Bangor Business School
Working Paper

BBSWP/13/009

BANK EFFICIENCY AND EXECUTIVE COMPENSATION

By

Timothy King, Jonathan Williams***

September, 2013

*** Bangor Business School**
Bangor University
Hen Goleg
College Road
Bangor
Gwynedd LL57 2DG
United Kingdom
Tel: +44 (0) 1248 382277
E-mail: business@bangor.ac.uk

**** Leeds University Business School, University of Leeds, Leeds LS2 9JT.**

Bank Efficiency and Executive Compensation

Abstract

We investigate whether handsomely rewarding bank executives' realizes superior efficiency by determining if executive remuneration contracts produce incentives that offset potential agency problems and lead to improvements in bank efficiency. We calculate executive Delta and Vega to proxy executives' risk-taking following changes in their compensation contracts and estimate their relationship with alternative profit efficiency. Our study uses novel instruments to account for the potentially endogenous relationship between efficiency and Delta and Vega whilst controlling for the structure of executive compensation, board structure, and bank-level characteristics. Our main results demonstrate that shareholders use executive Vega to incentivise executives into taking risks that improve bank efficiency, and also that executive perquisites can be used to attract and retain executives which ex post deliver efficiency gains.

Keywords: Banks, corporate governance, executive remuneration, efficiency, stochastic frontier.
JEL Classification: C2, G21, G3

Bank Efficiency and Executive Compensation

1. Introduction

We consider explicitly that the decision-making of bank executive directors reflects the particular incentives that are generated by executive compensation contracts. Underlying our investigation is the notion that if bank boards are to be 'effective' they should generate superior firm performance, which implies executives should be compensated accordingly. We contend that if the market values firm efficiency, then shareholders will willingly compensate their executives for decisions that realise efficiency gains.[1] Intuitively, we contemplate that if the benefits to shareholders reside in executives' ability to deliver superior firm performance, shareholders would pay a premium to attract and retain managerial talent, which infers executive compensation and bank efficiency are positively related.[2]

Executive compensation contracts implicitly incentivise management thereby affecting their behaviour (Shleifer and Vishny, 1997). This idea can be traced to Adam Smith (1776) who recognised that employee managers expended less effort in running a firm compared to owner managers. Essentially, Smith was describing the classic agency problem which from the separation of ownership and control of firms: agents (executives) can expropriate principals (shareholders) by using their knowledge and expertise to acquire private benefits or pursue their own objectives instead of maximising firm value (Jensen and Meckling, 1976). The 'own objectives' are deemed 'agency goods' and could include empire building, shirking, consuming perquisites, taking too much or too little risk in order to enhance control, or simply making poor production and investment decisions (Hughes et al, 2003). Any consumption of agency goods constitutes a deviation from efficiency because such consumption is representative of firm inefficiencies. This demonstrates the importance of designing correctly executive compensation contracts for bankers. Whilst the extent of agency problems has been identified as the primary factor explaining the degree of bank X-efficiency (Berger et al. 1993), the literature to date is yet to consider the extent to which executive compensation affects bank efficiency.

Whilst executives' decision-making critically affects bank performance, little is understood about the relationship between the incentives implicit within executive compensation contracts and the corresponding decisions taken by executives that affect bank efficiency (Baker, 1988; Core et al. 2003). Nevertheless, executive compensation, particularly for bankers, has significantly increased and gravitated towards higher variable components of pay over the past thirty years (Cuñat and Guadalupe, 2009). It has been suggested that executive compensation contracts inadvertently created an inappropriate set of incentives that induced excessive behaviour which contributed to the development of the 2007-2009 financial crisis (Turner, 2009; Financial Stability Form, 2009; Bhagat and Bolton, 2011; Beck et al. 2012). Many banks had restructured their

[1] Since the 1970s, financial sector firms have reacted to financial deregulation by making significant efforts to seek and secure efficiency gains (Spong et al. 1996; DeYoung et al. 2004; Fiordelisi et al. 2011). However, a negative repercussion has been the creation of " … *a boom-and-bust cycle, with banks taking excessive risks. There has also been evidence of a herding effect with financial institutions taking increasing risks in the same sectoral and geographic portfolios*" (Beck, 2012 p. 50).

[2] Following corporate scandals and crisis episodes, the US government legislated to target improvements in corporate governance. The Sarbanes Oxley Act (2002) and Dodd Frank Act (2010) have rekindled interest in the importance of governance mechanisms for banks and other firms (Certo, 2003; Hillman and Dalziel, 2003; Kroll et al. 2007; Hillman et al. 2009; Kor and Sundaramurphy, 2009; Ertimur et al. 2010). These observations suggest that attracting, incentivising and retaining managerial talent is fundamental for banks to produce efficient outcomes.

executives' compensation contracts to include greater amounts of variable pay components, like deferred compensation, to align agents' interests with firm performance (Core et al. 2003; Faulkender et al. 2010; DeYoung et al. 2013), nevertheless this did not prevent those banks from underperforming in the crisis (Fahlenbrach and Stulz, 2011; Beltratti and Stulz, 2012; Erkens et al. 2012). Crucially, contracts failed because they aligned executives' interests with short-term and not long-term bank performance (Berrone, 2008; Bebchuk and Fried, 2010; Posner, 2011; Bair, 2011).

Our objective is to establish the true nature of the relationship between executive compensation and bank efficiency. Despite an established importance placed on the role of executive compensation contracts in determining management decisions, surprisingly, and to the best of our knowledge, this relationship has not been properly addressed. Whilst other studies have investigated the effect of incentives generated by the executive compensation of CEOs on firm performance, relatively little is known about the impact of compensation incentives on other board members. Our study departs from the norm by explicitly considering bank executives other than the CEO. First, we aim to determine if executive compensation contracts create incentives for bank executives that offset possible agency problems and lead to improvements in bank efficiency. Second, we contend that the relationships between executive compensation and efficiency are likely to vary by bank size.

Our application is to a sample of 122 US bank holding companies (BHCs) between 1992 and 2010. Alternative profit efficiency is our preferred efficiency concept and we estimate a true random effects stochastic profit function taking advantage of developments in the efficiency modelling literature. We calculate executive Delta and Vega to measure the effect on executives' risk-taking following changes in their compensation contracts. Instrumental variables (IV) methods account for endogenous relations between efficiency and both Delta and Vega which we instrument using novel and interesting variables. In preview, two results are generalised across different size banks: shareholders' use executive Vega to incentivise executives into taking risks that raise bank efficiency; shareholders' use executive perquisites to attract and retain executives who are better able to perform the task of increasing efficiency.

Section 2 reviews theory and motivation. Section 3 presents the preferred methodologies, variables and choice of instruments. Section 4 presents results and section 5 concludes.

2. Theory and motivation

Considering theoretical research on the setting of executive compensation contracts, we review two perspectives underpinned by agency theory: namely, 'optimal contracting' (Holmstrom and Milgrom, 1991) and 'managerial power' (Bebchuk and Fried, 2003; 2004; 2005). The traditional (and dominant) perspective for setting pay is optimal-contracting: an executive compensation contract is considered 'optimal' if it maximises shareholder value or minimises agency costs (Core et al. 2003).[3] Agency theory posits a role for shareholders in setting executive compensation contracts to overcome problems associated with differences in the objectives and

[3] The nature of compensation contracts also depends on other considerations such as the relative bargaining power of managers, managerial behaviour, and legal considerations (Bebchuk and Fried, 2004).

incentives of principals and agents. The classic agency problem arises from the separation of ownership and control that renders it difficult for shareholders to monitor and influence executives (Jensen and Meckling, 1976). Furthermore, and in the terminology of Smith, agency problems infer that employee managers face considerably weaker incentives to devote resources to managing a firm compared to owner managers. Consequently, it is relatively easy for executives to pursue their own objectives at the expense of shareholders. Under 'optimal' conditions, a positive relationship could exist between the monitoring of executives and their compensation. Evidence from US firms demonstrates that greater monitoring of CEOs yields an increase in their effort for which CEOs demand higher remuneration to compensate for their reduced utility caused by the expansion of effort (Hermalin, 2005).

The managerial power perspective suggests executives hold more power than shareholders and are able to influence the setting of their remuneration (Bebchuk et al, 2002; Bebchuk and Fried, 2006; 2010). Improved compensation resulting from managerial power could lead to improvements in firm performance that could deteriorate if executives deem compensation insufficient. However, agency-type anomalies are implicit when independent directors are involved in setting executive compensation because of pre-existing networked relationships with executives, which could extend to dictating director nominations to compensation committees or exerting influence through interlocking boards (Faulkender et al. 2010). The relative power of senior executives to affect their compensation can be offset by large institutional shareholders holding sizeable ownership claims (Hope and Thomas, 2008; Canarella and Nourayi, 2008).

The core notion of the principal-agent model of executive compensation contracts posits that shareholders' design the pay contracts of agents to create optimal incentives for executives to maximise firm value (Mirrlees, 1976).[4] However, if shareholders select to maximise their personal wealth, they will design compensation contracts to create incentivise for executives to take more risk, which assumes executives are naturally risk-averse and hold different objectives and risk preferences to shareholders. Executives could be risk-averse since they cannot diversify employment risk because of career concerns or because risk-aversion is increasing in age (MacCrimmon and Wehrung, 1990). In contrast, shareholders' risk preferences vary due to differences in investment time horizons (Shleifer and Vishny, 1997; Hoskisson et al. 2002) and different firm ownership structures create different incentives for monitoring executives (Grossman and Hart, 1982; Shleifer and Vishny, 1986; Harris and Raviv, 1988; Gogineni et al. 2013).

