What's in an education? Implications of CEO education for bank performance

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Abstract

Exploiting a unique hand-built dataset, this paper finds that CEO educational attainment, both level and quality, matters for bank performance. We offer robust evidence that banks led by CEOs with MBAs outperform their peers. Such CEOs improve performance when compensation structures are geared towards greater risk-taking incentives, and when banks follow riskier or more innovative business models. Our findings suggest management education delivers skills enabling CEOs to manage increasingly larger and complex banking firms and achieve successful performance outcomes.

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1. Introduction

If heterogeneous CEO characteristics matter for firm performance, which characteristics define a good CEO? The corporate governance literature has established that the personal characteristics of CEOs hold explanatory power in explaining firm performance differentials (Bertrand and Schoar, 2003; Malmendier and Tate, 2005, 2008; Frank and Goyal, 2007; Malmendier et al., 2011; Kaplan et al., 2012; Fee et al., 2013; Graham et al., 2013). Our paper contributes to literature by disentangling the dynamic relationships between CEO education and the incentives for risk-taking that are implicit in the structure of executive compensation contracts, in order to determine the effects on firm performance outcomes. We investigate possible channels through which CEO education and the choice of business policies interact and influence performance outcomes. Our findings shed light on an important yet unresolved issue. Graham et al. (2012) and Benmelech and Frydman (2015) cite a paucity of substantive evidence on the effects of unobservable personal characteristics like the innate ability of CEOs that conditions educational attainment, and which shapes CEO fixed-effects and firm performance.

This paper offers a rigorous treatment on whether and how CEO educational attainment affects firm performance. Educational attainment influences career outcomes in terms of pay and career trajectory. Literature shows that education background conditions firm investments and general decision-making (Laderman, 1994; Donkers et al., 2001; Frank and Goyal, 2007). Educational attainment contains expectations on the latent ability of CEOs. Bhagat et al. (2010) report stock market reaction to announcements of appointments

of CEOs with stronger educational credentials is positive and creates significant abnormal returns. Falato et al. (2015) find firms pay a premium to newly appointed CEOs with superior educational credentials. Yet, not all forms of CEO education produce a homogenous effect on firm performance because of selection effects. Academic qualifications vary by levels and quality of awarding institutions. This leads to differences in CEO skill-sets and results in performance differentials (Miller et al., 2015).

We investigate if a particular type of CEO education has greater causal effect on firm performance. Literature on the demand for human capital piques our interest. Frydman (2007) and Murphy and Zabojnik (2007) describe the recent growth in business education as reaction to increasing demand for general managerial skills over technical skills. This shift in preference stems from the fact that firms have become considerably larger and more complex because of technological advances and innovations in business practices.[1] In support, Chevalier and Ellison (1999) report that fund managers who graduated from universities with tougher entry requirements, and managers with MBA awards, generated higher returns. Evidence shows CEOs with MBA choose more aggressive corporate strategies (Bertrand and Schoar, 2003), and such CEOs speculate more in the forex market (Beber and Fabbri, 2012).

For our analysis, we carefully construct a unique hand-collected dataset that captures CEO educational qualifications for 149 large US banks for the period 1992 to 2011. A relatively recent process of financial deregulation and financial innovation has increased

[1] Murphy and Zabojnik (2007) report a 15 percentage point increase in the number of CEO hires with MBA from the 1970s to the 1990s (14 to 29 percent). The statistics infer that approximately one-in-three U.S. CEOs held an MBA qualification in the 1990s.

the scale and scope of what have become increasingly complex operations. The opaque nature of a bank's assets and liabilities, and the fact that large banks operate across financial markets and jurisdictions including cross-border, suggests that the banking industry is an ideal laboratory on which to test the proposition that the observed increase in business education and preference for general managerial skills has resulted in superior firm performance outcomes. We collect data on the types of degrees held by CEOs (undergraduate, MBA, or PhD) and identify if the awarding university is amongst the top-20 U.S. institutions according to U.S. World and News Report, following Bhagat et al. (2010) and Cohen et al. (2010). Just under 40% of our sample CEOs hold MBA awards.

We exploit the properties of the dataset to determine the sensitivity of bank performance to the level and quality of CEO educational attainment. To do this, we develop a CEO Education Index comprising three factors: **UG Education** (constituting a basic undergraduate level of training that aids development of transferable skills), **MBA Education** (representing the level of management training and knowledge acquired through an MBA programme), and **PhD Education** (showing the level of technical expertise obtained through an advanced degree or doctorate)**.** We arrive at this measure by following prior work (Tetlock, 2007; Kaplan et al., 2012; Ellul and Yeramilli, 2013) and employing factor analysis to extract these factors. Using factor analysis to construct an index, which acts as a barometer of educational attainment, potentially mitigates issues arising from subjective researcher judgement. For instance, the choice of variables that should be included and how each factor should be scored relative to other factors (Tetlock, 2007), as well as mitigating other measurement issues (Custódio et al., 2013).

Our paper provides several contributions to existing literature. First, our work extends and complements earlier analysis conducted on CEO education and firm performance (Chevalier and Ellison, 1999; Bhagat et al., 2010; Beber and Fabbri, 2012) by investigating the banking industry. We find that bank CEOs with higher **MBA Education** factors (i.e. level and quality of management education) typically exhibit better firm performance, but **UG Education** and **PhD Education** appear not to matter. This effect is also economically meaningful, with one standard deviation in **MBA Education** resulting in improving performance by 11.4% relative to the mean. Our main results reconcile an apparent contradiction between strong theoretical priors and the mixed empirical evidence on the impact of education on firm performance. Our result substantiates the duration of the effect of **MBA Education**, which counters arguments in Bhagat et al. (2010) that the impact of education is short-lived, and supports the actions of external and internal stakeholders in considering CEO education a measure of innate talent (Kaplan et al.,2012; Elsaid et al., 2015). Our results are consistent with the emerging consensus in literature that the education of CEOs is a factor in explaining performance differentials (Chevalier and Ellison 1999; Beber and Fabbri, 2012; Miller et al., 2015). Furthermore, we find that the 'quality' of education matters, since our results highlight that CEOs who graduate from top-20 US universities are able to realise superior firm performance.

Our original contribution speaks to the compensation literature, where prior research has largely focused on the relationship between equity incentives and bank performance (Crawford et al., 1995; Mehran, 1995; Fahlenbrach and Stulz, 2011; Minnick et al., 2011). Our findings provide new insight into this relationship. We show that education moderates the responsiveness of CEOs to incentives embedded in their compensation contracts. CEOs

with higher **Management Education** scores are more likely to improve bank performance in response to higher risk-taking incentives (notably, Vega incentives to increase the volatility of stock price returns) and receiving a higher fraction of equity compensation in their compensation structure. Our findings preclude any form of generalisation across either CEO education or types of incentives. Instead, we show that specific types of incentives and education matter for performance. In this regard, we further extend Bandiera et al.'s finding (2015) that managers with high-powered incentives are more likely to be university-educated and hold a business education award. Taken together, we argue that CEO-specific attributes may play a key role in explaining cross-sectional heterogeneity in how CEOs respond to equity incentives embedded in their compensation contracts.

Another contribution of our paper is to demonstrate channels through which CEOs with specific education credentials improve bank performance. We provide micro-level evidence by focusing on bank business models and implicit strategic choices to better identify CEO actions and decisions. Custódio and Metzger (2014) point out that very little is known about how CEOs improve performance and create value for shareholders, and the channels through which such performance gains accrue. We provide new insights on this issue. We show that CEOs with higher **MBA Education** factor scores who follow riskier or more innovative business models achieve significantly higher levels of bank profitability.

Our evidence infers that such CEOs were more adept at navigating the twin processes of financial deregulation and financial innovation when selecting riskier business models, namely, income generating activities (in the form of fee-based income and real estate and mortgage lending) and managing a riskier asset portfolio (consisting of a greater fraction

of securitized assets and derivatives). Our results support arguments in DeYoung et al. (2013) that the risk-taking incentives implicit in executive compensation explain CEOs pre-crisis decision to shift bank business models from traditional originate-to-hold towards originate-to-distribute model. Our evidence is consistent with findings in the non-financial sector that CEOs with MBAs are better at managing risks and pursuing aggressive policies like higher capital expenditure (Bertrand and Schoar, 2003) and using derivatives in forex markets (Beber and Fabbri, 2012). Our finding supports propositions in Frydman (2007) and Murphy and Zabojnik (2007) that business-educated CEOs with general skills are fine-tuned to manage the complexities associated with the use of innovative albeit riskier business models.

To add further confidence in our findings, we conduct a battery of robustness checks. We account for potentially endogenous equity incentives. In this regard, we contribute by introducing a new instrument to the literature in the form of the pay of professional sports players, which we use to instrument for CEO compensation.[2] Our results are robust to alternate measures of bank performance and the quality of CEO education. Next, we anticipate that CEOs may select into particular banks based on their educational background and hence control for endogenous CEO-firm matching. Finally, we control for various other CEO characteristics, such as firm-specific executive experience and equity ownership. Our results hold throughout.

Our findings have broad economic and policy implications, which extend beyond the banking sector. In particular, our evidence on the importance of education, and especially

[2] Please see appendix B for details.

that CEOs with varying levels of education respond differently to compensation incentives, fuel ongoing debate over how best to structure CEO compensation incentives. Consequently, board of directors should take into account inherent differentials in CEO characteristics when setting their pay contracts.

The paper proceeds as follows. Section 2 presents a brief background on CEO education and firm performance. Section 3 introduces the dataset, explains the construction of CEO Education Index, and provides variable definitions. Section 4 investigates the impact of CEO education on bank performance. Section 5 considers the impact of CEO pay structure and questions whether the benefits of CEO education for bank performance can be partially attributed to the design of implicit incentives generated by CEO compensation contracts. Section 6 conducts micro-analysis into the channels through which CEOs are able to improve bank performance, whilst Section 7 reports robustness tests and Section 8 concludes.

2. Background

A large literature originating from psychology affirms the relationship between an individual's cognitive ability, level of educational attainment and decision-making. Jensen (1998) argues that the cognitive ability, or 'IQ', of an individual determines several social and economic outcomes. Higher cognitive ability is positively associated with mental capacity, length of life, speed of reactions and lifetime income. Likewise, individual 'intelligence' influences decision-making ability (Lubinski and Humphreys, 1997), with more intelligent individuals exhibiting greater patience and acting less on impulse (Mischel, 1974; Shoda et al., 1990; Funder and Block, 1989; Parker and Fischhoff, 2005).

