigroup *(headquartered in New York City, NY)*	*JP Morgan Chase & Co,* *Metlife Inc.,* *National City Corp,* *Bank of New York Mellon Corp,* *M&T Bank Corp*
Comerica Inc. *(headquartered in Dallas, TX)*	*Cullen Frost Bankers Inc.,* *Prosperity Bancshares Inc.,* *First Financial Bankshares Inc.,* *Sterling Bancshares Inc.,* *US Bancorp DEL*
Commerce Bankshares Inc.*(headquartered in Kansas City, MO)*	*U M B Financial Corp,* *Wintrust Financial Corporation,* *First Midwest Bancorp DE,* *First Horizon National Corp,* *Corus Bankshares Inc.*

Figure 1:
Peer Group Examples *(Continued)*

Northern Trust Corp *(headquartered in Chicago, IL)*	*Wintrust Financial Corporation,* *First Midwest Bancorp DE,* *Corus Bankshares Inc.,* *Privatebancorp Inc.,* *Marshall & Ilsley Corp New*
Regions Financial Corp *(headquarters in Birmingham, AL)*	*Colonial Bancgroup Inc.,* *Suntrust Banks Inc.,* *Synovus Financial Corp,* *First Horizon National Corp,* *Pinnacle Financial Partners Inc.*
Susquehanna Bancshares Inc. PA *(headquartered in Lititz, PA)*	*PNC Bank Corp,* *Fulton Financial Corp PA,* *First Commonwealth Financial,* *National Penn Bancshares Inc.,* *Wilmington Trust Corp.*
Westamerica Bank Corp *(headquartered in San Rafael, CA)*	*Wells Fargo & Co New,* *Charles Schwab Corp New,* *UnionBancal Corp,* *Citi National Corp,* *U C B H Holdings Inc.*
Zions Bancorp *(headquartered in Salt Lake City, UT)*	*Wells Fargo & Co New,* *Schwab Charles Corp New,* *Unionbancal Corp,* *City National Corp,* *U C B H Holdings Inc.*

Figure 2. Scatter Plots

Figure 2, Scatter Plot A. Changes in BHC Cash Compensation vs. Changes in BHC Total Interest Income.

In this scatter plot diagram, we present changes in a given BHC's cash compensation (i.e., changes through salary, bonus and net benefits) vs. changes in that BHC's total interest income. Included are all pairs of such observations for the 77 banks in our final sample, over the period 2003-2006.

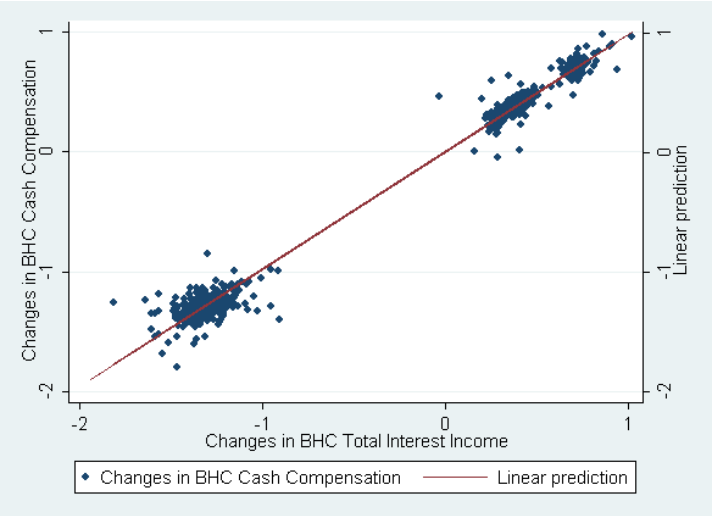


Figure 2, Scatter Plot B. Changes in BHC Cash Compensation vs. Changes in Peer Group Total Interest Income.

In this scatter plot diagram, we present changes in a given BHC's cash compensation (i.e., changes through salary, bonus and net benefits) vs. changes in its peer-group's total interest income. Included are all pairs of such observations for the 77 banks in our final sample, over the period 2003-2006.

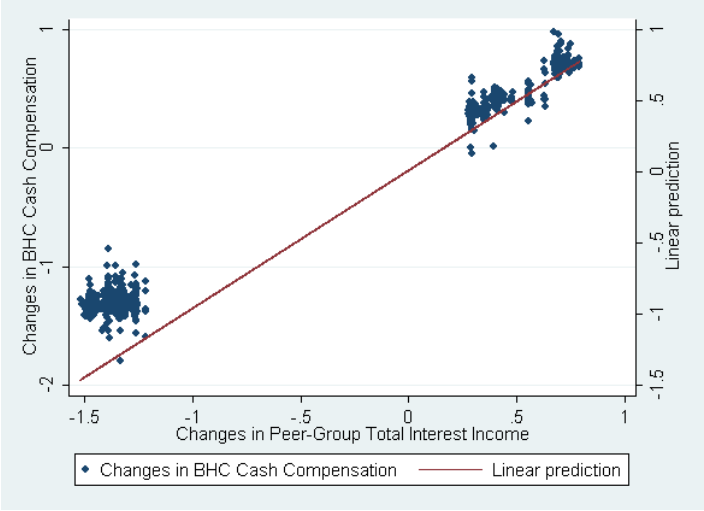
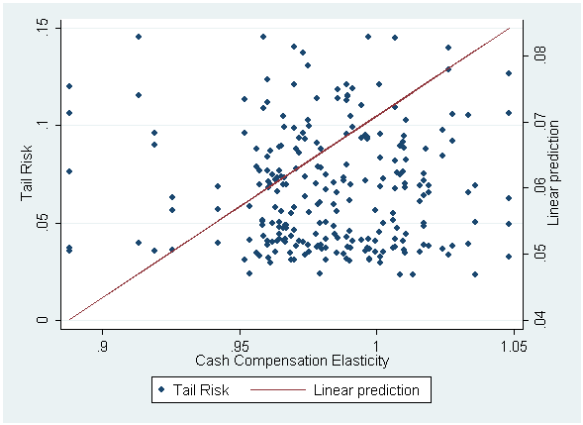


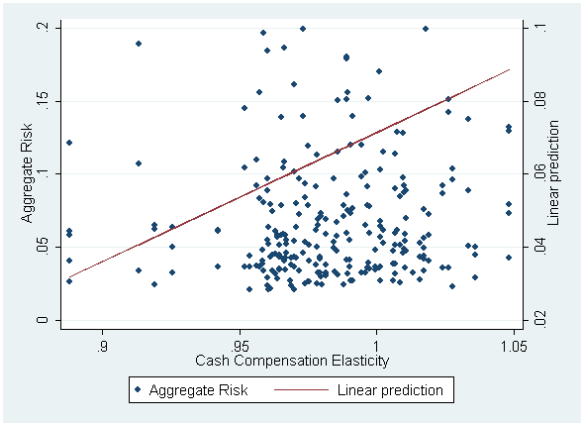
Figure 2, Scatter Plot C. *Cash Compensation Elasticity* and *Cash Compensation Elasticity-Market* vs. Measures of BHC Risk

In these sic sub-diagrams, we present scatter plots for, on the one hand, *Cash Compensation Elasticity* or *Cash Compensation Elasticity-Market*, and, on the other hand, *Tail Risk*, *Aggregate Risk* or *Z-Score*. *Cash Compensation Elasticity* and *Cash Compensation Elasticity-Market* are estimated over the period 2003-2006, while measures of BHC risk are estimated over the period 2007-2009.

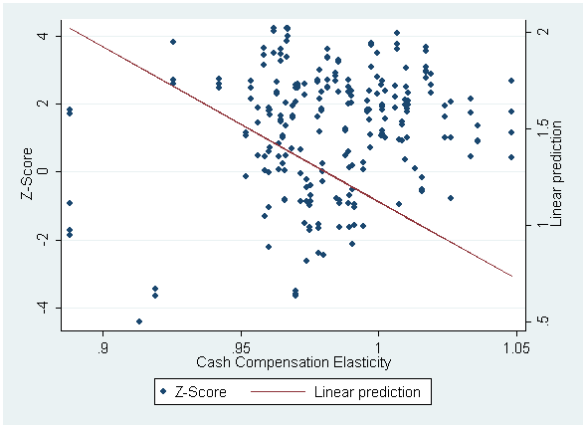
Scatter Plot C.1.