Earlier we noted criticism that bankers' remuneration contracts over-emphasised myopic objectives which were inconsistent with improving long-term bank performance in the build-up to the crisis. If shareholders' did incentivise executives to take risks through the design of compensation contracts, then the incentive structure could also adversely affect default risk (Bebchuk and Fried, 2010), market efficiency and attempts to improve corporate governance (Krehmeyer et al. 2006). To avoid such outcomes in the future, best practice involves re-designing executive compensation contracts to provide executives with incentives to pursue longer-term firm

[4] A slightly different perspective is the shareholder-orientated model of the firm that considers the main conflict to be between entrenched management and dispersed shareholders. This view has bought a concentrated effort by policy makers and academics to better understand aspects of corporate governance including the role of the board and executive compensation (Maher and Andersson, 1999).

objectives (Nourayi and Mintz, 2008) to be measured by variables including market share, sales growth, profit gains, and improvements in operational efficiency (Verbeeten, 2008). To avoid short-termism contracts provide executives with long-term equity positions in the firm (Thévenoz and Bahar, 2007), or contracts could be set against both firm-specific performance and performance relative to a peer group (Gong et al. 2011).

The classic agency problem infers that bank executives could make decisions which serve to increase their entrenchment thereby rendering it difficult for shareholders to replace them. Entrenched executives are expected to demand more substantial compensation including higher non-monetary compensation, because entrenchment confers a greater ability to dictate corporate strategy according to executives' own skill-sets, which can lead to poor production and investment decisions that result in weaker efficiency performance. If executives have weak incentives to improve efficiency, they could either over- or under invest in certain assets or their behaviour become consistent with shirking. Compensation contracts have sought to remedy the weak incentives problem by increasing (decreasing) the proportion of variable (fixed) income components (Grossman and Hart, 1982; Easterbrook, 1984; Jensen, 1986; Stulz, 1990; Zweibel, 1994; Hart, 1995; Kanniainen, 2000). However, evidence unambiguously highlights that increasing the variable pay component in total compensation is associated with a greater willingness for CEOs to take risk (Tufano, 1996; Rogers, 2002, 2005; Nam et al. 2003; Mehran and Rosenberg, 2008; Billet et al. 2010; Liu and Mauer, 2011; and Tchistyi et al. 2011).

The 'empire building' hypothesis posits that entrenched executives seek to enhance their control and power through expansion and diversification at the expense of firm value (Baumol, 1959; Marris, 1964; Williamson, 1964). Empire building produces a sub-optimal outcome when lack of effective monitoring by shareholders allows executives to pursue self-interest (Jensen, 1986). Indeed, compensation contracts can create perverse incentives encouraging executives to consume agency goods (Kanniainen, 2000). Under conditions of price uncertainty the optimal response of executives depends on the extent executive pay aligns with bank risk-taking. A priori executives could adopt a growth strategy to benefit from higher compensation for running a bigger bank since executives can gain substantially from firm growth through equity-linked pay. Other important incentives pertain to prestige, power and business reputation (Avery et al. 1998).

It is difficult to establish the role of agency good consumption in affecting executives' behaviour and decision-making and, ultimately, the impact on bank performance. Earlier studies often regard executive perquisites or perks (almost) purely as a vehicle for executives to misappropriate a portion of firm surplus (Jensen and Meckling, 1976; Grossman and Hart, 1980; Jensen, 1986).[5] The ambiguity partially reflects SEC reporting rules that only require banks (and other firms) to report executives' perquisites above a very high level. Therefore, only very significant items like corporate jets exceed the reporting threshold, which could explain the reported absence of a significant relationship between CEO remuneration and the degree of personal wealth held in firms (Yermack, 2006). Under-reporting and lack of transparency in reporting implies that shareholders and other

[5] Perks include non-monetary compensation not strictly necessary for the completion of an executive's normal duties, such as, corporate jets, large executive offices, membership of country clubs and chauffeur-driven cars. Perks can contribute positively to firm efficiency by allowing executives the benefit of luxury travel by corporate jet to arrive fresher and better prepared for important meetings. This suggests perks may be incorrectly classified as agency goods because their usage produces more effective executive and hence firm performance (Rajan and Wulf, 2006). Nevertheless, certain perks like executive aeroplanes are said to exemplify agency costs (Persons, 1994; Borokhovich et al. 1997; Hall and Liebman, 1998; Core and Guay, 1999).

outsiders are unlikely to know the true extent of executives' agency good consumption or the effect of consumption on decision-making and performance. However, studies show the market reacts unfavourably to news that executives are consuming perquisites with stock price reductions signalling that perquisites constitute a substantial agency cost (Rajan and Wulf, 2006; Yermack, 2006; Andrews et al. 2009; Grinstein, 2011).

Nevertheless, firms that wish to both retain existing and hire new talent appear willing to face higher agency costs in the form of providing perquisites (Chen, 2010). Consequently, expenditure on and the impact of executive perks varies substantially between different types of firms and across banks; studies report that the average bank incurs expenses between 20 to 25 per cent above the most efficient banks (Spong et al. 1996), which partially explains observed differences in executive compensation across banks (Demsetz and Saidenberg, 1999). Of course, perquisites may support executives to perform their role more effectively and to make decisions consistent with shareholders' objectives. Although, to our knowledge, no studies explicitly consider banking firms, limited evidence from other studies provides some support for this argument. Executive perks do not always signal managerial excess and could enhance productivity and contribute positively to firm performance (Rajan and Wulf, 2006) which challenges the notion that perks represent substantial agency costs.

We contend that the relationship between bank efficiency and executive compensation reflect the incentives created by compensation contracts. These incentives in turn are conditional upon the extent of agency problems attributable to factors including the level of entrenchment and executives' consumption of agency goods. We suggest that as shareholders become aware of relative bank efficiencies, they will try to influence the decision-making of bank executives - particularly when efficiency performance is poor - by re-exerting their preferences and objectives by revising the compensation contract. Our view reflects the fact that banks now set executive compensation based on concerns other than simply maximising shareholder value. Increasingly, banking firms and regulators are interested in setting executive compensation contracts which better incentivise executives to make decisions more consistent with long-term bank performance including operational efficiency and other indicators, with larger banks more proactive in this regard (DeYoung et al. 2013). Existing research has failed to keep up with developments even though studies acknowledge that the structure and size of executive compensation are factors in determining subsequent executive behaviour and decision-making (Cuñat and Guadalupe, 2009). We believe that the role of executive compensation contracts in inducing bank executives to make particular decisions is a fundamental cog in the risk-efficiency relationship, and we contend that the nature and strength of relationships vary by bank size.

3. Methodology and research design

We introduce the dataset (3.1) and choice of efficiency concept and estimation technique (3.2). Statistical tests and diagnostics (3.3) precede our motivation for selecting instruments (3.4). The econometric model to determine the nature of the relationship between executive compensation and bank efficiency and discussion of covariates follows (3.5). The baseline specification is an ordinary least squares (OLS) fixed-effects model with robust standard errors clustered by bank (FE). The model is re-estimated using an instrumental variables (IV) approach to account for the possible endogenous relationship between efficiency and compensation. We estimate IV models using two-stage least squares (2SLS), feasible efficient two-step generalised method of moments (FEGMM), and three-stage least squares (3SLS) and allow statistical tests to identify a preferred model.

3.1 Data and Sample

Our study departs from much of the executive compensation and bank performance literature by considering the top five paid executives instead of the CEO only. We source data from a wide range of sources. Firstly we compile a detailed and extensive dataset of executive remuneration from Compustat ExecuComp which provides compensation data for the top five paid executives of each banking firm. The data are matched to stock price data for each bank from the CRSP database and bank-level financial data from SNL Financial and BankScope to yield a sample of 122 large US bank holding companies from 1992 to 2010. For our instruments, we source data on the salaries of professional sports players in the US from the USA Today Salaries database[6] which includes compensation data for professional sports teams in the Major League Baseball (MLB), National Football League (NFL), National Basketball Association (NBA), National Hockey League (NHL) and Major League Soccer (MLS). We obtain the S&P 500 VIX index which calculates the option implied volatility of the S&P 500 directly from its source. Index data on US housing prices comes from the Federal Reserve Bank of St Louis. Lastly we also collect a state composite index to capture variations in state-level performance which is provided by the Federal Reserve Bank of Philadelphia.[7]

3.2 Efficiency concept and model

A voluminous literature describes the development of models used to estimate firm-level efficiency (see Greene, 2008). So-called frontier techniques estimate the relative efficiency of firms in using observable production units to generate output. Farrell (1957) decomposed overall economic efficiency into technical efficiency and allocative efficiency. A firm is technically efficient if it uses an optimal set of inputs that maximise potential output whereas allocative efficiency considers a firm's ability to optimally use inputs whilst taking into account the relative prices of inputs. Bank efficiency studies mostly estimate "X-efficiency" which is the product of technical and allocative efficiencies (Leibenstein, 1966). Two methodological approaches dominate empirical studies of production and efficiency: the parametric stochastic frontier analysis (Aigner et al. 1977; Meeusen and Broeck, 1977; Battese and Corra, 1977); and non-parametric data envelopment analysis (Charnes et al. 1978). The stochastic frontier model specifies a two component error term that separates inefficiency and random error. In the composed error, a symmetric component captures random variation of the frontier across firms, statistical noise, measurement error, and exogenous shocks beyond managerial control. The other component is a one-sided variable that measures inefficiency relative to the frontier showing how far firms are from 'best practice'.