Education is often considered a proxy for cognitive ability. Relating CEO ability and cognitive intelligence to university entrance exam score requirements, Frey and Ditterman (2004) argue that CEOs who graduated from schools that require higher mean entrance exam scores are more intelligent and display greater managerial ability. Chevalier and Ellison (1999) find that fund managers who graduated from universities with tougher entry requirements generated higher returns. Datta and Rajagopalan (1998) suggest that both educational background and firm-specific experience, amongst other factors, explain variations in CEOs cognitive ability.

Despite prior literature arguing a link between the educational backgrounds of executives and firm performance (Hambrick and Mason, 1984; Finkelstein and Hambrick, 1996), the empirical evidence suggests that the effects vary according to the type and quality of education. Chevalier and Ellison (1999) show a positive relationship between managers' education and mutual fund performance. They find that managers with undergraduate degrees from Ivy League universities generate higher risk-adjusted returns, but managers with Ivy MBA achieve higher returns almost entirely due to a shift towards greater systematic risk. Interestingly, Bhagat et al. (2010) find education is a critical factor in the hiring process of CEOs, but fail to observe any systematic relationship between CEO education and long-term firm performance. This is in contrast to a traditional view of educational attainment as an observable measure of innate talent with better-educated CEOs realising greater impact on firm performance.

The purpose of our paper is to speak to this debate by focusing on a homogenous industry, namely the U.S. banking sector, and thereby control for important differences in CEO talent and labour market demand across different industries (Rajagopalan and Datta,

1996; Gabaix and Landier, 2008; Cuñat and Guadalupe, 2009; Frydman and Jenter, 2010; Falato et al., 2015). There have been dramatic changes in the competitive landscape facing U.S. banks following various deregulatory acts in the 1980s and 1990s (Crawford et al., 1995 Hubbard and Palia, 1995; DeYoung et al., 2013). With deregulation expanding opportunities for growth at banks, another realisation of this process is the greater labour market demand for talented CEOs that can take advantage of such opportunities.[3]

We argue that CEOs educational background in terms of the level and quality of education obtained plays a key role in shaping decision-making and determining bank performance. Our starting point in this paper is to investigate the importance of CEO education for bank performance outcomes. In doing so, we provide early evidence that CEO educational attainment matters for bank performance and, importantly, show the potential channels and drivers behind this relationship.

2.1. CEO Pay Incentives and Education

Extant literature has largely argued that compensation contracts create incentives for CEOs to take risks, and that risk-taking explains performance differentials (Mehran, 1995; Minnick et al., 2011). Use of equity incentives results in inducing convexity in the relationship between CEO wealth and firm performance, which could lead banks into

[3] Judge et al. (1995) find the level and quality of an executive's education are significant predictors of successful career outcomes, notably, remuneration and promotion. Consistent with suggestions that shareholders' willingly pay a premium to attract top talent, Graham et al. (2012) document that higher educational attainment in CEOs is rewarded with greater compensation, observed through higher manager fixed-effects for CEO compensation. Falato et al. (2015) examine CEO appointments to S&P 1500 firms between 1993 and 2005 and find education is a vital signal of quality, with stockmarkets rewarding firms that appoint higher quality CEOs measured as positive stock price reactions.

making riskier acquisitions (Hagendorff and Vallascas, 2011) and riskier investment choices (DeYoung et al., 2013). Cheng et al. (2015) argue that excessive CEO pay increases banks' exposure to riskier activities like mortgage-backed-securities and increases the volatility of returns.

Crucially, the responsiveness of executives to their equity incentives and the choice of risky policies may be determined by their educational background. Bertrand and Schoar (2003) find MBA-educated executives more aggressive in strategic choices. Frank and Goyal (2007) find that firms led by MBA-educated CEOs are more aggressive and adjust their capital structure faster following deviations from optimal leverage ratios. Beber and Fabbri (2012) find that in forex markets, CEOs with MBAs are engage in speculation because management education breeds overconfidence and greater tolerance to risk, but younger CEOs only display this tendency to overconfidence. Nevertheless, the evidence is suggestive that educational attainment, particularly management education, could enable CEOs to manage the risk-taking incentives, which are inherent in compensation contracts, because management education confer general managerial skills that are necessary for CEOs to deliver superior performance outcomes at larger and more complex businesses (see Frydman, 2007; Murphy and Zabojnik, 2007).

In the same vein, we posit that there is a dynamic interaction between equity incentives and educational background. If CEOs with better management education invest in riskier bank activities to improve performance, we expect them to be more likely to respond to risk-inducing pay incentives embedded in compensation contracts. Put differently, we expect the sensitivity of educational background to bank performance to be increasing in the use of equity incentives.

3. Data and Variables

3.1. Sample

The analysis is based on a sample of CEOs at publicly-listed U.S. banks. Our sample period is from 1992 to 2011. We begin by extracting data on CEOs from Compustat ExecuComp database and match accounting data obtained from quarterly FRY-9C call reports sourced from the Federal Reserve Bank of Chicago. We collect market data using the Centre for Research in Securities Prices (CRSP) database. This produces a sample of 172 unique banks.

From this initial list, we retain only those banks for which we could collect detailed data on CEO educational backgrounds that captures information on the types of degrees held (undergraduate, MBA, or Doctorate) and on the awarding institutions. We collect this information from annual and governance reports and conducting thorough searches of relevant databases, such as Bloomberg, Business Week, Forbes, local newspapers and historical State level records. Next, we identify the dates on which CEOs first joined their banks, either as CEO or in another executive position. We collect contract start dates and termination dates.[4] Some data is from SNL Financial, which we supplement by following the same search procedure we use to source education data. To ensure data accuracy, we validate each individual CEO in our dataset across at least two independent sources and

[4] We define start dates to be the first year a CEO held an executive-level position within the firm and termination dates to be when they left the firm as CEO. This hand-collected data gives our rich dataset an important dimension. Unlike previous studies, we do not need to apply the constraint of measuring within sample executive tenure. Instead, we are able to control for the influence of relevant functional experience, which may affect CEO behaviour. Ultimately, this means we are also able to disentangle relationships between CEO education and experience in influencing bank performance.

discard observations if there is ambiguity regarding CEO education or career background. Subject to these constraints, our final sample consists of 1032 observations from 1992 to 2011 belonging to 149 unique banks.

[Insert Table 1 here]

Table 1 shows summary statistics for our education variables. Nearly all sample CEOs are educated to undergraduate level (96.9%) with far fewer CEOs gaining MBA (37.7%) and doctorate (7.3%) qualifications. Top 20 U.S. institutions awarded undergraduate degrees to roughly one-quarter of CEOs (26.2%) and MBAs to less than 10 percent of CEOs (9.7%)[5].

3.2. CEO Education Index

A priori, our assumption is that the six education variables represent an underlying fundamental construct (or latent variable), which we interpret as CEO education index. Prior work confirms the suitability of using factor analysis techniques for constructing our education index. Tetlock (2007) employs factor analysis to constitute a composite measure of media pessimism and shows the pessimism factor predicts trading volumes and stock returns. Kaplan et al. (2012) assess which CEO characteristics affect the performance of firms participating in private equity transactions by analysing interview transcripts of

[5] There is cross-sectional hetereogeneity in terms of the distribution of the top-20 universities across our sample. For instance, 18% of CEOs had a UG degree from Harvard, 9% from Princeton and Dartmouth, and 6% from Duke, Stanford, and Cornell. Similarly, nearly 40% of CEOs in our sample had an MBA from Harvard and Stanford; and nearly 66% of CEOs had a PhD from Harvard and 34% from Stanford.

potential CEO candidates. Their factor solution identifies CEO ability based on three dimensions that capture overall CEO talent, communication and interpersonal abilities, and execution skills. Ellul and Yeramilli (2013) construct a Risk Management Index (RMI) comprising six bank-specific variables, with higher values of RMI indicating better quality of risk oversight and stronger risk controls. The authors show that banks with higher RMI were less risky during the financial crisis.

In the spirit of these studies, we use factor analysis to extract the underlying structure from the variance-covariance matrix of our six education categories. Factor analysis extracts the key factors of the CEO Education Index. It takes into account the total variance of each variable and groups variables that have high levels of shared or common variance into broader factors. These factors share a common core and likely represent an economic relationship for what they collectively represent.

From an econometric perspective, we prefer factor analysis to other methods, such as including all education variables or constructing a weighted average measure for three reasons. First, factor analysis mitigates any bias arising from subjective judgement, wherein the researcher assesses which variables to include and arbitrarily assigns relative importance to each category (Tetlock, 2007).[6] Second, factor analysis mitigates problems associated with including large numbers of highly inter-correlated variables, as well as

[6] For instance, constructing an index that assigns weightage of one for UG, two for MBA, and three for PhD may be vulnerable to researcher bias. It is not obvious why a bank CEO with a PhD should matter more than an MBA. Moreover, there is no a priori theoretical justification for expecting that all three levels of education are equally valuable to improving bank performance. Similarly, including only variables related to UG and MBA, but not PhD, may not present a holistic picture regarding the impact of the level and quality of education.

other measurement issues in multivariate analyses (Custódio et al., 2013). This is because the factor solution consists of composite measures for variables that share a common core and often these factors are orthogonal to each other. Third, including broader dimensions in our multivariate regression framework makes intuitive sense because factor analysis acts as an exploratory technique that first establishes the dimensionality of the construct, and then extracts the structure and composition of its dimensions for use in subsequent analyses.

[Insert Table 2 here]

Table 2 reports the factor solution to our CEO Education Index. Three factors represent vectors in the six dimensional space and these factors capture 67.5% of the variance. Each factor represents a linear combination of variables that accounts for more variance of the data than any other possible combination. The factor loadings for each variable on the three factors indicate the correlation of each variable with the broader factor and indicate the contribution of each variable in defining that factor.

The first factor, representing 25.9% of the variation, is a combination of two key variables: Level and Quality of PhD. Hereafter, we use the term **PhD Education** to refer to this first factor and interpret it as showing CEOs technical expertise acquired through a doctorate degree. The next factor represents the linear combination of variables that explains most of the covariance amongst remaining variables, after accounting for the variance explained by our first factor. This factor loads significantly on two key items:

Level and Quality of MBA. These characteristics capture CEOs general management knowledge and training acquired through an MBA degree.[7] Hence, we interpret this factor as measuring **MBA Education**. Similarly, the third factor represents CEOs **UG Education** since it loads significantly on two variables: Level and Quality of Undergraduate Degree.

We follow Tetlock (2007) and Kaplan et al. (2012) in using these factor loadings to predict factor scores for each of our three factors. Factor score is a standardized value that is computed using all of the variables, with their influence based on the factor loadings. *Ceteris paribus*, a CEO in our sample awarded an MBA by Harvard University has a **MBA Education** factor score of 2.248, reflecting that she is 2.248 standard deviations above the sample mean. However, a CEO who has no MBA has the corresponding factor score of -0.806. Similarly, a CEO who has an undergraduate degree from Princeton University has a **UG Education** factor score of 0.962, while a CEO with an undergraduate degree from non-top 20 US institution has a factor score of 0.063.