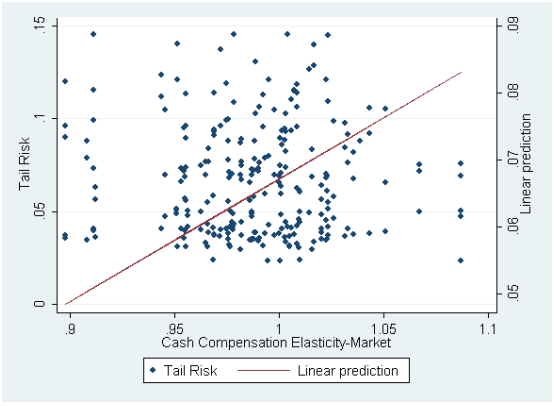
Scatter Plot C.2.



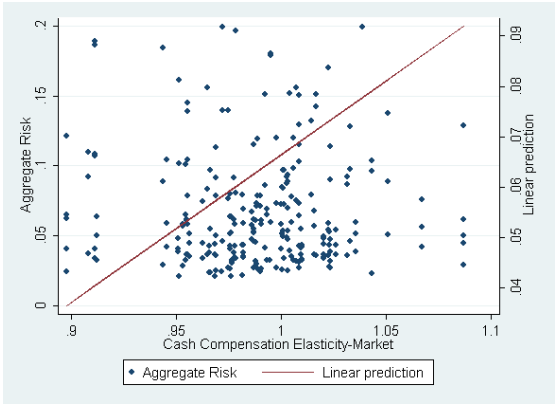
Scatter Plot C.3.



Scatter Plot C.4.



Scatter Plot C.5.



Scatter Plot C.6.

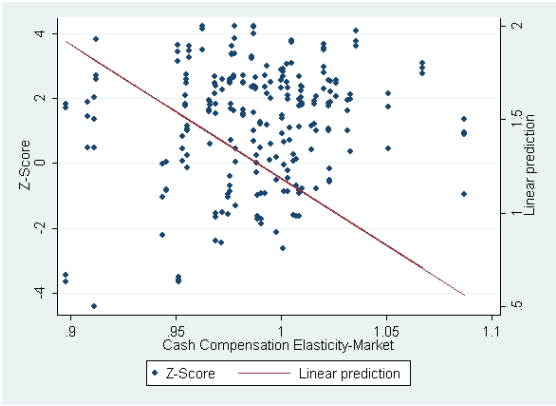


Table 1:
Variables Definitions

Risk Variables

Tail Risk: The marginal expected shortfall (i.e., MES) measure proposed by Acharya et al. (2010). In each given year, the MES is defined as the negative of the average return on the BHC's stock during the 5% worst stock-return days for the S&P500. The variable is Winsorized at 1% in each tail of its distribution.

Aggregate Risk: Standard deviation of the BHC's weekly excess returns (i.e., weekly return on the BHC stock less weekly return on the S&P500) over the calendar year. The variable is Winsorized at 1% in each tail of its distribution.

Z-Score: The natural logarithm of the ratio of the sum of ROA and each BHC's capital ratio to the standard deviation of each BHC's ROA. We calculate ROA using the sum of the preceding four quarters of the BHC's operating income before depreciation, divided by the sum of the preceding four quarters of the BHC's assets, obtaining data from the Compustat Quarterly data file. For the capital-to-assets ratio, we use quarterly book equity in the numerator and quarterly assets in the denominator. We calculate the ROA's standard deviation based on the last five years of quarterly ROA data for each BHC's in the Compustat Quarterly data file. Higher *Z-score* implies more stability. The variable is Winsorized at 1% in each tail of its distribution.

Firm Value Measure

Tobin's Q: The ratio of market to book value of assets for each BHC, following the definition of Fama and French (1992). Source of data is Compustat. The variable is Winsorized at 1% in each tail of its distribution.

Market-to-Book Ratio: The ratio of market to book value of equity for each BHC. Source of data is Compustat and CRSP. The variable is Winsorized at 1% of each tail of its distribution.

Elasticity Measures

Measures below are defined for changes from Q_{t-1} to Q_t.

Notation	*Definition*
Cash Compensation Elasticity	Key independent measure in our study reflecting the elasticity of quarterly employee *salary, bonus and net benefits* compensation with respect to total interest income (*TII*) estimated over sixteen quarters during 2003-2006: $\ln\left(\frac{C_{it}}{C_{it-1}}\right) = \alpha + \beta^{C}_{i1,TII} \times ln\left(\frac{TII_{it}}{TII_{it-1}}\right) + \beta^{C}_{i2,TII} \times ln\left(\frac{EMP_{it}}{EMP_{it-1}}\right) + \beta^{C}_{i3,TII} \times ln\left(\frac{MCAP_{it}}{MCAP_{it-1}}\right) +$ $+\delta_1 \times Q_{4t} + \varepsilon_{it}$, where Q_{4t} is the indicator variable for the fourth calendar quarter in the year and $\beta^{C}_{i1,TII}$ is the coefficient for *Cash Compensation Elasticity*. In the GMM analysis of Table 10, we calculate *Cash Compensation Elasticity* using the same approach, but using rolling windows of sixteen quarters each, starting Q1 1991.

(continued from previous page)

Cash Compensation Elasticity + & *Cash Compensation Elasticity –*	Elasticity of quarterly employee *salary, bonus and net benefits* compensation with respect to total interest income (*TII*) estimated over sixteen quarters during 2003-2006, where we split *TII* into income *above* the peer group mean and income *below* the peer group mean (peer group is defined below): $\ln\left(\frac{C_{it}}{C_{it-1}}\right) = \alpha + \beta^{C}_{i1,TII+} \times ln\left(\frac{TII_{it}}{TII_{it-1}}\right) \times I_{it,TII+} + \beta^{C}_{i1,TII-} \times ln\left(\frac{TII_{it}}{TII_{it-1}}\right) \times I_{it,TII-} +$ $+\beta^{C}_{i2,TII} \times ln\left(\frac{EMP_{it}}{EMP_{it-1}}\right) + \beta^{C}_{i3,TII} \times ln\left(\frac{MCAP_{it}}{MCAP_{it-1}}\right) + \delta_1 \times Q_{4t} + \varepsilon_{it},$ where Q_{4t} is the indicator variable for the fourth calendar quarter in the year, $I_{it,TII+}$ is an indicator variable equal to one if $ln\left(\frac{TII_{it}}{\mathrm{TII}_{it-1}}\right) > \overline{\ln\left(\frac{TII_{it}}{TII_{it-1}}\right)}$ and zero otherwise, $I_{it,TII-}$ equals one minus $I_{it,TII+}$, and $\beta^{C}_{i1,TII+}$ $\beta^{C}_{i1,TII-}$ are the coefficients for, respectively, *Cash Compensation Elasticity*+ and *Cash Compensation Elasticity*-. We define peer group income as of the fourth quarter in 2002. For each BHC, its peer group includes the five largest *other* BHCs whose headquarters are in the same geographical area as *that* BHC. As geographical area we consider the same state and the neighboring states to the state of that BHC's headquarter location. If following this definition a BHC is assigned no peer group members among our sample of 77 banks, we place that BHC into one of five distinct regions (Northeast, Southeast, Midwest, Northwest and Southwest) based on that BHC's headquarter location. We then use the five largest *other* BHCs with headquarters in the same region as peer group members.
Cash Compensation Elasticity-Market	Elasticity of quarterly employee *salary, bonus, and net benefits* compensation with respect to change in the average peer group's total interest income (*TII*) within the same quarter, estimated over sixteen quarters during 2003-2006: $\ln\left(\frac{C_{it}}{C_{it-1}}\right) = \alpha + \beta^{C}_{i1,M,TII} \times \overline{\ln\left(\frac{TII_{it}}{TII_{it-1}}\right)} + \beta^{C}_{i1,i,TII} \times ln\left(\widetilde{\frac{TII_{it}}{TII_{it-1}}}\right) + \beta^{C}_{i2,TII} \times ln\left(\frac{EMP_{it}}{EMP_{it-1}}\right) +$ $+\beta^{C}_{i3,TII} \times ln\left(\frac{MCAP_{it}}{MCAP_{it-1}}\right) + \delta_1 \times Q_{4t} + \varepsilon_{it},$ where Q_{4t} represents the quarterly indicator for the fourth calendar quarter, $\overline{\ln\left(\frac{TII_{it}}{TII_{it-1}}\right)} = \frac{1}{N}\sum_{i=1}^{N}\frac{TII_{it}}{TII_{it-1}}$ is the peer-specific equally-weighted average growth of *TII* from quarter *t-1* to quarter *t*, $\widetilde{ln\left(\frac{TII_{it}}{TII_{it-1}}\right)}$ is the residual from an OLS regression of $ln\left(\frac{TII_{it}}{TII_{it-1}}\right)$ on $\overline{\ln\left(\frac{TII_{it}}{TII_{it-1}}\right)}$, with this regression being performed for the time-series of observations for each BHC, and $\beta^{C}_{i1,M,TII}$ is the coefficient for *Cash Compensation Elasticity-Market*.
Cash Compensation Elasticity-Bank	Elasticity of quarterly employee *salary, bonus and net benefits* compensation with respect to changes in each BHC's total interest income (*TII*), estimated over sixteen quarters during 2003-2006 as in the regression presented above for $\beta^{C}_{i1,M,TII}$. The coefficient for *Cash Compensation Elasticity-Bank* is $\beta^{C}_{i1,i,TII}$.
Stock Compensation Elasticity	Elasticity of quarterly employee *stock* compensation with respect to total interest income (*TII*) estimated over sixteen quarters during 2003-2006: $\ln\left(\frac{S_{it}}{S_{it-1}}\right) = \alpha + \beta^{S}_{i1,TII} \times ln\left(\frac{TII_{it}}{TII_{it-1}}\right) + \beta^{S}_{i2,TII} \times ln\left(\frac{EMP_{it}}{EMP_{it-1}}\right) + \beta^{S}_{i3,TII} \times ln\left(\frac{MCAP_{it}}{MCAP_{it-1}}\right) + \delta_1 \times Q_{4t} + \varepsilon_{it},$ where Q_{4t} is the indicator variable for the fourth calendar quarter and $\beta^{S}_{i1,TII}$ is the coefficient estimate for *Stock Compensation Elasticity.*
Cash Compensation Cross-Elasticity	Cross-elasticity of quarterly employee *salary, bonus and net benefits* compensation with respect to *peer group salary, bonus and net benefits* compensation estimated over sixteen quarters during 2003-2006: $\ln\left(\frac{C_{it}}{C_{it-1}}\right)$ $= \alpha + \beta^{C}_{i1,M,TII} \times \overline{\ln\left(\frac{TII_{it}}{TII_{it-1}}\right)} + \beta^{C}_{i1,i,TII} \times ln\left(\frac{TII_{it}}{TII_{it-1}}\right) + \gamma^{C}_{i1,TII} \times \overline{\ln\left(\frac{C_{it}}{C_{it-1}}\right)} + \beta^{C}_{i2,TII} \times ln\left(\frac{EMP_{it}}{EMP_{it-1}}\right) + \beta^{C}_{i3,TII}$ $\times ln\left(\frac{MCAP_{it}}{MCAP_{it-1}}\right) + \delta_1 \times Q_{4t} + \varepsilon_{it},$