We use stochastic frontier and translog functional form methodologies to estimate bank efficiency employing the concept of alternative profit efficiency to measure how close a bank is to producing the maximum possible

---

[6] 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

[7] This index is calculated using a vector autoregressive model and incorporates a number of variables pertaining to state level performance, including data on housing, employment, average delivery times and the spread of interest between the 10 year Treasury bond and 3 month Treasury bill (Federal Reserve Bank of Philadelphia, 2013). The index is calculated on a monthly basis using a dynamic single factor model.

profit for given output levels and input prices leaving output prices free to vary and affect profit (Humphrey and Pulley, 1997). This efficiency concept holds advantages over cost efficiency and standard profit efficiency: for instance, the alternative profit function controls for unmeasured differences in the quality of bank output that allows banks to incur higher cost in order to generate higher profit, measured as inefficiency under the cost efficiency concept (Berger and Mester, 1997). In contrast to several studies we do not specify bank equity capital to control for differences in risk preferences across banks (Mester, 1997; Berger and Mester, 1997; Hughes and Mester, 1998, 2009; Hughes et al. 2001). In subsequent regressions on bank profit efficiency, the executive compensation variables indicate risk-preferences; therefore, we do not bias estimated efficiency by controlling for risk in the profit function (see Berger and DeYoung, 1997). The profit function, however, includes a bank asset quality indicator to proxy for credit risk that is calculated at state-level to ensure risk is wholly exogenous (Berger and Mester, 1997) and arises due to bad luck rather than bad management (Berger and DeYoung, 1997).[8]

The availability of panel datasets has boosted developments in the frontier literature. Standard panel data frontier models confound heterogeneity and inefficiency (Mester, 1997; Greene, 2005a,b). Greene (2005a, b) extends the fixed and random effects estimators in a stochastic frontier framework to account for unobserved heterogeneity in what he labels "true" effects models and demonstrates their effectiveness in reducing the heterogeneity problem for a sample of US BHCs. We estimate bank efficiencies using a 'true' random-effects stochastic frontier model as follows:

[1]

$$y_{it} = x'_{it}\beta + \alpha_i + v_{it} - u_{it}$$

Where subscripts i and t denote banks and time, y_{it} measures operating profit; β is the parameter vector to be estimated; the vector x_{it} contains input prices, output levels, and other exogenous variables, α_i represents additional bank-specific effects and unobservable heterogeneity across banks; the v_{it} are independently and identically distributed $N(0,\sigma^2_v)$ random errors that are independently distributed of the u_{it}'s, which are non-negative random variables that account for the inefficiency in production; the u_{it} are assumed to be positive and distributed normally with zero mean and variance σ^2_u. The inefficiency term u_{it} is calculated indirectly as proposed by Jondrow et al. (1982).

Equation [2] uses stochastic frontier and translog functional form methodologies to estimate bank efficiency. We adopt the intermediation approach (Sealey and Lindley, 1977) and specify two outputs and three input prices in the stochastic frontier alternative profit function:

[2]

$$ln\ OP_{it} = \alpha + \sum_{i=1}^{2} \beta_i lnQ_{it} + \sum_{h=1}^{3} \gamma_h lnW_{hit} + \mu_1 T$$

[8] Other risk indicators included as controls include: insolvency risk (Lepetit et al. 2008); liquidity risk (Altunbas et al. 2000; Demirgüç-Kunt and Huizinga, 2004; Brissimis et al. 2008; Fiordelisi and Molyneux, 2010), capital risk (Altunbas et al. 2000; Dietsch and Lozano-Vivas, 2000; Lozano-Vivas et al. 2002; Athanasoglou et al. 2008; Lepetit et al. 2008; Brissimis et al. 2008), off-balance sheet risk (Casu and Girardone, 2004); market risk (Fiordelisi and Molyneux, 2010); and credit risk (Athanasoglou et al. 2008; Brissimis et al. 2008; Fiordelisi and Molyneux, 2010).

$$+ {}^{1}/_{2}\left[\sum_{l=1}^{2}\sum_{j=1}^{2}\beta_{lj}\ln(Q_{lit})ln(Q_{jit}) + \sum_{k=1}^{3}\sum_{m=1}^{3}\gamma_{hm}\ln(W_{hit})ln(W_{mit}) + \kappa_{tt}T^{2}\right]$$

$$+\sum_{k=1}^{3}\eta_{ik}\ln(\mathrm{Q_{it}})\ln(W_{hit}) + \mu_{L}\ln Bad_{it} + \frac{1}{2}\mu_{D}\ln(Bad)^{2}{}_{it} + \mu_{D}\mathrm{NPI} + \ln\varepsilon_{it} - \ln\mu_{it}$$

Where *lnOP* is the natural logarithm of operating profit measured as profit before tax plus loan loss provisions; *lnQ* is the logarithm of bank output (gross loans and securities); *lnW* is the natural logarithm of bank input prices (labour: ratio of personnel expenses-to-number of employees; financial capital: ratio of interest paid-to-purchased funds; physical capital: the ratio of non-interest expense-to-fixed assets); *lnBad* and $ln(Bad)^2$ is the proportion of state-level non-performing loans-to-gross loans and its quadratic term; *T* is the time trend; NPI is the net profit indicator. For banks reporting negative operating profit, the dependent variable is set to unity and the value of NPI equals the absolute value of the loss (Bos and Koetter, 2011).

The true random effects stochastic frontier alternative profit function is estimated by maximum simulated likelihood. In the estimation procedure we use 250 Halton draws to speed up estimation and achieve a satisfactory approximation to the true likelihood function. In each model, u_{it} has a half-normal distribution truncated at zero to signify that each bank's profit lies either on or below the profit frontier. Deviations from the frontier are interpreted as evidence of the quality of bank management. The choice of distribution for the inefficiency term is arbitrary.

3.3 Statistical tests and diagnostics

To establish the fundamental relationship between efficiency and executive compensation we begin by estimating a baseline ordinary least squares (OLS) fixed-effects regression model with robust standard errors clustered by bank. This decision is driven by the results of specification and diagnostic tests. Following Borenstein et al. (2010) we distinguish between fixed and random effects models starting from the premise that FE models are more appropriate given their extensive use in US banking studies. The Hausman (1978) specification identification test result supports fixed effects over random effects: the χ^2 test statistic is 95.28 (p-value, 0.0000). Next, we motivate our rationale for using cluster robust regressions and examine if residuals are correlated across banks since the presence of contemporaneous correlation can induce estimation bias. We perform the Pesaran (2004) test for cross-sectional dependence. The null hypothesis posits that no correlation exists; rejection indicates the presence of correlation and infers that robust regressions be estimated. Results infer Driscoll-Kraay standard errors be used to correct for spatial correlation. We test for the presence of heteroskedasticity using a modified version of the Wald test: a significant result rejects the null that the data are homoskedastic. We also test for autocorrelation using the Wooldridge test. The F-statistic at 54.255 (p-value, 0.000) rejects the null hypothesis and signifies autocorrelation.

We consider the possibility that efficiency and executive compensation are endogenous. Endogeneity issues are more likely in evaluating the decision-making preferences of firm managers (Larcker and Rusticus, 2010) and if explanatory variables are jointly determined by several firm-specific factors (John and John, 1993). If endogeneity is an issue OLS may produce biased and inconsistent estimates; therefore, we test for endogeneity using the Durbin-Wu-Hausman test (Davidson and MacKinnon, 1993). We take a robust approach and re-estimate equation [3] using 2SLS, GMM, and 3SLS techniques. Using IV models can overcome endogeneity problems by instrumenting for variables that are endogenous. 2SLS models allow specification of multiple endogenous repressors and instruments. GMM and 3SLS are both system-based techniques: all equations in the system should be properly specified to estimate coefficients consistently. If this condition is met, the GMM and 3SLS estimates are asymptotically more efficient than 2SLS.

We consider if our models are correctly identified by calculating the Kleibergen-Paap Rank LM Statistic and the Kleibergen-Paap Rank Wald F Statistic to test for under-identification and weak identification. Instrument validity is checked by looking for significance in the first stage of models and computing the Hansen J Statistic to test for over-identification of instruments. The null hypothesis is that instruments are uncorrelated with the estimated equation error and are correctly excluded from the equation; rejection implies instruments are valid. Lastly, the Hausman (1978) specification identification test is used to select the most appropriate model.

3.4 Instrument selection

A suitable instrument should satisfy several criteria. First, the relevance condition implies that an instrument is statistically highly correlated with endogenous explanatory variables. Second, the condition of exogeneity /orthogonality specifies that an instrument should only be indirectly related to the dependent variable through the explanatory variable of interest and not through the model error term (Stock and Watson, 2003). We next discuss our choice of instruments.

We use one and two period lagged values of executive Vega and Delta to proxy the sensitivity of compensation, and also introduce additional instruments to instrument for executive compensation and efficiency. First, we instrument using the State Composite Index from the Federal Reserve Bank of Philadelphia. We contend that whilst home state-level economic conditions may affect banks headquartered in a particular state, these effects will be indirect and relatively weak since banks in our sample are large diversified BHCs operating across multiple states. We also include the S&P 500 VIX index which represents the option implied volatility of the S&P 500 stock price index. Existing research suggests the VIX index is a good proxy for the degree of risk aversion in financial markets (Bekaert et al. 2012) and captures movements in economic uncertainty (Bloom, 2009). Moreover, changes in the VIX are frequently cited in the Senior Loan Officer Opinion Survey (SLOOS) as a major reason why loan officers change their lending standards (Basset et al. 2012). As such, we anticipate that the degree of risk aversion in financial markets will influence both bank executives and bank shareholders to some extent, although not directly.

Next, we create a new variable that captures the number of failed banks in each state for each time period and match this to our existing dataset. Banks may be indirectly affected by the failure of other banks within their home state, but not directly. Lastly, we introduce a novel instrument in the form of the average cash compensation of American sports players of teams based in the same state or closest proximity to each BHC headquarters. Our motivation is Bouwman (2013) who introduces this instrument to investigate the effect of geography on CEO compensation for a sample of non-bank firms. Based on arguments in Bouwman (2013), we consider this instrument is potentially valid since it is improbable that a bank will use the compensation of professional sports players as a benchmark for setting the compensation contracts of its executives. Whilst Bouwman (2013) argues it is unlikely that the compensation of bank executives has any direct relationship to the pay of professional sports players in the same state since the latter are determined by game-specific supply and demand forces, it is rational to consider that the wage demands of bank executives could be influenced by the wages of professional sports players in the same state. This is because bank executives might view their pay partially as a symbol of status and potentially are envious of the salaries of professional sports players. Consequently, we could expect to observe some correlation between the compensation of bankers and sports players in the same geographical region.