Taken together, factor analysis helps in first deriving the structure of our multidimensional CEO Education Index construct, which lays the conceptual foundation, and we use this factor solution to estimate the relationship between CEO education and bank performance in Section 4.

3.3. Measuring Bank Performance

Our primary measure of firm performance is a proxy for bank profitability adjusted for industry trends, which we define as a bank's ROA minus the mean ROA of all other

[7] Custódio et al. (2013) note that firms tend to offer more lucrative compensation to CEOs with general managerial skills in comparison with more specialist CEOs.

banks on a per annum basis. ROA, return on assets, is the ratio of net income-to-the book value of assets. We industry-adjust our profitability measure to eliminate any industry-wide component that is driven by factors unrelated to CEO talent and is beyond their control (Holmstrom, 1982; Gibbons and Murphy, 1990; Jenter and Kannan, 2015). In additional robustness checks (Section 7.1), we show our results using alternate performance measures, such as Buy-and-Hold Abnormal Returns (BHAR) and the likelihood of a bank receiving external government support in the form of TARP funds.

3.4. Other Variables

CEO Pay: Previous evidence has shown that equity incentives embedded in CEO compensation contracts affect bank performance (Crawford et al., 1995; Fahlenbrach and Stulz, 2011; Minnick et al., 2011). When firms remunerate risk-averse managers in stock and options, it links the wealth of managers to that of shareholders, thereby causing managers to pursue risk-increasing but positive NPV projects that maximize firm value (Jensen and Meckling, 1976; Smith and Stulz, 1985). To control for this incentive effect, we calculate Vega and Delta incentives. Vega incentives, defined as the dollar change in option holdings for 1% change in stock price volatility, work to induce convexity in the relationship between CEO wealth and stock price, thereby motivating CEOs to pursue risky projects (Guay, 1999). Delta incentives, measured as the dollar change in equity and option holdings for 1% change in stock price, result in a linear relationship between firm value and CEO equity-based wealth. Delta incentives work to align the interests of CEOs with shareholders and could induce greater effort. Higher delta could expose CEOs who are undiversified in terms of firm-specific wealth to more risk compared to diversified shareholders (Coles et al., 2006). Following prior literature, we scale Vega and Delta

incentives by cash compensation since each incentive is a function of firm size[8] (Graham and Rogers, 2002; Edmans et al., 2009; Hagendorff and Vallascas, 2011). Appendix A details the construction of equity incentives. Additionally, we control for CEO risk aversion using the amount of cash-based compensation as proxy since CEOs with large amounts of cash-based pay have greater opportunities to diversify their wealth (Guay, 1999; Armstrong and Vashishtha, 2012).

Bank-specific Attributes: Prior evidence shows that larger banks, better-capitalised banks, and banks with better investment opportunities report greater profitability (Adams and Mehran, 2012; Berger and Bouwman, 2013; Demirgüç-Kunt et al., 2013; Bennett et al., 2015). We control for such attributes through **Bank Size** (natural logarithm of total assets), **Equity Capital** (fraction of equity-to-total assets), and **Charter Value** (logarithm of market-to-book value of equity), respectively. In response to banking deregulation described earlier, banks are increasingly relying on non-traditional sources of income to improve profit margins and diversify risk (Demirgüç-Kunt and Huizinga, 2010; DeYoung et al., 2013). Accordingly, we specify **Non-interest Income**, which is measured as the fraction of non-interest income-to-total assets.

Next, we control for **Deposits** (fraction of customer deposits-to-assets) to capture how variation in funding models impacts profitability because banks that fund operations with a larger fraction of deposits are less likely to face funding fragility (Demirgüç-Kunt et al., 2013). Evidence shows that banks that follow riskier policies (Adams and Mehran, 2012) and retain larger amounts of earnings to fund positive NPV projects, are more likely to

[8] The Pearson correlation coefficient between unscaled (scaled) Vega and Delta estimates is 0.654 (0.457). Each coefficient is statistically significant at the 1 percent level.

perform better. Therefore, we specify **Volatility** (standard deviation of monthly stock returns) and **Retained Earnings** (fraction of retained earnings-to-assets).

Lastly, we control for the impact of business cycle fluctuations and broader macroeconomic conditions on performance using **Macroeconomic Conditions**, measured as the Federal Reserve Bank of Philadelphia's state-coincident index, which summarizes macroeconomic conditions in the state where the bank has its headquarters.

Table 3 shows descriptive statistics for our variables. CEOs in our sample hold large amounts of equity incentives, with average values of scaled Vega and Delta incentives equal to 7.4% and 33.9% (of cash compensation), respectively. An average bank in our sample holds 9.6% equity capital and has high charter value with the average market-to-book value of 1.62.[9]

4. CEO Education and Bank Performance

We begin by investigating the impact of the level and quality of CEO education on bank performance. Equation [1] shows our baseline specification:

$$\textbf{Bank Performance}_{i,t+1} = \beta_0 + \beta_1(\textbf{UG Education}_t) + \beta_2(\textbf{MBA Education}_t) + \beta_3(\textbf{PhD Education}_t) + \beta_4(\textbf{Control Variables}_t) + \textbf{Bank}_i + \textbf{Year}_t + \varepsilon_{i,t} \quad (1)$$

[9] As shown in Table 3, the average value of the log of market-to-book value of assets is 0.482, which would equate to 1.62 after exponentiation.

where our primary variables of interest are the three factors **UG Education**, **MBA Education** and **PhD Education**, **Control Variables** is the vector of controls discussed in Section 3.4, **Bank** and **Year** control for bank and year fixed effects.

[Insert Table 4 here]

Table 4 reports estimates from the baseline regression, where we introduce our CEO Education factors sequentially in columns (1)-(3) and present the full model in column (4). We note that the level and quality of **MBA Education** is a strong determinant of bank performance, with the coefficient positive and statistically significant at less than 5% level. Specifically, one standard deviation increase in **MBA Education** score results in increasing bank profitability by 11.4%, relative to the sample mean. This is likely if executives with higher **MBA Education** utilise the general managerial knowledge gleaned from quality business education to improve performance through a superior choice of firm policies (Graham and Harvey, 2001; Graham et al., 2013). Frydman (2007) and Murphy and Zabojnik (2007) suggest that MBA education imparts subject-specific training that further improves general managerial skills.

By contrast, we do not find any evidence to suggest that the remaining two factors matter for bank performance. Regarding the impact of **UG Education**, we expect that banks might nurture executives with undergraduate degrees in an executive role over time, before promoting them to chief executive. We test this hypothesis in later sections (Section 7.4) and find tentative evidence that bank CEOs with better quality of undergraduate

education who are nurtured over time (i.e. have significant firm-specific experience in an executive role before being promoted to CEO) are able to improve bank performance.

We attribute the lack of significance on **PhD Education** score to the fact that such forms of advanced degrees may be more valuable in output-oriented industries, such as R&D and engineering (Barker and Muller, 2002), but not for banking. This finding is consistent with Berger et al. (2014) who do not find any conclusive evidence to suggest that executives with a doctorate matter for bank risk-taking.

The coefficients on the remaining control variables are consistent with previous studies on the determinants of bank performance (Demirgüç-Kunt and Huizinga, 2010; Adams and Mehran, 2012). Banks with higher charter value are more profitable. Lower leverage and higher internal sources of funding are positively associated with firm performance.

5. Impact of CEO Pay Structure and Incentives

In this section, we explore the impact of the design of pay incentives embedded in CEO compensation contracts on bank performance. Our premise is that the performance-related effects of risk-taking incentives inherent in executive compensation could further motivate CEOs with better management education to induce more effort and pursue riskier policies. To explore if the dynamics between education and compensation incentives exert a bearing on performance, we augment the baseline specification with interaction terms between our Education factor scores and equity incentives (**Vega** and **Delta**).

[Insert Table 5 here]

Table 5 shows key findings. Across all specifications the interaction term **CEO MBA Education*Vega** is positive and significant at less than 5% level, which implies that CEOs with higher MBA Education who face larger Vega incentives achieve superior bank performance. An increase in CEO Vega incentives from 50th percentile to 75th percentile yields an increase of 12% in the sensitivity of bank performance to CEOs MBA Education in column (1). In column (3), we control for potential concerns that CEO pay may be endogenously related to performance using an instrumental variables framework.[10,11] The results are consistent with our prior analysis and show that the impact of CEO education and Vega incentives remains statistically significant at the 10% level. We find inconclusive evidence that Delta incentives matter. The interaction term **CEO MBA Education*Delta** is positive and statistically significant at less than 10% in column (2).

5.1. Impact of CEO Pay Structure

The structure of CEO compensation can also affect the relationship between education and performance. Emerging evidence suggests that boards can mitigate the effects of risk-taking equity incentives to some extent by altering the structure of CEO compensation e.g.

[10] Endogeneity may arise because equity incentives and performance are jointly determined since boards may anticipate CEO behaviour in response to pay incentives and restructure compensation contracts to achieve desired outcomes (Armstrong and Vashishtha, 2012). In support of this view, DeYoung et al. (2013) argue that the emergence of new investment opportunities and competitive environment post-1999 (i.e. following the Gramm-Leach-Bliley act) motivated board members to structure CEO pay in a manner which gives CEOs strong incentives to respond and shift bank business models towards riskier policies.

[11] Following Coles et al. (2006) and Liu and Mauer (2011), we instrument endogenous CEO equity incentives through CEO age since older CEOs are more likely to hold greater firm-specific equity wealth. Our second instrument is the median salary of professional sports players from the nearest major sports team to each bank's headquarters. The first-stage IV estimation results show that the coefficients on our instruments have the expected signs and are statistically significant. Please see Appendix B for details.

granting long-term equity incentives and deferred compensation (see e.g. Edmans and Liu, 2011; Bennett et al., 2015). Our sample period, spanning nearly two decades from 1992-2011, witnessed a structural shift in CEOs compensation structure from cash-based pay to equity-based pay, driven by deregulation and changes in the competitive environment (Crawford et al., 1995; Hubbard and Palia, 1995; DeYoung et al., 2013).

Whether such changes in compensation structure were systematically associated with banks at which CEOs were more responsive to such incentives is an empirical issue that we address here. Specifically, we assess the interaction effects between the factors of **CEO Education Index** and the structure of compensation. Following prior literature, we take into account the structure of CEO incentives by including variables that capture the fraction of CEO pay in the form equity-based wealth (**% Equity Compensation**) and the fraction of CEO pay in the form of cash compensation (**% Cash Compensation**) (Hubbard and Palia, 1995; Mehran, 1995).