where Q_{4t} is the indicator variable for the fourth calendar quarter, $\overline{\ln\left(\frac{C_{it}}{C_{it-1}}\right)} = \frac{1}{N}\sum_{i=1}^{N}\frac{C_{it}}{C_{it-1}}$ is the *peer*-specific equally-weighted average growth of *salary, bonus and net benefits* compensation from quarter *t-1* to quarter *t*, and $\gamma_{i1,TII}^{C}$ is the coefficient estimate for *Cash Compensation Cross-Elasticity*.

Control Variables Definitions

Notation	*Definition*
Agri. Loans/Assets:	Ratio of agricultural loans (i.e., BHCK1590) to assets.
Bad Loans/Assets	Ratio of the sum of loans past due 90 days or more (i.e., BHCK5525) and non-accrual loans (i.e., BHCK5526) to assets.
BHC ROA	Ratio of the income before extraordinary items (i.e., BHCK4300) to assets.
BHC Size	Natural logarithm of the book value of total assets (i.e., BHCK2170).
CEO Delta	Sensitivity of CEO compensation to share price, expressed in thousands of dollars. We follow Core and Guay (2002) methodology in calculating *CEO Delta*.
CEO Vega	Sensitivity of CEO compensation to stock return volatility, expressed in $ '000.We follow Core and Guay (2002) methodology in calculating *CEO Vega*.
C&I Loans/Assets:	Ratio of commercial and industrial loans (i.e., BHDM1766) to assets.
Consumer Loans/Assets:	Ratio of consumer loans (i.e., BHDM1975) to assets.
Core Deposits/Assets	Ratio of "core" deposits to assets, where core deposits include deposits held in domestic offices of the subsidiaries of each BHC, excluding all time deposits over $100,000 and any brokered deposits (i.e., BHCB2210 + BHCB3187 + BHCB2389 + BHCB6648 + BHOD3189 + BHOD3187 + BHOD2389 + BHOD6648 - BHDMA243 - mBHDMA164).
Deposits/Assets	Ratio of total deposits (i.e., BHDM6631 + BHDM6636 + BHFN6631 + BHFN6636) to assets.
Derivative Hedging/Assets	Value of derivatives used for hedging purposes scaled by total BHC assets. The numerator is obtained by adding the following variables: BHCK8725, BHCK8726, BHCK8727 and BHCK8728.
Derivative Truding/Assets	Total gross notional amount of derivative contracts held for trading, obtained by adding amounts on interest rate contracts (i.e., BHCKA126), foreign exchange contracts (i.e., BHCKA127), equity derivative contracts (i.e., BHCK8723), and commodity and other contracts (i.e., BHCK8724). Aggregate value is then scaled by total BHC assets.
Employee Turnover	Ratio of the standard deviation of the quarterly change in the number of BHC employees over the absolute value of the interquartile range of this change in 2003-2006. That is, $Turnover_i = \frac{1}{\lvert Q_{3,i}-Q_{1,i}\rvert}\left[\frac{\sum_{q=1}^{16}(\Delta E_{i,q}-\overline{\Delta E_{i,q}})^2}{15}\right]^{0.5}$, where (i) $Q_{3,i}$ and $Q_{1,i}$ correspond to the third and first quartile of the number of employees quarterly change, i.e., $\Delta E_{i,q}$, (ii) i indexes BHCs, and (iii) q denotes the calendar quarters in 2003-2006. The first quartile for a random variable$x$, i.e., $Q_{1,i}$, is defined as: $\int_{-\infty}^{Q_{1,i}} f(x)dx = 0.25$, where $f(x)$ is the density function of the random variable x. Similarly, the third quartile, i.e., $Q_{3,i}$, is defined as: $\int_{-\infty}^{Q_{3,i}} f(x)dx = 0.75$.
Excess Cash Compensation	An indicator variable equal to one if the 2003-2006 average BHC excess quarterly wage is in the top decile of its distribution and zero otherwise. We define excess quarterly wage as the actual salary, bonus and net benefits net of the industry average of this variable within the same quarter.
Ins. Assets/Assets:	Ratio of assets of subsidiaries engaged in insurance and reinsurance (i.e., BHCKC253) to the BHC total assets.
Loans/Assets:	Ratio of total loans (i.e., BHCK2122) to assets.

Loan Concentration:	Measure of the concentration of a BHC's loan portfolio among the five loan segments defined above, computed as the sum of squares of each segment's share in the total loan portfolio.
Non-Core Deposits/Assets	Ratio of (total deposits - core deposits) to assets.
Non-Int. Income/Income:	Ratio of non-interest income (i.e., BHCK4079) to the sum of interest income (i.e., BHCK4107) and non-interest income (i.e., BHCK4079).
Other Loans/Assets:	Ratio of all other loans to assets.
Private MBS/ Assets:	The total value of private-label mortgage backed securities held in both trading and investment portfolios (excluding mortgage-backed securities that are either issued or guaranteed by government-sponsored enterprises) scaled by the BHC's total assets. This measure has a numerator computed by summing the following variables: BHCK1709, BHCK1733, BHCK1713, BHCK1736 and BHCK3536. The denominator of this measure is BHC's assets.
Real Estate Loans/Assets:	Ratio of loans secured by real estate (i.e., BHCK1410) to assets.
Risky Trading Assets:	Total trading assets (i.e., BHCK3545) less investments in U.S. treasury securities (i.e., BHCK3531), U.S. government agency obligations (i.e., BHCK3532), securities issued by states and political subdivisions in the U.S. (i.e., BHCK3533), and mortgage backed securities issued or guaranteed by government sponsored enterprises (i.e., BHCK3534 and BHCK3535).
Tier-1 Cap/Assets:	Ratio of Tier1 capital (i.e., BHCK8274) to assets.
UW Assets/Assets:	The ratio of the assets of subsidiaries engaged in underwriting or dealing securities (i.e., BHCKC252) to the total assets of the BHC.