3.5 Econometric model and variable description

In equation [3] the dependent variable is estimated alternative profit efficiency from equation [2]. The covariates contain information on (i) executive compensation; (ii) board structure; and (iii) bank-level characteristics. Additionally, dummy variables control for deregulatory acts: Gramm-Leach-Bliley Financial Services Modernization Act (GLB, 1999), Sarbanes-Oxley Act (SOX, 2002), and the recent crisis period (Crisis, 2007-09).

$$\text{Efficiency}_{it} = \beta_0 + \beta_1 \text{lnVega}_{it} + \beta_2 \text{lnDelta}_{it} + \beta_3 \text{lnOptionsGranted}_{it} + \beta_4 \text{lnTotalCompensation}_{it} + \beta_5 \text{lnOtherCompensation}_{it} + \beta_6 \text{lnSalary}_{it} + \beta_7 \text{Female}_{it} + \beta_8 \text{lnTenure}_{it} + \beta_9 \text{Duality}_{it} + \beta_{10} \text{lnAge}_{it} + \beta_{11} \text{CRO}_{it} + \beta_{12} \text{Income\_Div}_{it} + \beta_{13} \text{Portfolio\_Div}_{it} + \beta_{14} \text{RMP}_{it} + \beta_{15} \text{lnLeverage}_{it} + \beta_{16} \text{lnTotalAssets}_{it} + \alpha_i + \varepsilon_{it} \qquad [3]$$

Executive *Vega* and *Delta* are pay sensitivity measures which exhibit considerable cross-sectional differences and directly affect executives' behaviour and decision-making (Guay, 1999). Executive *Delta* equals the change in the dollar value of an executive's wealth for a one percentage point change in bank share price whilst *Vega* equals the change in the dollar value of an executive's wealth for a 0.01 change in the annualised standard deviation of returns (Coles and Li, 2011). Delta and Vega are used to offset opposing incentive structures (DeYoung et al. 2013). Whilst Vega incentivises risk-averse executives to increase risk, Delta induces executives to change their behaviour and decision-making though the effect on risk is ambiguous (Armstrong and Vashishtha, 2012). CEOs take fewer risks when Delta incentives dominate and greater risks when Vega incentives are paramount (Bliss and Rosen, 2001; Minnick et al. 2009; Hagendorff and Vallascas, 2011; DeYoung et al. 2013). When Vega incentives dominate, CEOs choose riskier corporate financing strategies and riskier investments (Coles et al. 2006), and try to obfuscate adverse outcomes of poor decisions from shareholders using management tools like income-smoothing (Grant et al. 2009). Notwithstanding, the literature does not predict the nature of the relationships with efficiency. We contend that these relationships reflect the extent to which executives are entrenched. Entrenchment can incentivise executives to expropriate resources to maximise private benefits leading to inefficiencies, whilst shareholders at inefficient banks can coerce executives into assuming greater risk. Smith and Stulz (1985) suggest that shareholders can induce executives to invest in riskier but potentially attractive investment projects using contracts which increase the convexity of executives' exposure to their bank's stock. Similarly, Belkhir and Chazi (2010) argue that higher Delta encourages executives to work harder to maximise the equity value of their banks. Consequently, we expect higher values of executive Delta and Vega to be associated with improvements in bank efficiency.

Options Granted is the logarithm of the number of options granted to the top five paid executives. Higher amounts of this variable pay component are believed to increase executives' appetite for risk (Chen et al. 2006; Pathan, 2009; Dong et al. 2010; Hagendorff and Vallascas, 2012; DeYoung et al. 2013). In the sub-prime crisis, bank shareholders used option grants to incentivise CEOs to assume higher risks; however, the effect on incentive structures can be offset by larger board size. The impact of option-based compensation on bank efficiency likely reflects the quality of executives' decision-making skills regarding risk. We leave the data to reveal the exact nature of the relationship.

Total Compensation is the logarithm of the value of the top five executives' remuneration. It includes salary, bonuses, and the value of all annual option and share grants. Assuming shareholders willingly pay to attract and retain executive talent, we expect a positive relationship between bank efficiency and total compensation, similar to that observed between total compensation and risk-taking (Adams, 2012). Although this expectation also assumes that contracts correctly incentivise executives to improve efficiency, if contracts fail in this regard the expected relationship could alter.

Other compensation is the logarithm of the value of other payments to the top five executives, including additional benefits and executive perquisites. The sign on this variable offers a test of claims that the consumption of agency goods results in poorer efficiency performance (Hughes and Mester, 2009). A negative coefficient with efficiency implies executives consume agency goods for personal benefit whereas a positive coefficient indicates perquisites aid executives to effectively perform their duties.

Salary is the logarithm of the top five executives' fixed pay component. Higher salaries may indicate entrenchment (Shleifer and Vishny, 1989) and incentivise executives to take fewer risks (Hagendorff and Vallascas, 2012). A priori entrenched executives make poorer investment decisions and consume more agency goods. This is expected to create inefficiencies.

Female is a dummy variable equal to 1 if a female serves as one of the top five paid executives and zero otherwise. The impact of female board members on firm performance is barely considered in the financial literature. However, a female presence may realise efficiency gains because females serve as role models for other females and minority groups, which could inspire productivity leading to superior firm performance via improvements in operational efficiency (Chung, 2000). Therefore, we expect a positive relation between female presence and bank efficiency.

Tenure is the logarithm of the total number of years served by the top five executives. Higher job tenure better aligns executive incentives with firms' long-term performance (see Spong et al. 1996 for evidence from US banks, and Pokrashenko, 2012 for Russian banks). Therefore, we predict tenure is positively associated with bank efficiency.

Duality is a dummy variable equal to 1 if a CEO is also the bank Chairman and zero otherwise. The effect of duality is uncertain. It is associated with lower cost efficiencies at US commercial banks (Pi and Timme, 1993) which counters arguments suggesting that duality facilitates clear-cut leadership and better corporate decision-making (Stoeberl and Sherony, 1985; Anderson and Anthony, 1986). However, duality may induce less aggressive risk-taking compared to instances when shareholders have greater control (Pathan, 2009; Byrd et al. 2012) which could produce an effect similar to entrenchment and consumption of agency goods.

Age is the natural logarithm of the average age of the top five executives. The impact of age on risk-taking is ambiguous (Bucciol and Miniaci, 2012; MacCrimmon and Wehrung, 1990) and few studies consider age's relationship with bank efficiency; one study finds the average age of bank executives is marginally greater in efficient banks (Spong et al. 1996). We suspect older executives make more informed investment choices leading to a positive relationship between age and efficiency.

CRO is a dummy variable to proxy the importance of a bank's risk management function. It equals 1 if a bank has a Chief Risk Officer belonging to the five top paid executives and zero otherwise. Since the presence of a CRO is expected to improve asset quality and the efficiency of loan production we anticipate a positive relationship with efficiency.

Income diversification is constructed as a Herfindahl–Hirschman type index to proxy the diversification of bank income: $\sum_{i=1}^{n}\left(X_i / Q\right)^2$ where the X variables are net interest revenue and net non-interest income and Q is the sum of X (Acharya et al. 2006). The index is increasing in diversification. Whereas the proportion of non-interest income in total income has risen considerably for US banks (DeYoung and Rice, 2004), the effects of diversification on bank efficiency are mixed (Stiroh, 2004): some studies report an inverse relationship (Akhigbe and Stevenson, 2010) and others a positive one (Chronopoulos et al. 2011 for accession country banks).

Portfolio diversification is Herfindahl–Hirschman type index to proxy diversification of banks' loan portfolios: $\sum_{i=1}^{n}\left(X_i / Q\right)^2$ where the X variables are commercial loans, real estate loans, and other loans and Q is the sum of X. The index is increasing in loan portfolio diversification. Following Rossi et al. (2009) we expect a positive relationship between diversification and efficiency.

RMP (relative market power) equals a bank's share of state-level lending. Higher values indicate greater local market power. Whilst the 'quiet life' hypothesis implies that higher market power is associated with lower efficiency (Berger and Hannan, 1998; Delis and Tsionas, 2009) because executives face insufficient market discipline, the efficient structure hypothesis contends that efficient banks acquire market share which infers a positive relationship (Demsetz, 1973).

Leverage is the ratio of assets-to-equity. Increased leverage serves to reduce agency conflicts since it produces an incentive for informed debt holders to exert pressure on executives to modify their behaviour and decision-making in order to improve bank efficiency (Jensen and Meckling, 1976; Calomiris and Kahn, 1991; Diamond and Rajan, 2001). Mehran et al. (2013) posit that a 'privately-optimal' level of leverage exists: very low debt levels offer insufficient incentives for shareholders to discipline executives leaving them free to consume agency goods; very high debt levels induce an asset-substitution effect that encourages greater risk-taking. This creates the paradox that a risky business model makes raising leverage more attractive whilst higher leverage makes pursuing a risky bank business model more attractive (Agur and Demertzis, 2012). The empirical record is opaque: Agur and Demertzis (2012) find no relationship between efficiency and leverage. They refer to a decision problem involving non-linearity and feedback effects, which echoes comments that risk not only affects, but is also affected by, leverage and inefficiency inferring that executives can be induced to offset higher capitalization by more risk-taking (Kwan and Eisenbeis, 1997). Altunbas et al. (2007) find more efficient European banks take more risk whilst Graf (2011) shows that bank managers of US and European banks adjust leverage ratios faster than managers of other types of firms.

Total Assets is a logarithm to control for bank size. The 'scale efficiency' hypothesis of the efficient structure theory suggests that increases in bank size lower the costs of bank production. As banks grow and become more efficient they use their relative advantage to generate economic rents and efficiency (Wheelock and Wilson, 2012). Other authors report a negative relationship between size and operational costs whilst Casu and Molyneux (2003) find no relationship between size and the efficiency of European banks.

α_i is the state fixed effect and the error term is ε_{it}.