[Insert Table 6 here]

The results, shown in Table 6, indicate that the structure of CEO's compensation matters. The coefficient on the interaction term **MBA Education*% Equity Compensation** is positive and significant at less than 5% level. This indicates that CEOs with higher **MBA Education** factor scores are more inclined to improve bank performance if their compensation structure is geared towards a larger fraction of equity-based pay. The sensitivity of bank performance to management education increases by 32% for increasing

'% Inside Equity' from 50th percentile to 75th percentile. Our results are robust to accounting for endogenous compensation structure by using 2SLS methods. We do not find any evidence for cash-based compensation.

Taken together, the main result from tables 5 and 6 is that CEOs with higher **MBA Education** scores and facing larger equity-based incentives are able to respond to such incentives and achieve significantly higher levels of bank profitability. One implication arising from our evidence is that a quality business education provides CEOs with a skill-set to manage complexities and mitigate what prove to be adverse performance outcomes resulting from risk-taking at banks led by a non-MBA.

6. How do performance improvements happen?

Sections 4 and 5 highlighted the potential value of CEOs with MBA qualifications. Section 4 showed that CEOs with higher **MBA Education** scores improve bank performance, whilst Section 5 demonstrated that such CEOs are more responsive to implicit compensation incentives.

Next, we explore the potential channels through which CEOs are able to improve bank performance. This helps in identifying which CEO actions and decisions across a spectrum of policies realise improvements in bank performance. We consider two potential channels: changes in bank business models, which affect income; and changes in asset composition, which affect returns generated on bank asset portfolios. In what follows, we demonstrate that CEOs with higher **MBA Education** factor scores improve bank performance by utilising innovative albeit possibly riskier business models. Our position is that such CEOs are more valuable when the degree of business complexity increases. We begin by assessing changes in bank business models that can drive bank profitability.

6.1. Changes to the Business Model

Prior research shows that banks had begun to increasingly prioritise fee-based activities to improve performance and take advantage of the emergence of new investment opportunities in the period before the sub-prime crisis (Demirgüç-Kunt and Huizinga, 2010; Beltratti and Stulz, 2012; DeYoung et al., 2013). Such forms of non-interest income include revenues from originate-and-securitize lending, fees and commissions, and income from proprietary trading, activities that are inherently riskier (DeYoung and Roland, 2001). We examine this channel in Panel A of Table 7, where our key variable is the interaction term between the three Education factor scores (**UG Education**, **MBA Education**, and **PhD Education**) and **Non-interest Income**. As noted above, we measure **Non-interest Income** as the fraction of income from non-interest activities-to-total assets.

Concomitantly, CEOs were recomposing asset portfolios by reducing reliance on traditional intermediation business and in its place growing investments in real estate and mortgages, as a result of the real estate boom and developments in financial innovation that saw banks readily adopt the originate-to-distribute model (Brunnermeier, 2009; Mian and Sufi, 2009; Loutskina and Strahan, 2009). We examine this effect in Panel B of Table 7, where our key variable is the interaction term between the three Education factor scores and **Real Estate & Mortgage Loans**. We measure **RE & Mortgage Loans** as the log of real estate loans-to-total assets.

[Insert Table 7 here]

The coefficients on **MBA Education * Non-interest Income** and on **MBA Education * RE & Mortgage Loans** are positive and significant at less than 5% level. This result indicates that bank CEOs with better **MBA Education** who follow riskier policies (in terms of diversifying income sources and reconfiguring loan composition towards assets with higher returns) can boost bank performance. The results appear to be economically relevant: a one standard deviation increase in the **Non-Interest Income** (**RE & Mortgage Loans**) around its mean leads to an increase in the sensitivity of performance to **MBA Education** factor score by 64% (35%) for model (4) in Panel A (Panel B).[12]

6.2. Changes in Asset Composition

Our next set of tests examine if CEOs follow riskier and innovative strategies through changing the composition of bank assets to improve bank performance. Using the originate-to-distribute model meant that banks came to rely on riskier yet ultimately hard-to-value activities such as derivatives and securitizations (Brunnermeier, 2009; DeYoung et al., 2013). The unforeseen outcome of the innovation process caused a general depletion in bank capital and realisation of large-scale losses in crisis (Brunnermeier, 2009). Despite widespread losses, the literature recognises that some banks managed to perform better relative to others (e.g. Beltratti and Stulz, 2012). In terms of asset composition, Erel et al.

[12] In unreported tests, we explore if the change in loan portfolio results in reduced loans to retail consumers and businesses, and confirm this. The coefficient on the interaction term between MBA Education and Traditional Lending Channel (fraction of commercial, industrial, and retail loans-to-assets) is significant and negative at less than 10% level. Since a shift from traditional lending to real estate loans may in turn result in higher levels of loan concentration, we assess if the interaction term between Education factor scores and loan concentration (log of HHI of loans) conveys a similar story. Again, we find that the coefficient on this interaction term is positive and statistically significant at less than 10% level. These results are available from the authors on request.

(2014) hypothesize that certain banks active in securitization were in a better position to understand the risk-return characteristics of highly rated trances of mortgage-backed securities. Loutskina (2011) argues that securitization enhances liquidity creation by transforming illiquid loans into marketable securities, which leads to an increase in the supply of credit. *Ceteris paribus*, we expect that CEOs with higher factor scores in **MBA Education** comprehend such risks and complexities resulting in superior performance outcomes. We test our proposition using two variables: **Securitization** (fraction of mortgage loans sold and securitized-to-assets) and **Derivatives** (fraction of highly rated mortgage-backed securities and asset-backed securities-to-assets), following Erel et al. (2014).

Finally, we introduce another proxy for asset composition: **RWA growth** (growth in RWA-to-total assets over previous year). Risk-weighted assets represent the weighted sum of on- and off- balance sheet assets, with the most liquid assets given a weightage of zero. Growth in RWA signals a shift in asset portfolios towards more risky investments.

[Insert Table 8 here]

Table 8 presents results. As expected, the coefficient on the interaction term between **MBA Education** and our measures of asset composition are positive and statistically significant at less than 10% level. Specifically, one standard deviation increase in our measures of asset composition around the mean results in increasing sensitivity of bank performance to **MBA Education** by 46% in Panel A, 35% in Panel B, and by 36% in Panel

C of Table 6. We also find that CEOs with higher **PhD Education** factor scores that follow a riskier strategy i.e. greater use of derivatives are associated with significantly weaker bank profitability, although such findings do not hold for the remaining two measures of asset composition.

Taken together, our evidence from tables 7 and 8 confirms that bank performance outcomes are stronger when the CEO has a higher **MBA Education** factor score and follows a riskier strategy. This result suggests that CEOs with MBA awards from selective universities are more valuable to their banks because they appear able to utilise innovative business models and manage more complex business activities in their efforts to realise performance gains. This is consistent with arguments in Beber and Fabbri (2012) that older MBA-educated CEOs can manage incentives to speculate, whereas younger CEOs with MBAs are susceptible to overconfidence, which breeds a greater tolerance to risk that facilitates speculative behaviour.

7. **Additional Checks**

The results thus far show that **MBA Education** is positively associated with bank performance. This section presents various robustness checks to add confidence in our findings. We first address the concern that our results may be specific to the choice of bank performance measures in Section 7.1 and to our measure of the quality of CEO education in Section 7.2. We then discuss the concern that talented CEOs sort into better-managed firms through endogenous bank-CEO matching in Section 7.3. We assess the nurturing of bank executives and if the 'nurturing' effect is stronger for CEOs with specific types of education in Section 7.4. Finally, we conduct various additional robustness checks in Section 7.5.

7.1. Alternate Performance Measures

We use three alternative measures of bank performance to assess the robustness of our findings. Our first measure is a market-based measure, BHAR, calculated over the calendar year, following Fahlenbrach and Stulz (2011) and Beltratti and Stulz (2012). BHAR is measured as the buy-and-hold return on an individual bank less the buy-and-hold return on a value-weighted bank index consisting of all public banks over the calendar year. Our second measure is the unadjusted measure of bank profitability, ROA. These results are shown in Table 9, columns (1) and (2).

Finally, we measure bank performance in terms of the likelihood that a bank received external government support i.e. TARP during 2008-09.[13] Fahlenbrach and Stulz (2011) argue that TARP receipt is an indicator of long-term bank performance because poorly performing banks required government support.[14] For our econometric framework, we utilise a quasi-natural experiment to examine banks' pre-crisis characteristics (2001-2006) and bank performance, measured by the probability of receiving TARP in 2008-09. Using logistic regression, we predict TARP likelihood based on differences in pre-crisis bank and CEO characteristics (see column (3) of Table 9).

[13] Fahlenbrach and Stulz (2011) report that bank CEOs suffered large losses in the value of their equity portfolios during the crisis. We assess if there are systematic differences in terms of dollar losses between CEOs with higher and lower educational qualifications, since CEOs with better education may be able to identify inherent risks in certain bank policies. Whereas we do not find that equity losses incurred by CEOs relate to their MBA Education and PhD Education factor scores, we find tentative evidence that CEOs with higher UG Education factor scores incurred larger losses on their equity portfolios.

[14] Bayazitova and Shivdasani (2012) argue that TARP funds were extended to banks that posed systemic concerns and had high charter value, suggesting that the grant of TARP was a result of excessive risk-taking.

[Insert Table 9 here]

Our findings continue to hold using each alternate measure of bank performance. In line with our results, banks run by CEOs with higher **MBA Education** factor scores were less likely to receive TARP.

7.2. Alternate Education Variables

Thus far, our results were derived from three Education factors, where we identify the quality of education from USNWR rankings. To ensure that our results are not specific to the ranking criteria of USNWR, we re-run our regressions with alternate measures of CEO educational attainment i.e. based on The Times top 20 rankings and an index of Ivy League universities.[15] We re-estimate our factor models and show the results in Table 10. They are broadly similar to the main results; CEOs with better **MBA Education** factor scores are able to perform better.[16]

[Insert Table 10 here]

[15] The eight universities in the Ivy League are: Brown University, Columbia University, Cornell University, Dartmouth College, Harvard University, the University of Pennsylvania, Princeton University, and Yale University.

[16] In unreported tests, we assess if our results are partially attributable to education at a specific college (e.g. Harvard). We re-run our regressions using dummy variables that take a value of one if the CEO completed any degree from Harvard. Our results continue to hold even for this robustness check, although the statistical significance of the coefficient on Harvard falls to less than the 10% level.