Table 2:
Summary Statistics

In this table, we show summary statistics for the main explanatory, dependent, and control variables in our study, based on the sample of 77 BHCs listed in Appendix Table 1. The columns show the mean, median, standard deviation as well as the 10th and 90th percentile for the sample distribution of the variable of interest. We note in parentheses the time period for which the applicable statistics are shown. All variables are Winsorized at 1% and 99% of their corresponding sample distribution.

	Mean	Median	St. Dev.	P-10	P-90
Main Explanatory Variables (2003-2006)					
(Estimates for changes Q_{t-1} to Q_t)					
Cash Compensation Elasticity	0.98	0.97	0.033	0.95	1.03
Stock Compensation Elasticity	0.52	0.29	0.99	-0.58	1.67
Cash Compensation Elasticity+	0.99	0.99	0.06	0.95	1.05
Cash Compensation Elasticity-	0.92	0.96	0.20	0.88	1.04
Cash Compensation Elasticity-Market	0.98	0.99	0.037	0.94	1.03
Cash Compensation Elasticity-Bank	0.18	0.77	3.67	-0.12	1.29
Dependent Variables (2007-2009)					
Aggregate Risk	0.066	0.054	0.041	0.030	0.125
Tail Risk	0.043	0.038	0.034	0.002	0.092
Z-score	1.170	1.560	1.913	-1.625	3.204
Tobin's Q	1.049	1.023	0.181	0.963	1.109
Market-to-Book Ratio	1.121	1.014	0.211	0.791	1.435
Annual BHC Returns	-0.203	-0.196	0.322	-0.626	0.235
Control Variables (2003-2006)					
CEO Delta	1,135.10	320.01	2,794.72	38.19	2195.14
CEO Vega	238.87	71.06	350.35	10.43	771.10
Bad Loans/Assets	0.004	0.004	0.002	0.001	0.007
BHC Size	18.82	18.39	1.66	17.14	20.86
BHC ROA	0.009	0.008	0.006	0.006	0.011
Core Deposits/Assets	0.500	0.545	0.166	0.208	0.664
Deposits/Assets	0.689	0.712	0.140	0.562	0.821
Derivative Hedging/Assets:	0.137	0.039	0.336	0.001	0.269
Derivative Trading/Assets:	0.449	0.000	1.448	0.000	0.870
Ins. Assets/Assets:	0.007	0.000	0.007	0.000	0.010
Loans/Assets:	0.610	0.652	0.151	0.398	0.751
Non-Core Deposits/Assets	0.187	0.145	0.123	0.075	0.360
Non-Int. Income/Income:	0.290	0.248	0.177	0.124	0.566
Tier-1 Cap/Assets:	0.082	0.078	0.037	0.061	0.094
UW Assets/Assets:	0.021	0.000	0.088	0.000	0.036

Table 3:
Correlation Analysis of Non-Executive Compensation Incentives

Panel A. Pearson pairwise correlations of our five estimates of non-executive compensation incentives as defined in Table 1 (*Cash Compensation Elasticity*, *Cash Compensation Elasticity+*, *Cash Compensation Elasticity-*, *Cash Compensation Elasticity-Market, Cash Compensation Elasticity-Bank,* and *Stock Compensation Elasticity*). Elasticity measures are estimated over the period 2003-2006. P-values to each correlation are noted below the correlation coefficients, in parentheses. Significant correlation coefficients are highlighted in bold.

Elasticity with respect to Total Interest Income

(Estimates for changes Q_{t-1} to Q_t)	*Cash Comp. Elasticity*	*Cash Comp. Elasticity+*	*Cash Comp. Elasticity-*	*Cash Comp. Elasticity-Market*	*Cash Comp. Elasticity-Bank*	*Stock Comp. Elasticity*
Cash Comp. Elasticity	1.000	-	-	-	-	-
	-	-	-	-	-	-
Cash Comp. Elasticity+	**0.207**	1.000	-	-	-	-
	(0.00)	-	-	-	-	-
Cash Comp. Elasticity-	0.066	-0.016	1.000	-	-	-
	(0.33)	*(0.82)*	-	-	-	-
Cash Comp. Elasticity-Market	**0.900**	**0.166**	0.032	1.000	-	-
	(0.00)	*(0.01)*	*(0.63)*	-	-	-
Cash Comp. Elasticity-Bank	0.020	-0.062	-0.099	0.010	1.000	-
	(0.39)	*(0.36)*	*(0.14)*	*(0.92)*	-	-
Stock Comp. Elasticity	**0.170**	0.104	0.043	**0.148**	-0.002	1.000
	(0.01)	*(0.12)*	*(0.53)*	*(0.02)*	*(0.97)*	-

Panel B. Pearson pairwise correlations of our five estimates of non-executive compensation incentives as defined in Table 1 (*Cash Compensation Elasticity*, *Cash Compensation Elasticity+*, *Cash Compensation Elasticity-*, *Cash Compensation Elasticity-Market, Cash Compensation Elasticity-Bank,* and *Stock Compensation Elasticity)* with measures of BHC risk (*Tail Risk*, *Aggregate Risk*, and *Z-Score*) and with *CEO Delta* and *CEO Vega*. *Tail Risk, Aggregate Risk,* and *Z-Score* are measured over the period 2007-2009, while *CEO Delta* and *CEO Vega* are measured as averages over the period 2003-2006. P-values to each correlation are noted below the correlation coefficients, in parentheses. Significant correlation coefficients are highlighted in bold.

Elasticities with respect to Total Interest Income

(Estimates for changes Q_{t-1} to Q_t)	*Tail Risk*	*Aggregate Risk*	*Z-Score*	*CEO Delta*	*CEO Vega*
Cash Comp. Elasticity	0.040	**0.130**	**-0.330**	0.030	**-0.260**
	(0.41)	*(0.02)*	*(0.00)*	*(0.54)*	*(0.01)*
Cash Comp. Elasticity+	0.019	-0.006	-0.032	0.095	-0.037
	(0.78)	*(0.92)*	*(0.64)*	*(0.16)*	*(0.58)*
Cash Comp. Elasticity-	-0.023	-0.057	0.022	0.006	0.007
	(0.73)	*(0.40)*	*(0.75)*	*(0.93)*	*(0.92)*
Cash Comp. Elasticity-Market	0.001	0.050	**-0.270**	0.010	**-0.350**
	(0.99)	*(0.34)*	*(0.00)*	*(0.87)*	*(0.01)*
Cash Comp. Elasticity-Bank	-0.100	-0.080	**0.330**	-0.080	**-0.180**
	(0.11)	*(0.21)*	*(0.00)*	*(0.21)*	*(0.00)*
Stock Comp. Elasticity	0.020	-0.100	-0.150	0.060	0.160
	(0.70)	*(0.11)*	*(0.02)*	*(0.17)*	*(0.01)*

Table 4:

Impact of Pre-Financial Crisis (2003-2006) Non-Executive Compensation Incentives on Bank Risk (Tail Risk, Aggregate Risk, and Z-Score) in Crisis Years (2007-2009).