4. Results

Table 1 presents summary statistics. Between 1992 and 2010 the average total compensation of executives equals $4,977,000 per annum. We observe considerable variation in total compensation between the 25th and 75th percentiles with a large standard deviation of $5,378,354. Delta has a mean (median) of $714,000 ($503,000); for Vega the corresponding values are $229,000 ($139,000). On average, bank executives serve nine years and less than 10 per cent of BHCs have a CRO among the top five highest paid executives. In 40 per cent of BHCs the roles of CEO and Chairman are separated, whilst females serve among the top five executives in 20 per cent of banks. On average, BHCs are roughly 50 per cent profit efficient which implies they lose around half of potential profit to inefficiencies. Inter-bank dispersion of profit efficiencies began to increase circa 2001-02 and was particularly pronounced prior to the recent crisis.[9]

Table 2 shows results from estimating equation [3] for all BHCs. Tables 3 to 5 show results for sub-samples: small-size banks (lowest third); medium-size banks (middle third); and large-size banks (highest third). For the IV models (2SLS, GMM and 3SLS) the Kleibergen-Paap Rank LM Statistics, Rank Wald F Statistics, and

[9] Copeland (2012) traces the evolution of US bank holding companies from 1994-2010 and finds the largest banks are structured differently to smaller ones.

Hansen J Statistics show neither under, weak nor over-identification are problematic. The endogeneity test rejects the null hypothesis that Delta and Vega are exogenous with the first stage results offering additional support. The Hausman (1978) test identifies the 2SLS as the preferred model (except Table 4 for medium-size banks where GMM is preferred).

Our results demonstrate the dominance of executive Vega which is positively associated with efficiency irrespective of bank size. The coefficients on Vega compensation suggest that although bank executives are incentivised to assume greater risk, their decision-making yields higher efficiencies particularly at large-size banks. This result implies that via executive Vega compensation contracts can align the objectives of executives and shareholders', and counters claims that agency problems and entrenchment allow executives to maximise private benefits. That executive Delta is insignificant (except for significant inverse coefficients in 3SLS models) confirms the offsetting role of Delta and Vega (see DeYoung et al. 2013). Nevertheless, it conflicts with suggestions that higher executive Delta fosters incentives for executives to work harder to maximise the equity value of their banks (Belkhir and Chazi, 2010). Instead, our result that higher Vega compensation leads to efficiency gains compares to findings showing Vega is positively associated with firm innovation (Cheng et al. 2013). It relates to arguments that innovation influences both short and long-term CEO compensation in business environments that are prone to high uncertainty and discretion, and because executives are better placed (compared to shareholders) to influence innovation they will be better compensated for innovations stemming from research and development and technology than for short-term performance (Balkin et al. 2000).

We next consider the relationships between other indicators of executive remuneration and bank efficiency. The coefficients on total compensation, options, and salary reveal information about the how the structure of executive compensation affects efficiency via the possible incentives created by contracts to bank executives. An unambiguous result is the significant positive effect of other compensation (executive perquisites) on efficiency. This suggests shareholders willingly pay for performance and that offering perks and benefits to attract and retain the best executives is rational and advantageous. It also suggests that perquisites help executives to function more effectively and make better decisions (Chen et al. 2010). Perquisites could stimulate efficiency gains because BHCs are complex and geographically-diversified firms (Krishnaswami et al. 1999). Certain perquisites may allow executives to do their jobs more efficiently, for instance, provision of corporate jets, executive offices and country club memberships. To the best of our knowledge, no other evidence exists in the case of banks. An ancillary benefit of higher perquisites is it may represent a vehicle to attract and retain talent whilst simultaneously enhancing job productivity (Rajan and Wulf, 2006). Thus, our findings support claims that using executive perquisites may be preferential to simply awarding higher salaries or bonuses (Veblen and Almy 1899; Frank 1985a,b; Bagwell and Bernheim, 1996).

Our other results are sensitive to bank size. For small-size banks our evidence demonstrates the importance of the fixed component of executive remuneration (salary) in setting incentives that realise efficiency gains (FE and 2SLS). However, for small-size banks higher levels of total compensation, which includes variable components of pay, are associated with weaker efficiency performance. Similarly, increases in another variable pay component, options granted, are associated with medium-size banks losing a greater proportion of potential profit to inefficiencies. In contrast, options are positively associated with efficiency at large-size banks though the coefficients generally lack significance. However, higher total compensation is associated with lower efficiency. In explanation, agency theory suggests higher compensation can indicate greater managerial power and entrenchment which in turn can incentivise executives to consume more agency goods, take fewer risks, and devote fewer resources to improving efficiency.

We consider how board structure affects efficiency. A female presence fails to realise a significant impact which infers that males wield greater power even if a female serves as one of the highest paid executives. If one conjectures that executives spend time in golf and country clubs for the purpose of informal business networking[10] then a lack of participation, including relative access to informal networking opportunities, may prevent females from reaching the highest echelon of the corporate ladder (Arthur and De Campo, 2011; Linehan and Scullion, 2008).[11] Longer tenure is associated with improved efficiency performance albeit for small-size banks only; this suggests experience is a major factor for recruiting executives at these banks. However, small-size BHCs that combine the CEO and Chairman in a dual function are less efficient. The results are consistent with findings on small US commercial banks (Pi and Timme, 1993). From an agency theory perspective, duality could cause monitoring difficulties for shareholders (Elsayed, 2007) that would provide a quiet life for executives leading to inefficiencies. We attribute the lack of significant evidence for medium and large-size banks to the fact that their CEOs more likely face greater scrutiny from shareholders, other stakeholders and regulators (Wilson and Wu, 2012).

Our findings demonstrate efficiency performance is weaker at small and medium-size BHCs whose top five executives are older on average than their peers. This suggests younger executives take more aggressive risks which pay off in terms of realised efficiency (Child 1974; Hart and Mellons, 1970; Carlson and Karlsson, 1970; Vroom and Pahl, 1971). Our evidence contrasts with evidence from the US banking sector showing the average age of executives is marginally greater (though statistical insignificant) at efficient banks (Spong et al. 1996). It also counters suggestions that older executives are more career-focused and more measured in their risk-taking (Wiersema and Bantel, 1992). Only at medium-size BHCs is the presence of a CRO in the top five executives associated with higher efficiency. Following arguments in Sinha (2013) CROs strengthen the risk management function at medium-size banks; arguably it is more difficult for CROs at small and large-size banks to be independent of other executives in order to be effective in their role.

We investigate the relationship between diversification and efficiency using the income diversification and loan portfolio diversification indexes. We discuss our findings in relation to two competing hypotheses: the idiosyncratic risk hypothesis; and the monitoring hypothesis (Rossi et al. 2009). The idiosyncratic risk hypothesis posits that diversification lowers idiosyncratic risk enabling banks to free-up resources used for

[10] A survey of 401 U.S. CEOs by Hyatt Hotels and Resorts (1993) reports that 93% of executives surveyed found golfing to be useful for establishing closer business relationships whilst 80% stressed the importance of golfing for generating new business. In addition, 60% of women golfing executives said that networking opportunities from golfing created new lines of business and increased their standing in firms.

[11] Arthur and De Campo (2011) examine if distances between ladies and men's golf tee positions matter for executives' networking. Distance does matter. The further the distance between tees the lower the general compensation of female executives, and the lower their participation rate in golf course networking.

monitoring activities which improves efficiency. The monitoring hypothesis infers that diversification lowers efficiency based on the assumption that the attention of regulators and supervisors forces executives to monitor bank performance irrespective of any changes in lending and income accruing from diversification. Furthermore, relatively risk-averse executives could devote greater resources to monitoring. Income diversification is negatively related to efficiency for medium-size banks. This supports the monitoring hypothesis but conflicts with findings from US commercial banks (DeYoung et al. 2004; DeYoung and Rice, 2004). For small and large-size banks we find positive albeit insignificant relations between income diversification and efficiency, and a similar relationship between loan portfolio diversification and efficiency for large-size banks. However, for medium-size banks' loan portfolio diversification is signed oppositely and significant in two models, supporting the idiosyncratic risk hypothesis. Greater state-level market power (RMP) realises higher efficiency for small and large-size banks consistent with the relative market power hypothesis (Shepherd, 1982; 1986a,b). This result refutes the quiet life hypothesis and findings from US regional banking that less competitive markets fail to discipline bank management into maximising efficiency (Berger and Hannan, 1998). However, it complements findings of a positive market power-efficiency relationship at US commercial banks (Koetter et al. 2012).

Leverage is associated with weaker bank efficiency. The finding is both statistically important and economically meaningful for small and large-size banks. It suggests debt holders fail to coerce executives into prioritising improvements in efficiency. It also implies executives in highly levered banks face incentives to assume greater risk (Mehran et al. 2013) or adopt a more risky business model (Agur and Demertzis, 2012). The result is broadly consistent with observations that increases in leverage adversely affect bank profitability (Athanasoglou et al. 2008). Within the sub-sample of small-size BHCs, we find relatively bigger banks are more efficient. This finding tentatively supports the scale efficiency hypothesis and suggests BHCs benefit from growth but only up to a certain point. Lastly, the Gramm-Leach-Bliley (GLB) Act is associated with lower efficiency for small and large-size BHCs. The Sarbanes Oxley Act (SOX) and crisis (2007-2009) mostly are insignificant.[12]

5. Conclusions

This paper represents a first attempt to examine relationships between bank efficiency and executive compensation using a robust empirical approach that treats efficiency and compensation as endogenous variables using a set of novel instruments. We identify two results that generalise across bank size. First, shareholders' affect executives' risk-taking by adjusting their compensation contracts. Increases in executive Vega incentivise executives to take more risks which we infer are managed effectively since banks lose less potential profit to inefficiencies. This result suggests executives' and shareholders' objectives are aligned through Vega, and also executives do not use entrenchment to maximise private benefits. Our finding confirms the offsetting role previously attributed to Vega and Delta (Coles et al. 2006; Bliss and Rosen, 2001; Minnick et al. 2009; DeYoung et al. 2013). Second, the provision of executive perquisites is associated with improvements in efficiency. This finding implies shareholders' use perks to attract and retain talented executives. It supports

[12] In unreported regressions using cost efficiency as the dependent variable, we observe significant reductions in bank efficiencies irrespective of size following passage of the GLB and SOX, and for the crisis period. We contend that the mostly insignificant relationships with profit efficiency are explained by fact that whilst banks assumed additional costs, they used their resources to generate compensatory increases in profit.

arguments that perquisites enable executives to function more effectively and make better decisions, and rejects claims that perks constitute significant agency costs.