7.3. **Endogenous Bank-CEO Match**

Another issue we address in this paper is the need to control for endogenous bank-CEO match, wherein we anticipate that the matching of a CEO to a particular bank is not the result of random assignment. According to match theory, a two-sided matching process exists in which CEOs and firms select one another, leading to strong relationships between bank and CEO characteristics (Allgood and Farrell, 2005; Li and Ueda, 2006). Such forms of matching may involve more talented CEOs being competitively sorted into larger firms (Gabaix and Landier, 2008; Tervio, 2008) or firms with better growth prospects or higher charter value (Pan, 2010).

The implication is that an executive with stronger educational credentials is likely to command greater value in the labour market[17] and be in a better position to 'self-select' into the largest and most viable banking institutions. Similarly, larger banks are more likely to attract and appoint better-educated CEOs since firms perceive that education signals unknown or latent talent. Our econometric framework to account for endogenous bank-CEO matching adopts a two-step approach, where the first-stage accounts for the selection of better-educated CEOs into the largest banks.[18] In the second-stage, we use the estimated

[17] In the absence of perfect information in hiring decisions, one important indicator of a prospective CEO's managerial talent, or innate ability, is their University education. In support, empirical papers examining CEO appointments find that stock markets positively value CEO educational backgrounds (Falato et al., 2015; Nguyen et al., 2015). Moreover, Rivera (2010) examines the hiring process at investment banks and other elite professional services firms by conducting interviews with industry professionals responsible for hiring high-level employees. The findings endorse opinion that the quality of education is a key component in hiring decisions.

[18] Our first-stage model specification is:

$$\text{Top10bank}_{i,t} = \beta_0 + \beta_1 \text{ UG Degree}_{i,t} + \beta_2 \text{ MBA Degree}_{i,t} + \beta_3 \text{ PhD Degree}_{i,t} + \varepsilon$$

probabilities that a CEO selects into a top-decile bank as probability weights[19] and repeat our main analysis from Table 4.

[Insert Table 11 here]

The results shown in Table 11 reaffirm our key findings. Banks that employ CEOs with higher **MBA Education** factor scores perform better. We note that the coefficient on **PhD Education** is positive in column (3) but this result dissipates when we include all three factors of **CEO Education Index**.

7.4. 'Nurturing' or Executive Experience

Prior career experience and the degree of training imparted can shape executive ability in order to develop them into top executives of the future (Hambrick and Mason, 1984; Hambrick, 2007; Barker and Mueller, 2002). Such forms of training impart job-specific knowledge and skills throughout a career that influences CEO decision-making (Rajagopalan and Datta, 1996; Barker and Mueller, 2002). We hypothesize that the amount of time a CEO serves in an executive position before being promoted as a chief executive

Top10bank is a dummy variable set to one if a bank ranks in the top 10 percentile by total assets and zero otherwise. UG Degree, MBA Degree, and PhD Degree represent dummy variables equal to 1 if a CEO was educated at a top-20 US university at the relevant level and 0 otherwise; and ε is the error term. Our results are robust to using the alternate measures of the quality of CEO education in Section 7.2.

[19] We use estimated coefficients from the first stage regression, which capture the likelihood of a CEO being selected into a large bank. We do this since our a priori expectation is that better-educated CEOs select into the largest banks. Our objective is to take into account the effect of this selection bias to understand the relationship between CEO education and bank performance and to validate our main results.

conditions his/her choices and therefore affects future firm performance. We contribute to extant knowledge by considering an atypical aspect of 'experience'. Different to studies that focus on formative experiences, we base our experience indicator on CEO experiences as executives in their banks. It draws on the later stages in executive careers, and captures valuable firm-specific knowledge that shapes CEO leadership and management styles. The availability of executive contract data let us construct this novel indicator (see footnote 4).

[Insert Table 12 here]

Table 12 shows results when we augment our regression models with interactions of the three Education factors and **Executive Experience**. The results show that CEOs with higher **MBA Education** scores and greater **Executive Experience** achieve significantly higher bank profitability at less than the 5% level. We find inconclusive evidence that the nurturing of CEOs with undergraduate education positively affects bank profitability (in column (4) and at less than 10% level).

7.5. Additional Checks

Finally, we perform additional checks over different sub-samples. We begin by excluding all observations where there was a turnover event to mitigate concerns that changes in bank performance are the result of the efforts of the previous CEO. Relatedly, our second robustness test focuses on the differential impact of education on performance over CEO tenure. Third, we control for CEO ownership since literature reports an inverse U-shaped relationship between ownership and performance, with large stock ownership

often leading to CEO entrenchment (Mehran, 1995; Datta et al., 2001; Bhagat and Bolton, 2008).[20] The results are shown in Table 13. Throughout all of these robustness checks, we can confirm that our main finding holds. CEOs with higher **MBA Education** factor scores perform better.

[Insert Table 13 here]

8. Summary and Conclusion

In this study, we disentangle the dynamic relationships between CEO education and the incentives for risk-taking that are implicit in the structure of executive compensation contracts, and determine the effects on firm performance outcomes. For this task, we utilise a novel hand-collected dataset that matches biographical information on the education and firm-specific experience of U.S. bank CEOs with data on CEO compensation and other bank characteristics.

We summarise our main results as follows. CEO fixed effects in terms of the level of CEO education and selectivity of awarding universities hold explanatory power in explaining bank performance differentials. Our robust set of results show that banks led by CEOs with better **MBA Education** scores achieve a level of bank profitability that is statistically higher than banks headed by non-MBA CEOs. Moreover, CEOs with better **MBA Education** who follow riskier and more innovative business models secure superior

[20] Our results remain robust to the impact of including quadratic term of CEO ownership to account for non-linear relation between ownership and performance.

bank performance outcomes. Such CEOs when facing larger incentives to increase stock price volatility, or if their compensation structure contains greater equity incentives, appear able to mitigate potentially adverse outcomes associated with excessive risk-taking and deliver significantly higher bank profitability. However, we caution that vesting conditions on equity awards may also result in distorting managerial incentives to pursue short-term interests (Bettis et al., 2010). Future research may wish to consider exploring the role of CEO-specific characteristics, such as education and experience, as moderators of the impact of performance-based and time-based vesting conditions.

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Table 1: Descriptive Statistics of CEO Education variables: This table shows descriptive statistics for our six education variables that represent the level and quality of CEO education for our sample. The three variables representing level of CEO education (UG/MBA/PhD Degree) are dummy variables that take a value of one if a CEO holds the corresponding degree, and zero otherwise. Similarly, the three variables that capture the quality of CEO education (Top-20 UG/MBA/PhD) take a value of one if a CEO obtained their degree from a top-20 US institution, according to latest USNWR rankings.

	Mean	**25th Percentile**	**Median**	**75th Percentile**
Level of Education:				
UG Degree	0.969	1	1	1
MBA Degree	0.377	0	0	1
PhD Degree	0.077	0	0	0
Quality of Education:				
Top-20 UG Degree	0.262	0	0	1
Top-20 MBA Degree	0.097	0	0	0
Top-20 PhD Degree	0.022	0	0	0

Table 2: CEO Education Index: Factor Analysis: This table presents factor loadings on the first three factors based on six education characteristics for 1032 bank-year observations in our sample from 1992-2011. Factor loadings are presented after a normalized orthogonal varimax rotation. Factor loadings with absolute value less than 0.4 are blank. The factors have been sorted by the percentage of variance explained.

Panel A: Factor Loadings	**Factor 1: PhD Education**	**Factor 2: MBA Education**	**Factor 3: UG Education**
Level of Education:			0.907
UG Degree			
MBA Degree		0.745	
PhD Degree	0.849		
Quality of Education:			
Top-20 UG Degree			0.479
Top-20 MBA Degree		0.809	
Top-20 PhD Degree	0.868		
Model Statistics:			
Eigenvalue	1.626	1.426	0.997
% Variance Explained	0.259	0.235	0.181
Cumulative % Variance Explained	0.259	0.494	0.675

Table 3: Descriptive Statistics of CEO Education variables: This table shows summary statistics for various CEO and bank characteristics for 1032 bank-year observations. Profitability is the industry-adjusted measure of bank profitability, defined as bank ROA minus the mean ROA of all other banks per annum. CEO Vega ($000s) represents the dollar change in dollar value of executive's option-based and equity-based wealth for 1% change in volatility. CEO Delta ($000s) represents the change in dollar value of CEO's equity-based wealth for 1% change in stock price. CEO Vega (Delta) (scaled) is the value of CEO Vega (Delta) scaled by cash compensation expressed in percentage. Cash Compensation is the natural log of the sum of salary and bonus. Bank Size is the natural log of total assets (in $ thousands). Equity Capital is the ratio of total equity-to-assets. Charter Value is the log of the market-to-book value of equity. Non-interest Income is the fraction of non-interest income-to-total assets. Deposits is the ratio of customer deposits-to-assets. Volatility is the standard deviation of daily stock returns. Retained Earnings is the fraction of retained earnings-to-assets. Macroeconomic Conditions is the five-factor Coincident Index for each state where a bank is headquartered as provided by Federal Reserve Bank of Philadelphia.

	N	Mean	Standard Deviation	Minimum	Maximum
Profitability	1032	0.010	0.005	-0.002	0.019
Profitability (industry-adjusted)	1032	0.003	0.006	-0.020	0.039
CEO Vega (scaled)	1032	0.074	0.094	0.000	0.359
CEO Delta (scaled)	1032	0.339	0.464	0.020	1.866
Cash Compensation	1032	6.736	0.780	0.001	10.009
Bank Size	1032	16.508	1.389	13.755	19.393
Equity Capital	1032	0.096	0.022	0.061	0.142
Charter Value	1032	0.482	0.625	-2.456	2.666
Non-interest Income	1032	0.019	0.013	0.004	0.054
Deposits	1032	0.685	0.167	0.001	0.927
Volatility	1032	0.413	0.207	0.167	0.831
Retained Earnings	1032	0.049	0.026	0.001	0.098
Macroeconomic Conditions	1032	141.535	18.106	99.743	202.048

Table 4: CEO Education and Bank Performance. This table shows the impact of our three-factor CEO Education Index on bank performance. Bank performance is the industry-adjusted ROA, i.e. the difference between bank ROA and average ROA of the remaining banks for each year. Table 3 defines all independent variables. All models include year fixed effects and bank fixed effects. Standard errors clustered at bank level are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)
UG Education	-0.013			0.005
	(0.060)			(0.062)
MBA Education		0.032***		0.035**
		(0.011)		(0.015)
PhD Education			0.025	-0.009
			(0.020)	(0.019)
CEO Vega	0.239	0.232	0.246	0.232
	(0.182)	(0.175)	(0.174)	(0.181)
CEO Delta	-0.036	-0.037	-0.039	-0.038
	(0.050)	(0.043)	(0.043)	(0.050)
Cash Compensation	0.025	0.025	0.026	0.025
	(0.018)	(0.017)	(0.018)	(0.018)
Bank Size	0.002	0.003	0.002	0.003
	(0.029)	(0.029)	(0.029)	(0.029)
Equity Capital	2.821***	2.875***	2.832***	2.877***
	(0.688)	(0.690)	(0.688)	(0.692)
Charter Value	0.192***	0.191***	0.192***	0.192***
	(0.037)	(0.037)	(0.037)	(0.037)
Non-interest Income	-0.892	-0.877	-0.881	-0.878
	(1.027)	(1.030)	(1.025)	(1.026)
Deposits	-0.188	-0.200*	-0.182	-0.202*
	(0.117)	(0.119)	(0.118)	(0.119)
Volatility	0.054	0.050	0.053	0.050
	(0.039)	(0.038)	(0.038)	(0.038)
Retained Earnings	1.269*	1.328*	1.232*	1.345*
	(0.713)	(0.707)	(0.709)	(0.713)
Macroeconomic Conditions	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Observations	1,032	1,032	1,032	1,032
R-squared	0.878	0.874	0.878	0.874

Table 5: CEO Education and Bank Performance: Impact of CEO Pay Incentives. This table shows the dynamics of CEO pay incentives and our three-factor CEO Education Index on bank performance. In models 1 and 2, we run FE models. In models 3 and 4, we account for endogenous equity incentives and employ 2SLS methodology using CEO Age and Median salary of MLS League Players in the state where each bank is headquartered as instruments. Appendix B shows more details on the first-stage regressions. Table 3 defines all independent variables. All models include year fixed effects and bank fixed effects. Standard errors clustered at bank level are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels.