In this table, we show multivariate analysis of *Tail Risk* in Column (1), *Aggregate Risk* in Column (2), and *Z-Score* in Column (3) as dependent variables, and the following main independent variables: *Cash Compensation Elasticity*; *CEO Delta*, *CEO Vega*, and *Tier-1Cap/Assets*. *Cash Compensation Elasticity* is estimated over the period 2003-2006. *CEO Delta, CEO Vega* are calculated as averages over the period 2003-2006. We further divide *CEO Delta* and *CEO Vega* by 1,000 to tabulate their coefficients. All remaining control variables are calculated as averages over 2003-2006. The dependent variables are measured within the financial crisis period (2007-2009). All variables are defined in Table 1. We use robust standard errors, cluster adjusted at the *bank* level. Included but not reported are year fixed effects. T-values are indicated in parentheses below estimates. The ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dep. Variable:	*Tail Risk*	*Aggregate Risk*	*Z-Score*
Independent Variables:	(1)	(2)	(3)
Cash Compensation Elasticity	0.0610***	0.147***	-3.970***
	(2.72)	(4.84)	(3.38)
Average CEO Delta (2003-2006)	-0.001*	0.0001	0.0530***
	(1.91)	(0.72)	(2.69)
Average CEO Vega (2003-2006)	-0.011	-0.025	-0.087***
	(1.13)	(1.36)	(4.88)
Tier-1Cap/Assets (2003-2006)	0.261	0.281	-9.470
	(1.33)	(0.82)	(1.58)
Observations	231	231	231
Adjusted R-squared	58.2%	41.2%	73.8%

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Dep. Variable:	*Tail Risk*	*Aggregate Risk*	*Z-Score*
Independent Variables:			
	(1)	(2)	(3)
BHC Size (2003-2006)	0.007	0.001	-0.88***
	(1.31)	(0.08)	(29.83)
BHC ROA (2003-2006)	-0.622	-2.450***	54.230***
	(1.65)	(15.79)	(3.01)
Deposits/ Assets (2003-2006)	-0.021***	-0.043**	-0.210
	(4.13)	(2.36)	(0.45)
Loans/Assets (2003-2006)	0.060**	0.110**	-2.890**
	(2.20)	(2.25)	(2.26)
Bad Loans/Assets(2003-2006)	-2.480**	-3.340**	171.200***
	(1.75)	(2.43)	(6.71)
Non-int. Inc./ Inc. (2003-2006)	-0.013	-0.022	-1.040***
	(0.80)	(0.69)	(6.11)
UW Assets/ Assets (2003-2006)	-0.004	-0.081	1.770***
	(0.15)	(1.19)	(4.25)
Ins. Assets/ Assets (2003-2006)	0.663	2.640**	-97.210
	(1.57)	(2.31)	(1.49)
Deriv. Trading/Assets (2003-2006)	0.004	0.008*	-0.350**
	(1.43)	(1.74)	(2.26)
Deriv. Hedging/ Assets (2003-2006)	0.019***	0.063***	-1.030***
	(2.89)	(3.45)	(3.07)

Table 5:

Impact of Pre-Financial Crisis (2003-2006) Asymmetric Non-Executive Incentives on Bank Risk (Tail Risk, Aggregate Risk, and Z-Score) in Crisis Years (2007-2009)

In this table, we present multivariate analysis of *Tail Risk* in Column (1), *Aggregate Risk* in Column (2), and *Z-Score* in Column (3) as dependent variables with the following main independent variables: *Cash Compensation Elasticity+* and *Cash Compensation Elasticity-*. The elasticity measures are estimated over the period 2003-2006. We also include *CEO Delta, CEO Vega*, and *Tier-1 Cap/Assets*, all calculated as averages over the period 2003-2006. We further divide both *CEO Delta* and *CEO Vega* by 1,000 to tabulate their coefficients. All remaining control variables—the same as those in Table 4—are calculated as averages over the period 2003-2006. The dependent variables are measured within the financial crisis period (2007-2009). All variables are defined in Table 1. We use robust standard errors, cluster adjusted at the *bank* level. Included but not reported are year fixed effects. T-statistics values are indicated in parentheses below estimates. The ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dep. Variables:	*Tail Risk*	*Aggregate Risk*	*Z-Score*
Independent Variables:	(1)	(2)	(3)
Cash Compensation Elasticity +	0.079***	0.133***	-1.590***
	(2.81)	(3.79)	(5.75)
Cash Compensation Elasticity -	-0.0008	0.001	0.070
	(0.15)	(0.72)	(1.36)
CEO Delta (mean 2003-2006)	-0.001*	-0.0004	-0.064***
	(1.79)	(1.04)	(4.93)
CEO Vega (mean 2003-2006)	0.0003	0.001	0.102
	(0.50)	(0.73)	(1.55)
Tier-1Cap/Assets (2003-2006)	0.240*	0.340	-10.120***
	(1.65)	(1.14)	(3.21)
Observations	231	231	231
Adjusted R-squared	60.2%	42.6%	80.8%

Table 6, Panel A:
Impact of Pre-Financial Crisis (2003-2006) *Cash Compensation Elasticity-Market* and *Cash Compensation Elasticity-Bank* on Bank Risk (Tail Risk, Aggregate Risk, and Z-Score) in Crisis Years (2007-2009)

In this table, we show multivariate analyses of *Tail Risk* in Column (1), *Aggregate Risk* in Column (2), and *Z-Score* in Column (3) as dependent variables with the following main independent variables *Cash Compensation Elasticity-Market* and *Cash Compensation Elasticity-Bank*. The elasticity measures are estimated over the period 2003-2006. We also include *CEO Delta* and *CEO Vega*, calculated as averages over the period 2003-2006. We further divide both *CEO Delta* and *CEO Vega* by 1,000 to tabulate their coefficients. All remaining control variables—the same as those in Table 4—are calculated as averages over the period 2003-2006. The dependent variables are measured within the financial crisis period (2007-2009). All variables are defined in Table 1. We use robust standard errors, cluster adjusted at the *bank* level. Included but not reported are year fixed effects. T-statistics values are indicated in parentheses below estimates. The ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dep. Variables:	*Tail Risk*	*Aggregate Risk*	*Z-Score*
Independent Variables:	(1)	(2)	(3)
Cash Compensation Elasticity-Market	0.0812***	0.135***	-2.83***
	(2.80)	(5.89)	(6.23)
Cash Compensation Elasticity-Bank	-0.0001	-0.0009	-0.060
	(0.01)	(1.55)	(1.62)
CEO Delta (2003-2006)	-0.001*	-0.0007	-0.064***
	(1.64)	(0.04)	(3.34)
CEO Vega (2003-2006)	0.0001	0.009	0.210***
	(0.11)	(0.61)	(3.52)
Tier-1Cap/Assets (2003-2006)	0.231*	-0.009	-10.520***
	(1.67)	(0.63)	(4.86)
Observations	231	231	231
Adjusted R-squared	60.4%	42.1%	79.3%

Table 6, Panel B:
Impact of Pre-Financial Crisis (2003-2006) *Cash Compensation Elasticity-Market* on Bank Risk (Tail Risk, Aggregate Risk, and Z-Score) in Crisis Years (2007-2009) - Interactions with *Employee Turnover*

In this panel, we present multivariate analysis of *Tail Risk* in Column (1), *Aggregate Risk* in Column (2), and *Z-Score* in Column (3) as dependent variables with the main independent variable being *Cash Compensation Elasticity-Market* estimated over the period 2003-2006. We also include an interaction of *Cash Compensation Elasticity-Market* with a variable for employee turnover that is estimated over the period 2003-2006 (*Employee Turnover*). In this specification, we demean both interacted variables prior to calculating the interaction. We also include *CEO Delta*, *CEO Vega,* and *Tier-1 Cap/Assets*, all calculated as averages over the time period 2003-2006. We further divide both *CEO Delta* and *CEO Vega* by 1,000 to tabulate their coefficients. All remaining control variables—the same as those in Table 4—are calculated as averages over the period 2003-2006. We do not show them to conserve space. The dependent variables are measured within the financial crisis period (2007-2009). All variables are defined in Table 1. We use robust standard errors, cluster adjusted at the *bank* level. T-statistics values are indicated in parentheses below estimates. The ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dep. Variables:	*Tail Risk*	*Aggregate Risk*	*Z-Score*
Independent Variables:	(1)	(2)	(3)
Cash Compensation Elasticity-Market	0.079**	0.122***	-6.370***
	(2.68)	(4.16)	(4.12)
Cash Compensation Elasticity-Market x Employee Turnover	0.023**	0.028**	-0.840***
	(1.95)	(1.94)	(4.92)
Employee Turnover	-0.063	0.003	-0.910***
	(0.91)	(0.41)	(3.14)
CEO Delta (2003-2006)	-0.001*	-0.001	-0.090***
	(1.72)	(0.46)	(4.32)
CEO Vega (2003-2006)	0.0001	0.010	0.130**
	(0.23)	(0.85)	(2.15)
Tier-1Cap/Assets(2003-2006)	0.246*	0.040	-9.720***
	(1.69)	(1.53)	(4.17)
Observations	231	231	231
Adjusted R-squared	59.5%	42.4%	82.1%

Table 7:
Impact of Pre-Financial Crisis (2003-2006) *Stock Compensation Elasticity* on Bank Risk (Tail Risk, Aggregate Risk, and Z-Score) in Crisis Years (2007-2009)