Our other findings are sensitive to bank size. We suggest executives are incentivised differently by the components of executive remuneration. At small-size banks, executives who receive a higher fixed pay component deliver superior efficiency performance. Option grants produce a similar albeit insignificant effect for executives at large-size banks whereas options are associated with significantly weaker efficiency at medium-size banks. The effect of board structure similarly varies with bank size. Small and large-size banks are more efficient if they hold greater market power whereas efficiencies deteriorate for highly-levered banks. In summary, our findings reject arguments that bank efficiency is unlikely to be affected by higher levels of executive remuneration. However, compensation contracts create incentives through different pay components that are sensitive to bank size. The variability in incentives implies that shareholders' pay considerable attention to the design of executive contracts if efficiency gains are a desired objective.

References

Acharya, V., Hassan, I. & Saunders, A. (2006). Should banks be diversified? Evidence from individual bank loan portfolios. Journal of Business, 79(3), 1355-1412.

Adams, R. (2012). Governance and the financial crisis. International Review of Finance, 12(1), 7-38.

Agur, I., Demertzis, M. (2012). Excessive bank risk taking and monetary policy. ECB Working Paper Series, No. 1457.

Aigner, D.J. Chu, S.F. (1968). On estimating the industry production function. American Economic Review, 58(4), 862-839.

Aigner, D.J., Lovell, C.A.K., Schmidt, P. (1977). Formulation and estimation of stochastic frontier models. Journal of Econometrics, 6(1), 21-37.

Akhigbe, A., Stevenson, B.A. (2010). Profit efficiency in U.S. BHCs: effects of increasing non-traditional revenue sources. Quarterly Review of Economics and Finance, 50(2), 132-140.

Altunbas, Y., Carbo, S, Gardener, E.P.M., Molyneux, P. (2007). Examining the relationships between capital, risk and efficiency in European banking. European Financial Management, 13(1), 49-70.

Altunbas, Y., Liu, M-H., Molyneux, P., Seth, R. (2000). Efficiency and risk in Japanese banking. Journal of Banking and Finance, 24(10), 1605-1628.

Anderson, C.A., Anthony, R.N. (1986). *The New Corporate Directors.* New York: John Wiley and Sons.

Andrews, A., Linn, S.C., Yi., H. (2009). Corporate governance and executive perquisites: Evidence from the new SEC disclosure rules. AAA 2009 Financial Accounting Reporting Section (FARS) Paper. http://dx.doi.org/10.2139/ssrn.1268087

Armstrong, C., Vashishtha, R. (2012). Executive Stock Options, Differential Risk-Taking Incentives, and Firm Value. Journal of Financial Economics, 104(1), 70-88.

Arthur, M.M., Del Campo, R.G. (2011). The impact of gender-differentiated golf course features on women's networking. Gender in Management: An International Journal, 26(1), 37-56.

Athanasoglou, P.P., Brissimis, S.N., Delis, M.D. (2008). Bank-specific, industry-specific and macroeconomic determinants of bank profitability. Journal of International Financial Markets, Institutions and Money, 18(2), 121-136.

Avery, C., Chevalier, J.A., Schaefer, S. (1998). Why do managers undertake acquisitions? An analysis of internal and external rewards for acquisitiveness. Journal of Law, Economics, and Organisation, 14(1), 24-43.

Bagwell, L.S. Bernheim, B.D. (1996). Bernheim Veblen effects in a theory of conspicuous consumption. American Economic Review, 86(3), 349-373.

Bair, S. (2011). We must resolve to end too big to fail. Remarks before the 47th Annual Conference on Bank Structure and Competition, Federal Reserve Bank of Chicago, May 5.

Baker, G.P., Jensen, M.C., Murphy, K.J. (1988). Compensation and incentives: Practice vs. theory. Journal of Finance, 43(3), 593-616.

Balkin, D.B., Markman, G.D., Gomez-Mejia, L.R. (2000). Is CEO pay in high-technology firms related to innovation? Academy of Management Journal, 43(6), 1118-1129.

Basset, W.F., Chosak, M.B., Driscoll, J.C., Zakrajšek, E. (2012). Changes in bank lending standards and the macroeconomy. Finance and Economics Discussion Series Working Paper, No. 2012-24.

Battese, G.E. Corra, G.S. (1977). Estimation of a production frontier model: With application to the pastoral zone of Eastern Australia. Australian Journal of Agricultural Economics, 21(3), 169-179.

Baumol, W.J. (1959). Business behaviour, value and growth. New York: Macmillan.

BCE (2012). Compensation Discussion & Analysis, Management Proxy Circular BCE Bell Canada Enterprises. Available at: http://www.bce.ca/assets/Events/EN/Shareholder/AGM_2012/AGM-2012-Compensation-EN.pdf

Bebchuk, L.A., Fried, J.M., Walker, D.I. (2002). Managerial power and rent extraction in the design of executive compensation. University of Chicago Law Review, 69(3), 751-846.

Bebchuk, L.A., Fried, J.M. (2003). Executive compensation as an agency problem. Journal of Economic Perspectives, 17(3), 71-92.

Bebchuk, L.A., Fried, J.M. (2004). Pay without performance: The unfulfilled promise of executive compensation. Cambridge and London: Harvard University Press.

Bebchuk, L.A., Fried, J.M. (2006). Pay without performance: Overview of the issues. *Academy of Management Perspectives*, 20(1), 5-24.

Bebchuk, L.A., Fried, J.M. (2010). Paying for long-term performance. University of Pennsylvania Law Review, 158, 1915-1959.

Bebchuk, L.A., Spamann, H. (2010). Regulating bankers' pay. *Georgetown Law Journal*, 98(2), 247-287.

Bebchuk, L.A., Weisbach, M.S. (2010). The state of corporate governance research. Review of Financial Studies, 23(3), 939-961.

Beck, T. (2012). The Role of Finance in Economic Development – Benefits, Risks, and Politics, In: Dennis Müller (Ed.): *Oxford Handbook of Capitalism*.

Beck, T., Degryse, H., Kneer, C. (2012). Is more finance better? Disentangling intermediation and

Belkhir, M., Chazi, A. (2010). Compensation vega, deregulation and risk-taking: Lessons from the U.S. Banking Industry. Journal of Business Finance and Accounting, 37(9-10), 1218-1247.

Beltratti, A., Stulz, R. (2012). The credit crisis around the globe: why did some banks perform better? Journal of Financial Economics, 105(1), 1-17.

Berger, A.N., DeYoung, R. (1997). Problem loans and cost efficiency in commercial banks. Journal of Banking and Finance, 21(6), 849-870.

Berger, A.N., Hannan, T.H. (1998). The efficiency cost of market power in the banking industry: A test of the "Quiet Life" and related hypotheses. Review of Economics and Statistics, 80(3), 454-465.

Berger, A.N., Hunter, W.C., Timme, S. G. (1993). The efficiency of financial institutions: A review and preview of past, present, and future. Journal of Banking and Finance, 17(2-3), 221-49.

Berger, A.N., Mester, L.J. (1997). Inside the black box: what explains differences in the efficiencies of financial institutions? Journal of Banking and Finance, 21(7), 895-947.

Berrone, P. (2008). Current global financial crisis: an incentive problem. Occasional Paper, OP-158, IESE Business School, University of Navarra.

Bhagat, S., Bolton, B. (2011), Bank Executive Compensation and Capital Requirements Reform, Working Paper, University of Colorado.

Billett, M., Mauer, D.C., Zhang, Y. (2010). Stockholder and bondholder wealth effects of CEO incentive grants. Financial Management, 39(2), 463-487.

Bliss, R.T., Rosen, R.J. (2001). CEO compensation and bank mergers. Journal of Financial Economics, 61(1), 107-138.

Bloom, N. (2009). The impact of uncertainty shocks. Econometrica, 77(3), 623-685.

BMO Financial Group (2012). Corporate Governance: Executive Compensation. Available at: http://www.bmo.com/ir/files/F12%20Files/2012%20Executive%20Compensation.pdf

Borenstein, M., Hedges, L.V., Higgins, J.P.T., Rothstein, H.R. (2010). A basic introduction to fixed-effect and random-effects models for meta-analysis. Research Synthesis Methods, 1(2), 97-111.

Borokhovich, K.A., Brunarski, K.R., Parrino, R. (1997). CEO contracting and anti-takeover amendments. Journal of Finance, 52(4), 1495-1517.

Bos, J.W.B., Koetter, M., (2011). Handling losses in translog profit models. Applied Economics, 43(3), 307-312.

Bouwman, C.H.S. (2013). The geography of executive compensation. Case Western Reserve University Working Paper.

Brissimis, S.N., Delis, M.D., Papanikolaou, N.I. (2008). Exploring the nexus between banking sector reform and performance. Journal of Banking and Finance, 32(12), 2674–2683.

Bucciol, A., Miniaci, R. (2012). Financial Risk Aversion, Economic Crises and Past Risk Perception. Working Paper No. 28, University of Verona, Department of Economics.

Byrd, J., Fraser, D.R., Lee, D.S., Tertarogulu, S. (2012). Are two heads better than one? Evidence from the thrift crisis. Journal of Banking and Finance, 36(4), 957-967.

Calomiris, C. Kahn, C. (1991). The role of demandable debt in structuring optimal banking arrangements. American Economic Review, 81(3), 497-513.

Canarella, G. Nourayi, M. (2008). Executive compensation and firm performance: adjustment dynamics, non-linearity and asymmetry. Managerial and Decision Economics, 29(4), 293-315.

Carlson, R., Karlsson, K. (1970). Age, cohorts, and the generation of generations. American Sociological Review, 35(4), 710-718.

Casu, B., Girardone, C. (2004). Financial conglomerates: strategic drive and impact on bank efficiency and productivity. Applied Financial Economics, 14(10), 687-696.

Casu, B., Molyneux, P. (2003). A comparative study of efficiency in European banking. Applied Economics, 35(17), 1865-1876.

Certo, S.T. (2003). Influencing initial public offerings investors with prestige: Signalling with board structures. Academy of Management Review, 28(3), 432-446.