	(1): FE	(2): FE	(3): 2SLS	(4): 2SLS
UG Education	0.015	-0.022	0.237**	-0.065
	(0.069)	(0.080)	(0.103)	(0.199)
MBA Education	0.032**	0.013	0.053**	0.021
	(0.015)	(0.017)	(0.022)	(0.024)
PhD Education	-0.011	0.022	-0.069*	-0.006
	(0.020)	(0.028)	(0.036)	(0.030)
UG Education * CEO Vega	-0.084		-0.183	
	(0.066)		(0.190)	
MBA Education * CEO Vega	0.085**		0.258*	
	(0.041)		(0.148)	
PhD Education * CEO Vega	0.004		0.033	
	(0.003)		(0.051)	
UG Education * CEO Delta		0.045		0.013
		(0.065)		(0.086)
MBA Education * CEO Delta		0.032*		0.060
		(0.019)		(0.038)
PhD Education * CEO Delta		0.011		0.000
		(0.011)		(0.012)
CEO Vega	0.237	0.280	0.648	-0.439
	(0.174)	(0.169)	(0.498)	(0.518)
CEO Delta	-0.048	-0.066	-0.329**	0.031
	(0.050)	(0.051)	(0.132)	(0.211)
Cash Compensation	0.036*	0.029	-0.039	-0.004
	(0.022)	(0.021)	(0.024)	(0.048)
Bank Size	0.005	-0.030	0.051	0.020
	(0.030)	(0.028)	(0.039)	(0.042)
Equity Capital	2.855***	3.700***	2.745***	2.383***
	(0.688)	(0.885)	(0.625)	(0.852)
Charter Value	0.191***	0.216***	0.272***	0.212***
	(0.037)	(0.036)	(0.051)	(0.063)
Non-interest Income	-0.896	-0.556	0.542	0.556
	(1.019)	(0.646)	(0.414)	(0.635)
Deposits	-0.203*	-0.217*	-0.213*	-0.291**
	(0.122)	(0.119)	(0.124)	(0.127)
Volatility	0.046	0.022	0.117**	0.044
	(0.038)	(0.035)	(0.050)	(0.049)
Retained Earnings	1.442*	-1.201	1.871**	1.514*
	(0.741)	(0.973)	(0.919)	(0.865)
Macroeconomic Conditions	-0.001	-0.001	-0.002	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Observations	1,032	1,032	902	902
R-squared	0.875	0.881	-	-
p-value: Incremental impact of CEO Vega (Delta)				
UG Educ. + UG Educ. * CEO Vega (Delta)	0.419	0.763	0.064	0.948

MBA Educ. + MBA Educ. * CEO Vega (Delta)	0.023	0.084	0.006	0.068
PhD Educ. + PhD Educ. * CEO Vega (Delta)	0.358	0.611	0.148	0.981

Table 6: CEO Education and Bank Performance: Impact of CEO Pay Structure. This table shows the dynamics of CEO pay structure and our three-factor CEO Education Index on bank performance. In models 1 and 2, we run FE models. In models 3 and 4, we account for endogenous equity incentives and employ 2SLS methodology using CEO Age and Median salary of MLS League Players in the state where each bank is headquartered as instruments. Appendix B contains more details on the first-stage regressions. Table 3 defines all independent variables. All models include year fixed effects and bank fixed effects. Standard errors clustered at bank level are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels.

	(1): FE	(2): FE	(3): 2SLS	(4): 2SLS
UG Education	0.067	-0.005	0.111	-0.094
	(0.068)	(0.040)	(0.218)	(0.086)
MBA Education	-0.155	0.031**	-0.230	0.086**
	(0.095)	(0.015)	(0.161)	(0.035)
PhD Education	0.003	-0.038	0.017	0.009
	(0.115)	(0.026)	(0.054)	(0.055)
UG Education * % Equity Compensation	-0.087		-0.265	
	(0.057)		(0.225)	
MBA Education * % Equity Compensation	0.224**		0.335*	
	(0.105)		(0.188)	
PhD Education * % Equity Compensation	0.004		0.060	
	(0.147)		(0.047)	
UG Education * % Cash Compensation		0.176		0.233
		(0.188)		(0.264)
MBA Education * % Cash Compensation		0.091		-0.412
		(0.116)		(0.263)
PhD Education * % Cash Compensation		0.097		0.131
		(0.168)		(0.186)
% Equity Compensation	-0.096	-0.131	1.606**	1.077
	(0.133)	(0.134)	(0.773)	(0.889)
% Cash Compensation	-0.033	-0.052	0.924	0.730
	(0.184)	(0.158)	(0.672)	(0.646)
Bank Size	-0.001	0.003	-0.037	-0.013
	(0.030)	(0.028)	(0.038)	(0.042)
Equity Capital	2.832***	2.856***	2.587***	2.548***
	(0.731)	(0.685)	(0.707)	(0.675)
Charter Value	0.198***	0.200***	0.148**	0.176**
	(0.042)	(0.042)	(0.063)	(0.070)
Non-interest Income	-0.835	-0.841	0.558	0.685
	(1.073)	(1.095)	(0.344)	(0.415)
Deposits	-0.214*	-0.214*	-0.369***	-0.329***
	(0.112)	(0.116)	(0.121)	(0.121)
Volatility	0.035	0.039	0.139**	0.110
	(0.039)	(0.036)	(0.062)	(0.068)
Retained Earnings	1.463*	1.497**	0.746	1.138
	(0.747)	(0.739)	(0.785)	(0.913)
Macroeconomic Conditions	-0.001	-0.001	-0.002	-0.002
	(0.001)	(0.001)	(0.002)	(0.002)
Observations	1,032	1,032	902	902
R-squared	0.879	0.873	-	-
p-value: Incremental impact of X1 (% Equity or % Cash Compensation)				
UG Educ. + UG Educ. * % Equity (Cash) Comp.	0.297	0.643	0.164	0.434
MBA Educ. + MBA Educ. * % Equity (Cash) Comp.	0.007	0.035	0.013	0.048
PhD Educ. + PhD Educ. * % Equity (Cash) Comp.	0.983	0.336	0.231	0.551

Table 7: CEO Education and Channels to Improve Bank Performance: Business Models. Panel A of this table focuses on the role of **Non-interest Income** in improving bank performance, measured as the fraction of interest income-to-total assets. Panel B focuses on our second measure **RE & Mortgage Loans** that is the fraction of real estate and mortgage loans-to-assets. Table 3 defines all independent variables. 'Other Controls' are as discussed in Section 3.4. All models include year fixed effects and bank fixed effects. Standard errors clustered at bank level are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels.

Panel A: Non-interest Income	(1)	(2)	(3)	(4)
UG Education * Non-interest Income	0.655			0.490*
	(0.484)			(0.249)
MBA Education * Non-interest Income		1.543**		1.720**
		(0.758)		(0.727)
PhD Education * Non-interest Income			-0.104	-1.199
			(1.120)	(0.979)
UG Education	-0.009	0.002	0.005	-0.014
	(0.065)	(0.063)	(0.062)	(0.063)
MBA Education	0.035**	-0.001	0.036**	0.002
	(0.015)	(0.022)	(0.016)	(0.020)
PhD Education	-0.006	-0.058	-0.005	-0.017
	(0.019)	(0.044)	(0.041)	(0.040)
Non-interest Income	-0.894	0.074	-0.905	-0.141
	(1.021)	(1.024)	(0.976)	(0.927)
Other Controls	Yes	Yes	Yes	Yes
Observations	1,032	1,032	1,032	1,032
R-squared	0.879	0.880	0.878	0.881
p-value: Incremental impact of Non-Interest Income				
UG Educ. + UG Educ. * Non-interest Income	0.396			0.145
MBA Educ. + MBA Educ. * Non-interest Income		0.030		0.010
PhD Educ. + PhD Educ. * Non-interest Income			0.892	0.196
Panel B: Real Estate & Mortgage Loans (RE Loans)				
UG Education * RE Loans	0.004			0.017
	(0.021)			(0.026)
MBA Education * RE Loans		0.045*		0.046*
		(0.026)		(0.027)
PhD Education * RE Loans			0.037	0.030
			(0.040)	(0.040)
UG Education	0.005	0.015	0.007	0.029
	(0.067)	(0.069)	(0.065)	(0.076)
MBA Education	0.034**	0.093**	0.035**	0.095**
	(0.015)	(0.040)	(0.015)	(0.042)
PhD Education	-0.008	-0.046	0.003	-0.036
	(0.019)	(0.039)	(0.023)	(0.042)
RE Loans	0.014	0.028	0.019	0.036
	(0.068)	(0.067)	(0.068)	(0.070)
Other Controls	Yes	Yes	Yes	Yes
Observations	1,032	1,032	1,032	1,032
R-squared	0.872	0.879	0.872	0.879
p-value: Incremental impact of RE Loans				
UG Educ. + UG Educ. * RE Loans	0.990			0.900
MBA Educ. + MBA Educ. * RE Loans		0.035		0.038
PhD Educ. + PhD Educ. * RE Loans			0.783	0.458

Table 8: CEO Education and Channels to Improve Bank Performance: Asset Composition. Panel A focuses on the role of **Securitization** in improving bank performance, measured as the fraction of real estate and mortgage securitizations-to-total assets. Panel B focuses on our second measure **Derivatives**, which we measure as the percentage of highly rated tranches of mortgage-backed securities and asset-backed securities held-to-total assets. Panel C focuses on the **RWA Growth**, measured as the year-on-year growth in Risk-weighted Assets. Table 3 defines all independent variables. 'Other Controls' are as discussed in Section 3.4. All models include year fixed effects and bank fixed effects. Standard errors clustered at bank level are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels.