In this table, we show multivariate analysis of *Tail Risk* in Column (1), *Aggregate Risk* in Column (2), and *Z-Score* in Column (3) as dependent variables, and the following main independent variables: *Stock Compensation Elasticity*; *CEO Delta*, and *CEO Vega*. *Stock Compensation Elasticity* is estimated over the period 2003-2006. *CEO Delta* and *CEO Vega* are calculated as averages over the period 2003-2006. We further divide *CEO Delta* and *CEO Vega* by 1,000 to tabulate their coefficients. All remaining control variables—the same as those in Table 4—are calculated as averages over the period 2003-2006. The dependent variables are measured within the financial crisis period (2007-2009). All variables are defined in Table 1. We use robust standard errors, cluster adjusted at the *bank* level. Included but not reported are year fixed effects. T-statistics values are indicated in parentheses below estimates. The ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dep. Variable:	*Tail Risk*	*Aggregate Risk*	*Z-Score*
Independent Variables:	(1)	(2)	(3)
Stock Compensation Elasticity	-0.0021***	-0.0047**	-0.0031
	(2.71)	(1.97)	(1.16)
CEO Delta (2003-2006)	-0.0018*	0.001	0.060**
	(1.83)	(1.15)	(2.05)
CEO Vega (2003-2006)	-0.012	-0.021	-0.063***
	(1.24)	(1.15)	(3.53)
Tier-1Cap/Assets(2003-2006)	0.297*	0.261	-8.510***
	(1.64)	(0.74)	(4.78)
Observations	231	231	231
Adjusted R-squared	59.1%	41.2%	74.2%

Table 8:
Tobin's Q, Market-to-Book Ratio, and Cash Compensation to Non-Executives

In this table, we present regressions of *Tobin's Q*, in Columns (1) and (3), and *Market-to-Book* ratio, in Columns (2) and (4), on *Cash Compensation Elasticity* and control variables. As main control variables, we use the following: *CEO Delta, CEO Vega* (both divided by 1,000), and *Tier-1 Cap/Assets*. All remaining control variables—the same as those in Table 4—are calculated as averages over the time period 2003-2006. Included but not reported are year fixed effects. The dependent variables are measured within the financial crisis period 2007-2009. All variables are defined in Table 1. We use robust standard errors, cluster adjusted at the *bank* level. T-statistics values are indicated in parentheses below estimates. The ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dep. Variable:	*Tobin's Q*	*Market-to-Book Ratio*	*Tobin's Q*	*Market-to-Book Ratio*
Independent Variables:	(1)	(2)	(3)	(4)
Cash Compensation Elasticity	-0.205**	-0.241**		
	(2.49)	(2.53)		
Stock Compensation Elasticity			0.002	0.0024*
			(1.65)	(1.69)
CEO Delta (2003-2006)	-0.012***	-0.021***	-0.011***	-0.011***
	(6.43)	(6.98)	(3.06)	(2.93)
CEO Vega (2003-2006)	0.0143***	0.0128***	0.0115***	0.009**
	(3.15)	(3.24)	(2.72)	(2.46)
Tier-1Cap/Assets(2003-2006)	0.428**	0.392*	0.230*	0.220*
	(2.23)	(1.67)	(1.91)	(1.71)
Observations	231	231	231	231
Adjusted R-squared	61.8%	58.4%	62.1%	59.3%

Table 9:
Impact of Pre-Financial Crisis (2003-2006) *Cash Compensation Cross-Elasticity* on Bank Risk (Tail Risk, Aggregate Risk, and Z-Score) in Crisis Years (2007-2009)

In this table, we show multivariate analysis of *Tail Risk* in Column (1), *Aggregate Risk* in Column (2), and *Z-Score* in Column (3), as dependent variables, and the following main independent variables: *Cash Compensation Cross-Elasticity, CEO Delta* and *CEO Vega*. *Cash Compensation Cross-Elasticity* is estimated over the period 2003-2006. *CEO Delta* and *CEO Vega* are calculated as averages over the period 2003-2006. We further divide *CEO Delta* and *CEO Vega* by 1,000 to tabulate their coefficients. All remaining control variables—the same as those in Table 4—are calculated as averages over the period 2003-2006. The dependent variables are measured within the financial crisis period (2007-2009). All variables are defined in Table 1. We use robust standard errors, cluster adjusted at the *bank* level. Included but not reported are year fixed effects. T-statistics values are indicated in parentheses below estimates. The ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dep. Variable:	*Tail Risk*	*Aggregate Risk*	*Z-Score*
Independent Variables:	(1)	(2)	(3)
Cash Compensation Cross-Elasticity	0.0018**	0.0017**	-0.125*
	(2.14)	(2.19)	(1.93)
Average CEO Delta (2003-2006)	-0.001	-0.002	-0.0999**
	(1.08)	(0.93)	(1.99)
Average CEO Vega (2003-2006)	0.011	0.0227**	-1.2145***
	(1.31)	(2.1)	(2.75)
Tier-1Cap/Assets(2003-2006)	0.344***	0.6997***	-16.7092***
	(5.71)	(7.66)	(7.47)
Observations	231	231	231
Adjusted R-squared	67.3%	66.04%	91.01%

Table 10:
Panel Data Results of Blundell-Bond (1998) System GMM Estimation of the Impact of *Cash Compensation Elasticity* on Bank Risk (Tail Risk, Aggregate Risk, and Z-Score), 1994-2010