Charnes, A., Cooper, W.W., Rhodes, E. (1978). Measuring the efficiency of decision making units. European Journal of Operational Research, 2(6), 429-444.

Chen, C.R., Steiner, T.L., Whyte, A.M. (2006). Does stock option-based executive compensation induce risk-taking? An analysis of the banking industry. Journal of Banking and Finance, 30(3), 915-945.

Chen, D., Li, O.Z., Liang, S. (2010). Do managers perform for perks? http://dx.doi.org/10.2139/ssrn.1562003.

Cheng, X., Fu, K., Low, A., Zhang, W. (2013). Non-executive employee stock options and corporate innovation. Journal of Financial Economics (forthcoming).

Child, J. (1974). Managerial and organisational factors associated with company performance. Journal of Management Studies, 11(3), 13-27.

Chronopoulos, D.K., Girardone, C., Nankervis, J.C. (2011). Are there any cost and profit efficiency gains in financial conglomeration? Evidence from the accession countries. European Journal of Finance, 17(8), 603-621.

Chung, K. (2000). Role models and arguments for affirmative action. American Economic Review, 90(3), 640-648.

Coles J.L., Daniel N.D., Naveen L. (2006). Managerial incentives and risk-taking. Journal of Financial Economics, 79(2), 431-468.

Coles, J.L., Li, Z.F. (2011). Managerial attributes, incentives, and performance. Working Paper, Arizona State University.

Copeland, A. (2012). Evolution and heterogeneity among bank holding companies: 1994 to 2010. Economic Policy Review, 18(2), 83.

Core, J., Guay, W. (1999). The use of equity grants to manage optimal equity incentive levels. Journal of Accounting and Economics, 28(2), 151-184.

Core, J., Guay, W., Larcker, D.F. (2003). Executive equity compensation and incentives: A survey. Economic Policy Review, 9(1), 27-44.

Cuñat, V., Guadalupe, M. (2009). Executive compensation and competition in the banking and financial sectors. Journal of Banking and Finance, 33(3), 495-504.

Davidson, R., MacKinnon, J.G. (1993). Estimation and Inference in Econometrics. New York: Oxford University Press.

Delis, M.D., Tsionas, E.G. (2009). The joint estimation of bank-level market power and efficiency. Journal of Banking and Finance, 33(10), 1842-1850.

Demsetz, H. (1973). Industry structure, market rivalry, and public policy. Journal of Law and Economics, 16(1), 1-9.

Demsetz, R.S., Saidenberg, M.R. (1999). Looking beyond the CEO: Executive compensation at banks. Federal Reserve Bank of New York, Staff Reports No. 68.

DeYoung, R., Hunter, W.C., Udell, G.F. (2004). The past, present, and probable future for community banks. Journal of Financial Services Research, 25(2-3), 85-33

DeYoung, R., Peng, E.Y., Yan, M. (2013). Executive compensation and business policy choices at U.S. commercial banks. Journal of Financial and Quantitative Analysis, 48(1), 165-196.

DeYoung, R., Rice, T. (2004). Noninterest income and financial performance at U.S. commercial banks. Financial Review, 39(1), 101-127.

Diamond, D.W., Rajan R.G. (2001). Liquidity risk, liquidity creation, and financial fragility: A theory of banking. Journal of Political Economy, 109(2), 287-327.

Dong, Z., Wang, C., & Xie, F. (2010). Do executive stock options induce excessive risk taking? Journal of Banking and Finance, 34(10), 2518-2529.

Easterbrook, F.H. (1984). Two agency-cost explanations of dividends. American Economic Review, 74(4), 650-659.

Ellul, A., Yerramilli, V. (2013). Stronger risk controls, lower risk: Evidence from U.S. bank holding companies. Journal of Finance, 68(5), 1757-1803.

Elsayed, K. (2007). Does CEO duality really affect corporate performance? Corporate Governance: An International Review, 15(6), 1203-1224.

Erkens, D.H., Hung, M., Matos, P.P. (2012). Corporate governance in the 2007-2008 financial crisis: Evidence from financial institutions worldwide. Journal of Corporate Finance, 18(2), 389-411.

Ertimur, Y., Ferri, F. Stubben, S. (2010). Board of directors' responsiveness to shareholders: Evidence from shareholder proposals. Journal of Corporate Finance, 16, 53-72.

Fahlenbrach, R., Stulz, R.M. (2011). Bank CEO incentives and the credit crisis. Journal of Financial Economics, 99(1), 11-26.

Farrell, M.J. (1957). The measurement of productive efficiency. Journal of the Royal Statistical Society, 120(3), 253-290.

Faulkender M., Kadyrzhanova, D., Prabhala N., Senbet L, (2010). Executive compensation: An overview of research on corporate practices and proposed reforms. Journal of Applied Corporate Finance, 22(1), 107-118.

Faulkender, M., Kadyrzhanova, D., Prabhala, N. (2011). Executive compensation: An overview of research on corporate practices and proposed performs. Journal of Applied Corporate Finance, 22(1), 107-118.

Federal Reserve Bank of Philadelphia (2013). State Coincident Indexes. http://www.philadelphiafed.org/research-and-data/regional-economy/indexes/coincident/

Financial Stability Forum (2009). FSF principles for sound compensation practices. Financial Stability Forum, 2nd April 2009.

Fiordelisi, F., Molyneux, P. (2010). The determinants of shareholder value in European banking. Journal of Banking and Finance, 34(6), 1189-1200.

Fiordelisi, F., Marqués-Ibáñez, D., Molyneux, P. (2011). Efficiency and risk in European banking. Journal of Banking and Finance, 35(5), 1315-1326.

Frank, R.H. (1985a). The demand for unobservable and other nonpositional goods. American Economic Review, 75(1), 101-116.

Frank, R.H. (1985b). Choosing the right pond: human behavior and the quest for status. Oxford University Press, New York.

Gogineni, S., Linn, S.C., Yadav, P.K. (2013). O*wnership structure, management control and agency costs.* http://dx.doi.org/10.2139/ssrn.2024597

Gong, G., Li, L.Y., Shin, J.Y. (2011). Relative performance evaluation and related peer groups in executive compensation contracts. *The Accounting Review,* 86 (3), 1007-1043.

Graf, F. (2011). Leverage, profitability and risk of banks: An empirical analysis. University of Konstanz Working Paper.

Grant, J., Markrian, G., Parbonetti, A. (2009). CEO risk-related incentives and income smoothing. Contemporary Accounting Research, 26(4), 1029-1065.

Greene, W.H. (2008). The econometric approach to efficiency analysis. In: H.O. Fried, C.A. Knox Lovell, and S.S. Schmidt (eds), The Measurement of Productive Efficiency and Productivity Growth (Oxford University Press: New York).

Greene, W.H. (2005a). Reconsidering heterogeneity in panel data estimators of the stochastic frontier model. Journal of Econometrics, 126(2), 269–303.

Greene, W.H. (2005b). Fixed and random effects in stochastic frontier models. Journal of Productivity Analysis, 23(1), 7-32.

Grinstein, Y., Weinbaum, D., Yehuda, N. (2011). The economic consequences of perk disclosure. Johnson School Research Paper Series No. 06-2011.

Grossman, S.J. Hart, O.D. (1982). Corporate financial structure and managerial incentives. In: McCall, J. (Ed.). The Economics of Information and Uncertainty, University of Chicago Press, 107-140.

Guay, W. (1999). The sensitivity of CEO wealth to equity risk: An analysis of the magnitude and determinants. Journal of Financial Economics, 53(1), 43-71.

Hagendorff, J., Vallascas, F. (2011). CEO pay incentives and risk-taking: Evidence from bank acquisitions. Journal of Corporate Finance, 17(4), 1078-1095.

Hall, B.J., Liebman, J.B. (1998). Are CEOs really paid like bureaucrats? Quarterly Journal of Economics, 113(3), 653-691.

Harris, M., Raviv, A. (1988). Corporate control contests and capital structure. Journal of Financial Economics, 20(1-2), 55-86.

Hart, O. (1995). Firms, Contracts, and Financial Structure. Clarendon Press, Oxford.

Hart, P., Mellons, J. (1970). Management youth and company growth: a correlation? Management Decision, 4(1), 50-53.

Hermalin, B.E. (2005). Trends in corporate governance. Journal of Finance, 60(5), 2351-2384.

Hillman, A.J., Dalziel, T. (2003). Boards of directors and firm performance: Integrating agency and resource dependence perspectives. Academy of Management Review, 28(3), 383-396.

Hillman, A.J., Withers, M.C., Collins, B.J. (2009). Resource dependence theory: A review. Journal of Management, 35(6), 1404-1427.

Holmstrom, B., Milgrom, P. (1991). Multi-task principal-agent analyses: Incentive contracts, asset ownership, and job design. Journal of Law, Economics, and Organisation, 7(0), 24-52.

Hope, O-K., Thomas, W.B. (2008). Managerial empire building and firm disclosure. Journal of Accounting Research, 46(3), 591-626

Hoskisson, R.E., Hitt, M.A., Johnson, R.A., Grossman, W. (2002). Conflicting voices: The effect of institutional ownership heterogeneity and internal governance on corporate innovation strategies. Academy of Management Journal, 45(4), 697-716.

Hughes, J.P., Lang, W.W., Mester, L.J., Moon, G-G., Pagano, M.S. (2003). Do bankers sacrifice values to build empires? Managerial incentives, industry consolidation, and financial performance. Journal of Banking and Finance, 27(3), 417-447.

Hughes, J. P., Mester, L.J. (1998). Bank capitalization and cost: evidence of scale economies in risk management and signalling. Review of Economics and Statistics, 80(2), 314-25.

Hughes, J.P., Mester, L.J. (2009). Efficiency in banking: theory, practice, and evidence. In: Berger, A.N., Molyneux, P., Wilson, J.O.S. (Eds). Oxford Handbook of Banking, Oxford University Press.

Hughes, J.P., Mester, L.J., Moon, C-G. (2001). Are scale economies in banking elusive or illusive? Evidence obtained by incorporating capital structure and risk-taking into models of bank production.