Panel A: Securitization	(1)	(2)	(3)	(4)
UG Education * Securitization	0.520			0.474
	(0.361)			(0.380)
MBA Education * Securitization		0.763***		0.773***
		(0.249)		(0.283)
PhD Education * Securitization			-0.174	0.061
			(0.138)	(0.120)
UG Education	0.006	0.036	0.031	0.015
	(0.068)	(0.077)	(0.076)	(0.067)
MBA Education	0.065*	0.048	0.060*	0.053
	(0.034)	(0.036)	(0.035)	(0.035)
PhD Education	-0.053	-0.031	-0.044	-0.039
	(0.041)	(0.039)	(0.041)	(0.039)
Securitization	0.944*	0.423	1.158**	0.314
	(0.530)	(0.346)	(0.580)	(0.463)
Other Controls	Yes	Yes	Yes	Yes
Observations	763	763	763	763
R-squared	0.876	0.877	0.876	0.877
p-value: Incremental impact of Securitization				
UG Educ. + UG Educ. * Securitization	0.331			0.442
MBA Educ. + MBA Educ. * Securitization		<0.001		<0.001
PhD Educ. + PhD Educ. * Securitization			0.262	0.524
Panel B: Derivatives				
UG Education * Derivatives	0.241			0.199
	(0.147)			(0.156)
MBA Education * Derivatives		0.261**		0.240**
		(0.116)		(0.120)
PhD Education * Derivatives			-0.157**	-0.187***
			(0.069)	(0.067)
UG Education	-0.118**	-0.108*	-0.097*	-0.127**
	(0.056)	(0.057)	(0.053)	(0.056)
MBA Education	0.047*	0.050**	0.058**	0.047*
	(0.028)	(0.025)	(0.026)	(0.026)
PhD Education	-0.044	-0.071**	-0.039	-0.048
	(0.030)	(0.033)	(0.030)	(0.033)
Derivatives	-0.277	-0.228	-0.198	-0.302
	(0.218)	(0.194)	(0.217)	(0.204)
Other Controls	Yes	Yes	Yes	Yes
Observations	807	807	807	807
R-squared	0.860	0.866	0.856	0.867

p-value: Incremental impact of Derivatives				
UG Educ. + UG Educ. * Derivatives	0.057			0.054
MBA Educ. + MBA Educ. * Derivatives		0.009		0.035
PhD Educ. + PhD Educ. * Derivatives			0.014	0.005
Panel C: RWA Growth				
UG Education * RWA Growth	-0.044			-0.053
	(0.093)			(0.090)
MBA Education * RWA Growth		0.092*		0.096*
		(0.055)		(0.057)
PhD Education * RWA Growth			-0.033	-0.037
			(0.039)	(0.039)
UG Education	0.053	0.048	0.048	0.059
	(0.064)	(0.060)	(0.063)	(0.063)
MBA Education	0.050***	0.032	0.050***	0.031
	(0.017)	(0.019)	(0.017)	(0.020)
PhD Education	-0.043	-0.037	-0.041	-0.032
	(0.030)	(0.026)	(0.030)	(0.027)
RWA Growth	0.107**	0.109**	0.100**	0.110**
	(0.049)	(0.046)	(0.048)	(0.047)
Other Controls	Yes	Yes	Yes	Yes
Observations	905	905	905	905
R-squared	0.881	0.882	0.881	0.882
p-value: Incremental impact of RWA Growth				
UG Educ. + UG Educ. * RWA Growth	0.653			0.568
MBA Educ. + MBA Educ. * RWA Growth		0.002		0.003
PhD Educ. + PhD Educ. * RWA Growth			0.348	0.424

Table 9: Robustness Checks: Alternate Measures of Bank Performance. Column (1) of this table measures bank performance through Buy-and-Hold Abnormal Returns (BHAR) for each bank, where the performance of each bank is benchmarked against a value-weighted bank index comprising all public banks. Column (2) employs unadjusted bank ROA, without adjusting for industry-specific trends. Column (3) measures bank performance through a binary variable TARP, which takes a value of one if a bank received external government support in the form of TARP funds during 2008-09, and zero otherwise. All independent variables for this column are measured using hold-out samples over the period 2001-06. Results in column (1) and (2) are from Fixed-Effects models and for column (3) from logistic regressions. Table 3 defines all independent variables. All models include year fixed effects and bank fixed effects. Standard errors clustered at bank level are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels.

	BHAR	ROA	Pr(TARP)
	(1)	(2)	(3)
UG Education	0.022	-0.093	-0.228
	(0.019)	(0.059)	(0.260)
MBA Education	0.031***	0.042**	-0.566**
	(0.009)	(0.017)	(0.272)
PhD Education	-0.039**	-0.028	0.203
	(0.019)	(0.023)	(0.279)
CEO Vega	-0.099*	-0.123	0.355
	(0.053)	(0.150)	(2.856)
CEO Delta	0.002	0.085*	0.715
	(0.011)	(0.048)	(0.538)
Cash Compensation	-0.007	0.028	-0.771*
	(0.006)	(0.022)	(0.464)
Bank Size	-0.030**	0.015	0.717***
	(0.013)	(0.035)	(0.259)
Equity Capital	0.115	3.744**	15.840
	(0.277)	(1.630)	(13.657)
Charter Value	-0.009	1.079	1.677**
	(0.013)	(0.830)	(0.746)
Non-interest Income	-0.095	0.030	-41.180**
	(0.121)	(0.052)	(19.919)
Deposits	-0.038	-0.237	-0.872
	(0.076)	(0.168)	(2.125)
Volatility	0.030	2.900***	-1.776
	(0.020)	(0.862)	(1.096)
Retained Earnings	-0.850***	0.282***	-2.581
	(0.290)	(0.041)	(10.201)
Macroeconomic Conditions	-0.000	-0.000	0.022
	(0.001)	(0.001)	(0.021)
Observations	1,027	1,032	375
R-squared	0.095	0.471	-

Table 10: Robustness Checks: Alternate Measures of CEO Education Quality. This table constructs three-factor CEO Education Index using alternate measures of CEOs quality of education. In column (1), we measure quality of education, if the CEO received her/his undergraduate, MBA, and PhD degree from a university that ranks amongst the top-20 universities according to Times Higher Education rankings. In column (2), we measure CEOs quality of education through dummy variables that take a value of one if the CEO received his/her undergraduate, MBA, and PhD degree from a university classified as an Ivy League university, and zero otherwise. Table 3 defines all independent variables. All models include year fixed effects and bank fixed effects. Standard errors clustered at bank level are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels.

	Times 20	Ivy League
	(1)	(2)
UG Education	0.060	0.057
	(0.136)	(0.111)
MBA Education	0.073**	0.042***
	(0.030)	(0.015)
PhD Education	-0.037	-0.001
	(0.034)	(0.017)
CEO Vega	0.246	0.240
	(0.182)	(0.181)
CEO Delta	-0.040	-0.043
	(0.049)	(0.050)
Cash Compensation	0.026	0.024
	(0.018)	(0.018)
Bank Size	0.004	0.003
	(0.029)	(0.029)
Equity Capital	2.887***	2.875***
	(0.688)	(0.689)
Charter Value	0.191***	0.193***
	(0.037)	(0.037)
Non-interest Income	-0.859	-0.868
	(1.018)	(1.020)
Deposits	-0.194	-0.206*
	(0.117)	(0.118)
Volatility	0.052	0.051
	(0.038)	(0.038)
Retained Earnings	1.310*	1.351*
	(0.705)	(0.714)
Macroeconomic Conditions	-0.001	-0.001
	(0.001)	(0.001)
Observations	1,032	1,032
R-squared	0.753	0.777

Table 11: Robustness Checks: Endogenous Firm-CEO Matching. This table shows the impact of our three-factor CEO Education Index on bank performance whilst controlling for potential CEO-bank endogenous selection bias (please refer to Section 7.3 and to footnote 17 for details). Bank performance is the industry-adjusted ROA. Table 3 defines all independent variables. All models include year fixed effects and bank fixed effects. Standard errors clustered at bank level are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)
UG Education	-0.010			0.038
	(0.069)			(0. 065)
MBA Education		0.035***		0. 041**
		(0.012)		(0.017)
PhD Education			0.037**	-0.008
			(0.019)	(0.032)
CEO Vega	0.548**	0.531**	0.550**	0.540**
	(0.250)	(0.242)	(0.242)	(0.249)
CEO Delta	-0.073	-0.070	-0.070	-0.076
	(0.058)	(0.053)	(0.052)	(0.057)
Cash Compensation	0.007	0.008	0.009	0.006
	(0.012)	(0.012)	(0.012)	(0.011)
Bank Size	0.032	0.033	0.033	0.033
	(0.026)	(0.026)	(0.026)	(0.026)
Equity Capital	2.896***	2.960***	2.911***	2.964***
	(0.661)	(0.657)	(0.667)	(0.657)
Charter Value	0.135***	0.133***	0.133***	0.135***
	(0.024)	(0.024)	(0.025)	(0.024)
Non-interest Income	-0.051	-0.029	-0.029	-0.031
	(0.716)	(0.716)	(0.711)	(0.711)
Deposits	-0.413**	-0.438**	-0.408	-0.436**
	(0.180)	(0.176)	(0.179)	(0.180)
Volatility	0.037	-0.044	-0.039	-0.043
	(0.037)	(0.037)	(0.036)	(0.037)
Retained Earnings	2.553***	2.621***	2.493***	2.644***
	(0.759)	(0.720)	(0.743)	(0.722)
Macroeconomic Conditions	0.000	0.000	0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Observations	1,032	1,032	1,032	1,032
R-squared	0.940	0.941	0.940	0.941