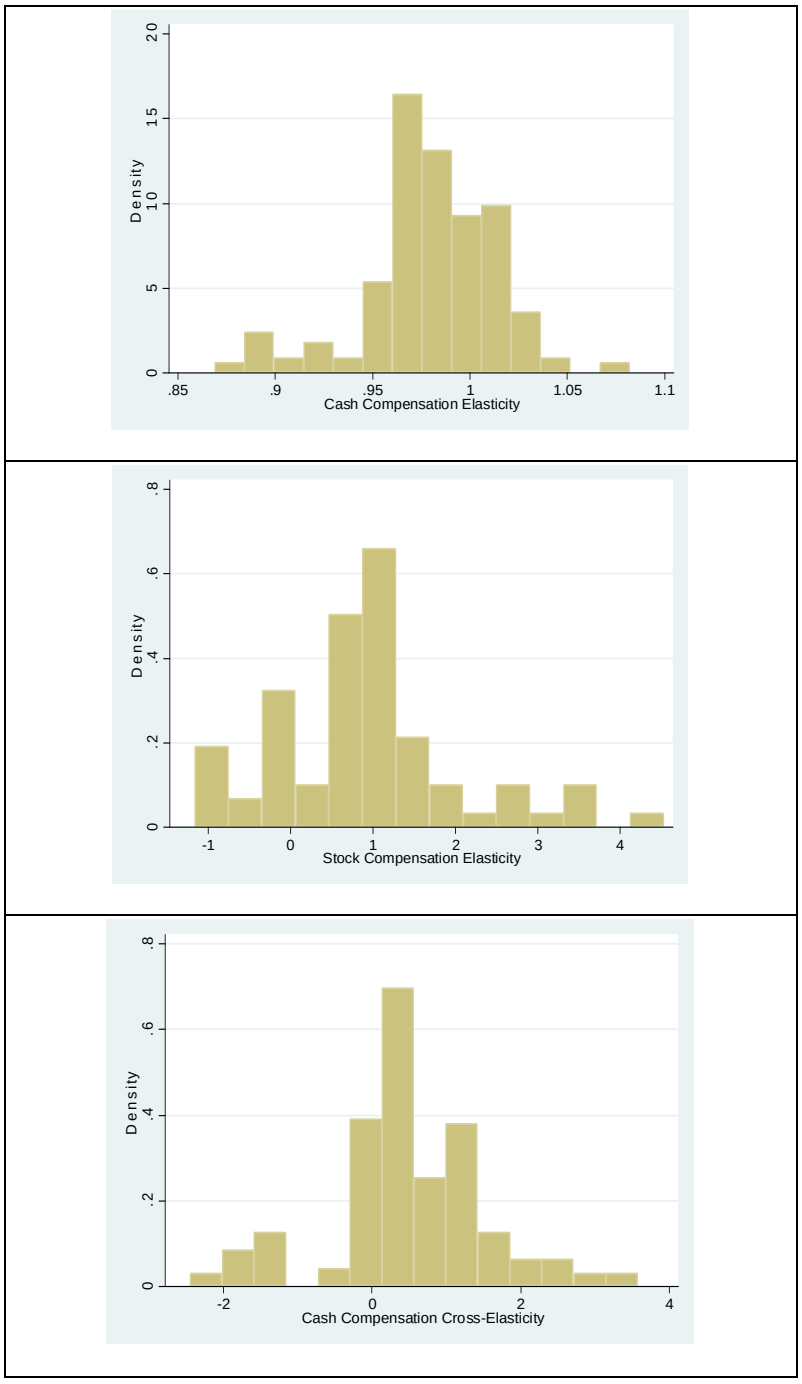
In this table, we show multivariate analysis using Blundell and Bond (1998) *system GMM* estimator of *Tail Risk* in Column (1), *Aggregate Risk* in Column (2), *Z-Score* in Column (3) with *Cash Compensation Elasticity* as main independent variable. *Cash Compensation Elasticity* is obtained from overlapping estimation windows each of four years, the first one starting Q1 1991 and ending Q4 1994; the second one starting Q2 1991 and ending Q1 1995, and so on. We also include as control variables *annual* estimates of *CEO Delta* and *CEO Vega*. We divide both *CEO Delta* and *CEO Vega* by 1,000 to tabulate their coefficients. We include the same quarterly control variables as in Table 4, except for *BHC Size* and *BHC ROA* that are used as instruments along with year indicator variables. Included but not reported are *firm* fixed effects. All variables are defined in Table 1. The estimation period is 1994-2010. T-statistics values are indicated in parentheses below estimates. The ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dep. Variables:	*Tail Risk*	*Aggregate Risk*	*Z-Score*
Independent Variables:	(1)	(2)	(3)
Cash Compensation Elasticity$_{(t-1)}$	0.370***	0.430*	-7.200**
	(3.17)	(1.80)	(2.43)
CEO Delta$_{(t-1)}$	-0.002***	0.003	0.190*
	(2.63)	(0.35)	(2.53)
CEO Vega$_{(t-1)}$	0.160***	0.0066***	-0.280***
	(3.71)	(3.72)	(3.36)
Tier-1Cap/Assets$_{(t-1)}$	0.233	0.234	-8.230
	(1.15)	(0.58)	(1.21)
Deposits/ Assets$_{(t-1)}$	-0.013***	-0.038**	-0.140
	(3.01)	(2.19)	(0.21)
Loans/Assets$_{(t-1)}$	0.060*	0.092*	-2.240*
	(1.90)	(1.81)	(1.81)
Bad Loans/ Assets$_{(t-1)}$	-1.940***	-4.920***	153.000***
	(3.12)	(5.81)	(4.52)
Non-int. Inc./ Inc.$_{(t-1)}$	-0.011	-0.014	-0.830***
	(0.71)	(0.51)	(5.34)
UW Assets/ Assets$_{(t-1)}$	0.011	-0.117	2.590***
	(0.38)	(1.02)	(5.02)
Ins. Assets/ Assets$_{(t-1)}$	0.598	2.131**	-86.920
	(1.03)	(1.96)	(1.27)
Deriv. Trading/Assets$_{(t-1)}$	0.003	0.007	-0.270*
	(1.17)	(1.63)	(1.82)
Deriv. Hedging/Assets$_{(t-1)}$	0.043**	0.050***	-1.050**
	(1.97)	(3.13)	(2.45)
Observations	2,010	2,010	2,010
Chi-2 (p-value)	0.033	0.039	0.061

Appendix Tables and Figures to Acharya, Litov, and Sepe (2014)

Appendix Figure 1.
Histograms of the measures of incentives to non-executive employees.

We present *Cash Compensation Elasticity*, *Stock Compensation Elasticity*, and *Cash Compensation Cross-Elasticity*, all estimated over 2003-2006 for our final sample of 77 BHCs.



Appendix Table 1:
List of BHCs Included in the Sample

This table shows the list of 88 BHCs that appear in our initial sample. These consist of 77 BHCs with comprehensive data (i.e., our final BHC sample) and 11 BHCs (highlighted and noted with a *) that were delisted in 2007-2009. Asset values shown are averages for the period 2007-2009. BHCs that were delisted from our initial sample of 88 BHCs were either (i) acquired by other financial institutions, or (ii) closed by the regulator, during the financial crisis. In particular, Wachovia Corp. was acquired by Wells Fargo & Co in 2008, National City Corp was acquired by PNC Financial Services in 2008, Commerce Bancorp Inc. NJ was acquired by TD BankNorth in 2008, UnionBanCal Corp was acquired by Mitsubishi UFJ (in its remaining 35% equity stake) in 2009, Colonial BankGroup Inc. was acquired by BB&T in 2009, U C B H Holdings Inc. was delisted by NASDAQ due to inability to meet listing requirements in 2009, Provident Bankshares Corp was acquired by M&T Bank in 2009, Corus Bankshares Inc. was closed by the Office of the Comptroller of the Currency in 2009, Irwin Union Bank was closed by the Office of Thrift Supervision in 2009 and subsequently delisted by NYSE for not meeting market cap and equity level hurdles, Freemont General Corp was delisted by NYSE due to low capital and share price below $1 and filed for Chapter 11 bankruptcy in 2008, and Countrywide Credit Inc. was acquired by Bank of America in 2008.

Bank Holding Company Name	Assets($m)	Bank Holding Company Name	Assets($m)
CITIGROUP INC	$408,871.0	NEW YORK COMMUNITY BANCORP INC	$161.0
J P MORGAN CHASE & CO	$197,845.8	BANCORPSOUTH INC	$158.2
METLIFE INC	$163,685.7	S V B FINANCIAL GROUP	$156.6
BANK OF AMERICA CORP	$133,219.6	PACWEST BANCORP DE	$154.9
STATE STREET CORP	$20,910.0	N B T BANCORP INC	$152.5
WACHOVIA CORP	$17,692.0	PROSPERITY BANCSHARES INC	$145.0
WELLS FARGO & CO NEW	$5,739.8	FRONTIER FINANCIAL CORP	$132.6
U S BANCORP DEL	$4,363.5	SUSQUEHANNA BANCSHARES INC PA	$112.2
SCHWAB CHARLES CORP NEW	$4,134.4	OLD NATIONAL BANCORP	$110.3
NATIONAL CITY CORP*	$3,042.8	FIRST MIDWEST BANCORP DE	$109.3
REGIONS FINANCIAL CORP NEW	$2,938.0	WESTAMERICA BANCORPORATION	$107.2
BANK OF NEW YORK MELLON CORP	$2,866.5	FIRST COMMONWEALTH FINANCIAL	$105.1
NORTHERN TRUST CORP	$2,336.6	COMMUNITY BANK SYSTEM INC	$101.6
SUNTRUST BANKS INC	$1,974.2	UNITED COMMUNITY BANKS INC GA	$88.0
ZIONS BANCORP	$1,555.6	***PROVIDENT BANKSHARES CORP****	$83.4
COMMERCE BANCORP INC NJ*	$1,425.7	FIRSTMERIT CORP	$82.0
FIRST HORIZON NATIONAL CORP	$1,422.6	STERLING BANCORP	$82.0
P N C BANK CORP	$1,406.6	FRANKLIN RESOURCES INC	$80.6
U M B FINANCIAL CORP	$1,319.0	HANMI FINANCIAL CORP	$80.5
B B & T CORP	$1,100.2	EAST WEST BANCORP INC	$69.5
FIFTH THIRD BANCORP	$1,098.0	UMPQUA HOLDINGS CORP	$66.3
CULLEN FROST BANKERS INC	$1,077.1	CATHAY BANCORP INC	$64.8
KEYCORP NEW	$1,057.5	CENTRAL PACIFIC FINANCIAL CORP	$60.2
FIRST BANCORP P R	$876.8	NARA BANCORP INC	$59.9
UNIONBANCAL CORP*	$859.7	***CORUS BANKSHARES INC****	$58.9
M & T BANK CORP	$855.9	GLACIER BANCORP INC NEW	$58.6
FULTON FINANCIAL CORP PA	$628.8	FIRST FINANCIAL BANKSHARES INC	$58.1
WINTRUST FINANCIAL CORPORATION	$618.3	FIRST FINANCIAL BANCORP OHIO	$55.9
POPULAR INC	$500.3	BOSTON PRIVATE FINL HLDS INC	$52.4
MARSHALL & ILSLEY CORP NEW	$414.1	STERLING BANCSHARES INC	$50.5
CITY NATIONAL CORP	$392.4	CASCADE BANCORP	$49.4
COMERICA INC	$365.9	***IRWIN FINANCIAL CORP****	$47.8
COLONIAL BANCGROUP INC*	$363.7	NATIONAL PENN BANCSHARES INC	$45.3
WHITNEY HOLDING CORP	$358.9	PRIVATEBANCORP INC	$44.7
BANK OF HAWAII CORP	$357.1	SIMMONS 1ST NATIONAL CORP	$44.5
WILMINGTON TRUST CORP	$349.6	CITY HOLDING CO	$44.3
COMMERCE BANCSHARES INC	$279.2	TOMPKINS TRUSTCO INC	$41.9
ASSOCIATED BANC CORP	$249.8	PINNACLE FINANCIAL PARTNERS INC	$29.6
SYNOVUS FINANCIAL CORP	$243.7	INDEPENDENT BANK CORP MICH	$28.2
SOUTH FINL GROUP INC	$236.6	***FREMONT GENERAL CORP****	$22.1
HUNTINGTON BANCSHARES INC	$233.9	COLUMBIA BANKING SYSTEM INC	$20.4
U C B H HOLDINGS INC*	$222.6	S & T BANCORP INC	$19.5
T C F FINANCIAL CORP	$202.7	BANK OF THE OZARKS INC	$14.8
UNITED BANKSHARES INC	$162.0	***COUNTRYWIDE CREDIT INDS INC****	$10.0