Table 12: CEO Education and Bank Performance: Impact of Executive Experience. We measure executive experience as the time (in years) from the first year when a CEO held an executive position within the bank to the termination date when they left the bank as CEO. Table 3 defines all independent variables. 'Other Controls' are as discussed in Section 3.4. All models include year fixed effects and bank fixed effects. Standard errors clustered at bank level are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)
Executive Experience * UG Education	0.000			0.004*
	(0.001)			(0.002)
Executive Experience * MBA Education		0.007***		0.007***
		(0.003)		(0.003)
Executive Experience * PhD Education			0.005	0.002
			(0.005)	(0.006)
UG Education	-0.154	-0.056	-0.162	-0.119
	(0.097)	(0.105)	(0.099)	(0.087)
MBA Education	0.022	0.066**	0.022	0.058**
	(0.032)	(0.026)	(0.033)	(0.023)
PhD Education	-0.003	-0.057**	-0.039	-0.068
	(0.039)	(0.028)	(0.052)	(0.047)
Executive Experience	-0.004	-0.003	-0.003	-0.004
	(0.003)	(0.002)	(0.003)	(0.003)
CEO Vega	-0.125	-0.065	-0.106	-0.067
	(0.133)	(0.125)	(0.130)	(0.127)
CEO Delta	0.103**	0.094*	0.098**	0.089*
	(0.048)	(0.048)	(0.048)	(0.048)
Cash Compensation	0.023	0.025	0.021	0.023
	(0.023)	(0.023)	(0.023)	(0.023)
Bank Size	0.055	0.056	0.055	0.056
	(0.042)	(0.039)	(0.042)	(0.039)
Equity Capital	2.467***	2.762***	2.422***	2.823***
	(0.854)	(0.812)	(0.850)	(0.825)
Charter Value	0.283***	0.276***	0.281***	0.278***
	(0.046)	(0.044)	(0.045)	(0.045)
Non-interest Income	4.165***	3.951***	4.137***	3.879***
	(1.156)	(0.911)	(1.130)	(0.874)
Deposits	-0.175	-0.136	-0.195	-0.132
	(0.163)	(0.162)	(0.162)	(0.161)
Volatility	0.030	0.025	0.032	0.024
	(0.060)	(0.061)	(0.061)	(0.061)
Retained Earnings	1.369	1.246	1.361	1.292
	(0.946)	(0.921)	(0.944)	(0.915)
Macroeconomic Conditions	-0.000	-0.001	0.000	-0.001
	(0.001)	(0.002)	(0.001)	(0.002)
Observations	926	926	926	926
R-squared	0.860	0.863	0.861	0.864

Table 13: Additional Checks. This table presents the results of regressing bank performance on different sub-samples. In column (1), we exclude all observations where a CEO turnover event occurred since it is less likely that newly appointed CEOs can influence bank performance materially and to mitigate concerns arising from using educational characteristics of the incumbent CEO on current bank performance. In columns (2) and (3), we show results by splitting the sample according to whether CEOs tenure is below or above median, where we measure CEO tenure in years. In column (4), we control for the impact of CEO ownership. **CEO Ownership** equals the log of fraction of stocks owned by the CEO-to-total stocks outstanding. Table 3 defines all independent variables. 'Other Controls' are as discussed in Section 3.4. All models include year fixed effects and bank fixed effects. Standard errors clustered at bank level are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels.

	Excluding CEO Turnovers	Tenure < Median	Tenure >= Median	Controlling for Ownership
	(1)	(2)	(3)	(4)
UG Education	0.041	0.045	-0.109	0.003
	(0.098)	(0.074)	(0.179)	(0.070)
MBA Education	0.044**	0.057*	0.039**	0.037**
	(0.020)	(0.030)	(0.017)	(0.015)
PhD Education	-0.040*	-0.024	0.504	-0.001
	(0.023)	(0.036)	(0.545)	(0.020)
CEO Vega	0.199	0.577**	-0.063	0.228
	(0.217)	(0.264)	(0.173)	(0.245)
CEO Delta	-0.050	-0.073	0.032	-0.016
	(0.047)	(0.072)	(0.042)	(0.076)
Cash Compensation	0.006	0.042	0.032	0.027
	(0.014)	(0.035)	(0.038)	(0.018)
Bank Size	0.013	-0.062	0.093*	0.013
	(0.035)	(0.059)	(0.048)	(0.027)
Equity Capital	2.988***	1.728	1.756***	2.381***
	(0.857)	(1.418)	(0.643)	(0.638)
Charter Value	0.201***	0.286***	0.174***	0.182***
	(0.036)	(0.058)	(0.039)	(0.037)
Non-interest Income	-0.927	8.383***	2.523	2.129
	(0.983)	(1.795)	(1.602)	(1.383)
Deposits	-0.243*	-0.381	-0.309	-0.169
	(0.135)	(0.236)	(0.209)	(0.115)
Volatility	0.017	0.048	0.051	0.045
	(0.034)	(0.065)	(0.057)	(0.038)
Retained Earnings	1.306	-0.356	2.497**	1.165**
	(0.857)	(1.393)	(1.059)	(0.587)
CEO Ownership				-0.714
				(0.519)
Macroeconomic Conditions	-0.000	-0.006	0.002	-0.001
	(0.001)	(0.004)	(0.002)	(0.001)
Observations	838	421	579	1,030
R-squared	0.887	0.871	0.886	0.880

Appendix A: Calculation of executive pay sensitivities and inside wealth measure

To calculate Vega and Delta option portfolio sensitivities, we follow Core and Guay (2002) and Coles et al. (2006) to account for changes made to executive compensation reporting standards in 2006. The changes require fair value recording of equity-based compensation including the calculation of executive stock options in bank financial statements.

Pre 2006 Vega and Delta sensitivities

We calculate pre-2006 Vega and Delta option portfolio sensitivities using an extended version of the Black-Scholes pricing formula, which allows for dividends (see Merton, 1973):

$$Exec\ Delta = e^{-dt}N(Z) \qquad [A1]$$

$$Exec\ Vega = e^{-dt}N(Z)S\sqrt{T} \qquad [A2]$$

$$Z = \frac{ln\frac{S}{K}+T(r-d+0.5\sigma^2}{\sigma\sqrt{T}} \qquad [A3]$$

Where the normal distribution N(Z) represents the density function, S the bank stock price, K the option strike price, r the natural log of the risk-free rate, T the time to option maturity, d is equal to the expected dividend yield over option life taken as the natural log, and σ is the expected volatility of bank returns.

Post 2006, we calculate the sensitivities of Delta and Vega contingent upon vested and unvested option tranches summated for each executive firm-year (see Coles et al, 2002; 2006 for details).

Calculation of equity-based compensation

This measure captures the total equity holding (stock and option portfolio) or 'inside equity' of an executive (see Sundaram and Yermack, 2007). We follow Coles et al. (2006) in dealing with differences in pre and post 2006 reporting standards. Pre-2006, we compute the total sum of current year stock grants, previously granted unvested options and vested options, whilst post-2006, we sum the total of all tranches of options outstanding. We derive an executive's total share portfolio by multiplying the number of shares by the end of fiscal year price (see Coles et al., 2006 for details).

Appendix B: First-stage Regressions for Endogenous CEO Pay Variables

Appendix B discusses the instruments used in the first-stage of our instrumental variables setup to account for the endogenous nature of CEO compensation incentives. Based on Coles et al. (2006) and Liu and Mauer (2011), our first instrument is CEO age. Next and most interestingly, we specify a novel instrument in the form of professional baseball players' salaries. We collect data on the salaries of US professional sports players from the USA Today Salaries database[21], which contains data for all major sports team in the US, including Major League Baseball (MLB), National Football League (NFL), National Basketball Association (NBA), National Hockey League (NHL) and Major League Soccer (MLS). We focus on the MLB since baseball is the national sport in the U.S., is widely followed across the country, and commands extensive media coverage. We use this data as a novel instrument for the pay of bank CEOs in our instrumental variables framework in Tables 5 and 6

Bouwman (2013) introduces this instrument in a study investigating the effect of geography on CEO compensation for a sample of non-bank firms. Following arguments given in Bouwman (2013), we consider this instrument passes the test of validity. On one hand, it is difficult to argue that banks use the pay of professional sports players as benchmarks when setting the compensation of bank CEOs. Whilst it is unlikely that the compensation of bank CEOs has any direct relationship to the pay of professional sports players in the same state since game-specific supply and demand forces determine the latter, it is rational to consider that the pay of professional sports players in the same state could influence bank CEO wage demands. The rationale is that bank CEO might view pay partially as a symbol of status, and become envious of large salaries afforded to professional baseball players. Consequently, we anticipate a positive correlation between the compensation of bank CEOs and sports players in the same geographical region.

[21] The USA Today Salaries database provides salary information for sports players for the main professional sports leagues by team.

The database is available from: http://content.usatoday.com/sportsdata/baseball/mlb/salaries/team

Table B1: CEO Education and Bank Performance: First-stage Regressions. This table shows the first-stage results of the 2SLS framework where bank performance is the dependent variable in the second stage. The first-stage mitigates endogeneity concerns arising from CEO's equity incentives by instrumenting them with CEO age, and Median MLS Salary. CEO age is the age of CEO in years. Median MLS Salary represents the median value of compensation earned by MLS League Players in the state where each bank is headquartered. All independent variables have been defined in Table 3. All models include year fixed effects and bank fixed effects. Standard errors clustered at bank level are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)
First-stage Regressions	**CEO Vega**	**CEO Delta**	**% Inside Equity**	**% Cash Comp.**
CEO Age	0.004**	0.018**	0.000	-0.005***
	(0.002)	(0.009)	(0.003)	(0.001)
Median MLS Salary	0.001	-0.007	0.012**	-0.004*
	(0.003)	(0.012)	(0.006)	(0.002)
UG Education	-0.040	0.647***	0.087**	0.019
	(0.035)	(0.194)	(0.037)	(0.021)
MBA Education	-0.003	0.041	0.015	-0.016*
	(0.011)	(0.059)	(0.018)	(0.009)
PhD Education	-0.004	-0.097	-0.042*	0.020**
	(0.011)	(0.086)	(0.023)	(0.009)
Bank Size	0.019	0.137*	0.028	0.009
	(0.013)	(0.074)	(0.022)	(0.010)
Equity Capital	0.272	2.481*	0.049	-0.468***
	(0.303)	(1.277)	(0.429)	(0.167)
Charter Value	0.023***	0.248***	0.063***	-0.036***
	(0.008)	(0.059)	(0.013)	(0.007)
Non-interest Income	-0.164	-1.809	-0.293	0.134*
	(0.243)	(1.294)	(0.221)	(0.080)
Deposits	0.001	0.180	0.096	-0.055*
	(0.055)	(0.202)	(0.101)	(0.032)
Volatility	-0.039**	0.083	-0.064***	0.027**
	(0.017)	(0.070)	(0.020)	(0.011)
Retained Earnings	0.533*	2.551	0.444	-0.103
	(0.286)	(1.865)	(0.520)	(0.216)
Macroeconomic Conditions	-0.001	-0.004	0.001	-0.001
	(0.001)	(0.004)	(0.001)	(0.001)
Observations	902	902	902	902
R-squared	0.406	0.416	0.472	0.325