Appendix Table 2:
Descriptive Statistics and Correlations for *Cash Compensation Cross-Elasticity*

Panel A. In this panel we show the mean, median, standard deviation, and the 10th and 90th percentile for several measures of *Cash Compensation Cross-Elasticity* estimated over the period 2003-2006. All the measures of cross-elasticity are Winsorized at 1% and 99% of their corresponding sample distribution.

	Cross-Elasticity with respect to Peer Group Compensation (2003-2006)				
(Cross-Elasticity for changes Q_{t-1} to Q_t)					
	Mean	*Median*	*St. Dev.*	*P-10*	*P-90*
Cash Compensation Cross-Elasticity	0.44	0.42	1.15	-0.98	1.67
(Cross-Elasticity for changes Q_{t-3} to Q_t)					
Cash Compensation Cross-Elasticity	0.45	0.43	1.23	-1.03	1.61

Panel B. Pearson pair-wise correlations of *Cash Compensation Cross-Elasticity* with the measures of non-executive incentives as defined in Table 1—*Cash Compensation Elasticity*, *Cash Compensation Elasticity-Market, Cash Compensation Elasticity-Bank,* and *Stock Compensation Elasticity*. *P*-values to each correlation are noted in parentheses below the coefficient estimates. Significant correlation coefficients are highlighted.

		Elasticity with respect to Total Interest Income		
(Estimates for changes Q_{t-1} to Q_t) *(Elasticities estimated over 2003-2006)*	*Cash Comp. Elasticity*	*Cash Comp. Elasticity-Market*	*Cash Comp. Elasticity-Bank*	*Stock Comp. Elasticity*
Cash Compensation Cross-Elasticity	0.088 *(0.18)*	**0.115** *(0.08)*	-0.002 *(0.98)*	**0.130** *(0.048)*

Panel C. Correlations of *Cash Compensation Cross-Elasticity* with BHC risk proxies (*Aggregate Risk*, *Tail Risk*, and *Z-Score*) and with *CEO Delta* and *CEO Vega*. *Aggregate Risk, Tail Risk,* and *Z-Score* are all measured over the period 2007-2009. *CEO Delta* and *CEO Vega* are measured as averages over the period 2003-2006. *P*-values to each correlation are noted in parentheses below the coefficient estimates. Significant correlation coefficients are highlighted.

(Cross-Elasticity for changes Q_{t-1} to Q_t)	*Aggregate Risk*	*Tail Risk*	*Z-Score*	*CEO Delta*	*CEO Vega*
Cash Compensation Cross-Elasticity	-0.031 *(0.64)*	0.015 *(0.82)*	**-0.251** *(0.00)*	**0.248** *(0.00)*	**0.198** *(0.00)*

Appendix Table 3:
Firm Characteristics and Non-Executive Compensation (*Cash Compensation Elasticity* and *Stock Compensation Elasticity*).

In this table, we relate estimates of *Cash Compensation Elasticity*, calculated over the period 2003-2006, to BHC characteristics obtained over the fourth quarter of 2002. All independent variables are defined in Table 1. We divide both *CEO Delta* and *CEO Vega* by 1,000 to tabulate their coefficients. T-statistics are indicated below estimates in parentheses. The ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dep. Variable:	*Cash Compensation Elasticity*
Independent Variables:	(1)
Employee Turnover (2003-2006)	0.173***
	(3.47)
BHC ROA (Q4 in 2002)	0.015***
	(3.31)
BHC Size (Q4 in 2002)	0.007**
	(2.01)
Bad Loans/Assets (Q4 in 2002)	-0.091***
	(3.15)
CEO Delta (2002)	-0.001
	(0.53)
CEO Vega (2002)	-0.040***
	(2.64)
Observations	77
Adjusted R-squared	19.2%

Appendix Table 4:
Non-Executive Incentives, Risk, and Performance in the Crisis Years (2007-2009).

In this table, we present regression analyses for alternative measures of BHC risk and BHC value, on the one hand, and *Cash Compensation Elasticity* (in odd-numbered models), *Stock Compensation Elasticity* (in even-numbered models), and control variables, on the other. The dependent variables are: in Columns (1) and (2), the ratio of private mortgage-backed securities to total BHC assets (*Private MBS/Assets*); in Columns (3) and (4), the ratio of bad loans to BHC's total assets (*Bad Loans/Assets*); in Columns (5) and (6), BHC's ROA (*ROA*); and in Columns (7) and (8), the buy-and-hold return on the BHC's stock over the calendar year (*BHC Stock Returns*). Included but not reported are year fixed effects. We use robust standard errors, cluster adjusted at the *bank* level. T-statistics are shown in parentheses below the coefficient estimates. The ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dep. Variables:	*Private MBS/ Assets*	*Private MBS/ Assets*	*Bad Loans/ Assets*	*Bad Loans/ Assets*	*ROA*	*ROA*	*BHC Stock Returns*	*BHC Stock Returns*
Independent Variables:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cash Compensation Elasticity	0.00007***		0.061***		-0.034*		-1.661**	
	(8.87)		(2.79)		(1.83)		(2.33)	
Stock Compensation Elasticity		0.00002**		0.0001		0.0001		0.001*
		(2.27)		(1.59)		(0.18)		(1.73)
BHC Size (mean 2003-2006)	0.003**	0.0001	0.002**	0.001**	0.0001	0.0001	-0.012	-0.008
	(2.02)	(0.07)	(2.10)	(2.13)	(0.74)	(0.28)	(0.26)	(0.47)
BHC ROA (mean 2003-2006)	-0.091	1.924	0.615***	0.210	0.94***	1.278***	8.443	4.142
	(0.22)	(1.23)	(4.43)	(0.68)	(5.74)	(5.00)	(0.92)	(0.51)
Tier-1 Cap/ Assets (mean 2003-2006)	-0.076***	-0.357*	0.229*	0.003	-0.09	0.040	0.095	-0.255
	(3.64)	(1.66)	(1.87)	(0.08)	(0.83)	(1.06)	(0.03)	(0.24)
Bad Loans/ Assets (mean 2003-2006)	-0.081	0.345	0.58***	0.787	-0.071	0.143	-0.85	-6.321
	(0.42)	(0.41)	(4.43)	(1.59)	(0.30)	(0.76)	(0.09)	(0.71)
Deposits/ Assets (mean 2003-2006)	0.011	0.022	-0.007	0.002	0.011*	0.008**	0.533***	0.443*
	(1.64)	(0.63)	(1.12)	(0.18)	(1.75)	(2.10)	(3.61)	(1.68)
Loans/ Assets (mean 2003-2006)	-0.022**	-0.094**	0.031*	0.03***	-0.022	-0.02***	-0.973***	-0.775***
	(2.12)	(2.25)	(1.68)	(3.05)	(1.55)	(2.71)	(7.61)	(3.79)
Observations	231	231	231	231	231	231	231	231
Adj. R-squared	23.1%	31.2%	39.1%	41.2%	25.2%	52.9%	14.1%	10.