Humphrey, D.B., Pulley, L.B. (1997). Banks' response to deregulation: profits, technology and efficiency. Journal of Money, Credit and Banking, 29(1), 73-93.

Hyatt Hotels and Resorts (1993). Golf and the Business Executive, Research and Forecasts, Inc, New York.

Jensen, M.C. (1986). Agency costs of free cash flow, corporate governance, and takeovers. American Economic Review, 76(2), 323-329.

Jensen, M.C., Meckling W.H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. Journal of Financial Economics, 3(4), 305-360.

John, T.A., John, K. (1993). Top-management compensation and capital structure. Journal of Finance, 48(3), 949-974.

Jondrow, J., Lovell, C.A.K., Materov, I.S., Schmidt, P. (1982). On estimation of technical inefficiency in the stochastic frontier production function model. Journal of Econometrics, 19, 233-238.

Kanniainen, V. (2000). Empire building by corporate managers: The corporation as a savings instrument. Journal of Economic Dynamics and Control, 24(1), 127-142.

Koetter, M., Kolari, J.W., Spierdijk, L. (2012). Enjoying the quiet life under deregulation? Evidence from adjusted Lerner indices for U.S. banks. Review of Economics and Statistics, 94(2), 462-480.

Kor, Y.Y., Sundaramurthy, C. (2009). Experience-based human capital and social capital of outside directors. Journal of Management, 35(4), 981-1006.

Kortelainen, M. (2008). Estimation of semiparametric stochastic frontiers under shape constraints with application to pollution generating technologies. MPRA, Paper No 9257.

Krishnaswami, S., Spindt, P.A., Subramaniam, V. (1999). Information asymmetry, monitoring, and the placement structure of corporate debt. Journal of Financial Economics, 51(3), 407-434.

Kroll, M., Walters, B.A., Le, S.A. (2007). The impact of board composition and top management team ownership structure on post-IPO performance in young entrepreneurial firms. Academy of Management Journal, 50(5), 1198-1216.

Kwan, S.H., Eisenbeis, R.A. (1997). Bank risk, capitalization, and operating efficiency. Journal of Financial Services Research, 12(2), 117-131.

Larcker, D.F., Rusticus, T. (2010). On the use of instrumental variables in accounting research. Journal of Accounting and Economics, 49(3), 186-205.

Leibenstein, H. (1966). Allocative efficiency vs. X efficiency. American Economic Review, 56(3), 392-415.

Lepetit, L., Nys, E., Rous, P., Tarazi, A. (2008). Bank income structure and risk - An empirical analysis of European banks. Journal of Banking and Finance, 32(8), 1452-1467.

Linehan, M., Scullion, H. (2011). The development of female global managers: the role mentoring and networking. Journal of Business and Ethics, 83(1), 29-40.

Liu Y., Mauer, D.C. (2011). Corporate cash holdings and CEO compensation incentives. Journal of Financial Economics, 102(1), 183-198.

MacCrimmon, K.R., Wehrung, D.A. (1990). Characteristics of risk taking executives. Management Science, 36(4), 422-435.

Maher, M., Andersson, T. (1999). Corporate governance: effects on firm performance and economic growth. Organisation for Economic Co-operation and Development (OECD), 1-51.

Marris, R. (1964). The economic theory of “managerial” capitalism. Glencoe, IL: Free Press of Glencoe.

Meeusen, W., Broeck, J.V.D. (1977). Efficiency estimation from Cobb-Douglas production function with composed error. International Economic Review, 18(2), 435-444.

Mehran, H., Rosenberg, J. (2008). The effects of employee stock options on bank investment choice, borrowing, and capital. Federal Reserve Bank of New York Staff Report.

Mehran, H., Acharya, V.V., Thakor, A.V. (2013). Caught between Scylla and Charybdis? Regulating bank leverage when there is rent seeking and risk shifting. ECGI - Finance Working Paper No. 365/2013; http://dx.doi.org/10.2139/ssrn.1786637.

Mester, L.J. (1997). Measuring efficiency at U.S. banks: accounting for heterogeneity is important. European Journal of Operational Research, 98(2), 230-242.

Minnick, K., Zhao, M. (2009). Backdating and director incentives: money or reputation? Journal of Financial Research, 32(4), 449-477.

Mirrlees, J. (1976). Optimal structure of incentives and authority within an organisation. Bell Journal of Economics, 7(1), 105-131.

Nam, J., Ottoo, R., Thornton J.H.J. (2003). The effect of managerial incentives to bear risk on corporate investment and R&D investment. Financial Review, 38(1), 77-101.

Nourayi, M.M., Mintz, M.S. (2008). Tenure, firm's performance, and CEO compensation. Managerial Finance, 34(8), 524-536.

Pathan, S. (2009). Strong boards, CEO power and bank risk-taking. Journal of Banking and Finance, 33(7), 1340-1350.

Persons, J.C. (1994). Renegotiation and the impossibility of optimal investment. Review of Financial Studies, 7(2), 419-449.

Pesaran, M.H. (2004). General diagnostic tests for cross section dependence in panels. University of Cambridge, Faculty of Economics, Cambridge Working Papers in Economics No. 0435.

Pi, L., Timme S.G. (1993). Corporate control and bank efficiency. Journal of Banking and Finance, 20(2-3), 515-530.

Pokrashenko, P. (2012). Cost efficiency of Russian banks: The impact of board of directors and executive group. Economics Education and Research Consortium, Working Paper No 12/02E, 2-31.

Posner, R.A. (2011). A failure of capitalism. The crisis of '08 and the descent into depression. Journal of Pension Economic and Finance, 10(3), 486-488.

Rajan, R., Wulf, J. (2006). Are perks purely managerial excess? Journal of Financial Economics, 79(1), 1-33.

Rogers, D.A. (2002). Does executive portfolio structure affect risk management? CEO risk-taking incentives and corporate derivatives usage. Journal of Banking and Finance, 26(2-3), 271-295.

Rogers, D.A. (2005). Managerial risk-taking incentives and executive stock option repricing: A study of US casino executives. Financial Management, 34(1), 95-121.

Rossi, S.P.S., Schwaiger, M.S., Winkler, G. (2009). How loan portfolio diversification affects risk, efficiency and capitalisation: A managerial behaviour model for Austrian banks. Journal of Banking and Finance, 33(12), 2218-2226.

Sealey, C., Lindley, J.T. (1977). Inputs, outputs and a theory of production and cost at depository financial institutions. Journal of Finance, 32(4), 1251-1266.

Shepherd, W.G. (1982). Economies of scale and monopoly profits. In: Craven, J.V. (Eds). Industrial Organization, Antitrust, and Public Policy, Kluwer Nijhoff, Boston, MA.

Shepherd, W.G. (1986a). Tobin's q and the structure performance relationship: Reply. American Economic Review, 76(5), 1205-1210.

Shepherd, W.G. (1986b). On the core concepts of industrial economics. In: H.W. De Jong, and W. G. Shepherd eds., Mainstreams in Industrial Organization, Boston: Kluwer Academic.

Shleifer, A., Vishny, R.W. (1986). Large shareholders and corporate control. Journal of Political Economy, 94(3), 461-488.

Shleifer, A., Vishny, R.W. (1989). Management entrenchment: The case of management-specific investments. Journal of Financial Economics, 25(1), 123-139.

Shleifer, A., Vishny, R.W. (1997). A survey of corporate governance. Journal of Finance, 52(2), 737-783.

Sinha, A. (2013). Governance in banks and financial institutions. RBI Monthly Bulletin April.

Smith, A. (1776). An Inquiry into the Nature and Causes of the Wealth of Nations. 5th Edition, London, Methuen and Co., Ltd.

Smith, C., Stulz, R.M. (1985). The determinants of firms' hedging policies. Journal of Financial and Quantitative Analysis, 20(4), 391-406.

Spong, K., Sullivan, R.J., DeYoung, R. (1996). What makes a bank efficient? A look at financial characteristics and management and ownership structure. Financial Industry Perspective, 1-19.

Stiroh, K.J. (2004). Diversification in banking: Is noninterest income the answer? Journal of Money, Credit, and Banking, 36(5), 853-882.

Stoeberl, P.A., Sherony, B.C. (1985). Board efficiency and effectiveness. In: Mattar. E. and Ball, M. (eds.) Handbook for Corporate Directors, McGraw-Hill, New York, pp.12.01-12.10.

Stulz, R.M. (1990). Managerial discretion and optimal financial policies. Journal of Financial Economics, 26(1), 3-27.

Tchistyi, A., Yermack, D., Yun, H. (2011). Negative hedging: Performance-sensitive debt and CEOs' equity incentives. Journal of Financial and Quantitative Analysis, 46(3), 657-686.

Thévenoz, L., Bahar, R. (2007). Executive Compensation: Is Disclosure Enough? Conflicts of Interest: Corporate Governance and Financial Markets, Kluwer Law International, 85.

Tufano, P. (1996). Who manages risk? An empirical examination of risk management practices in the gold mining industry. Journal of Finance, 51(4), 1097-1137.

Turner, A. (2009). A regulatory response to the global banking crisis. Financial Services Authority.

Veblen, T., Almy, C. (1899). The theory of the leisure class: An economic study in the evolution of institutions, Macmillan and Company, Limited.

Verbeeten, F. (2008). Performance management practices in public sector organisations: Impact on performance. Accounting Journal, 21(3), 427-454.

Vroom, V., Pahl, B. (1971). Relationship between age and risk-taking among managers. Journal of Applied Psychology, 55(5), 399-405.

Wheelock, D.C., Wilson, P.W. (2012). Do large banks have lower costs? New estimates of returns to scale for U.S. banks. Journal of Money, Credit and Banking, 44(1), 171-199.

Wiersema, M.F., Bantel, K.A. (1992). Top management team demography and corporate strategic change. The Academy of Management, 35(1), 91-121

Williamson, O.E. (1964). The economics of discretionary behaviour: Managerial objectives in a theory of the firm. Englewood Cliffs, NJ: Prentice-Hall.

Yermack, D. (2006). Flights of fancy: Corporate jets, CEO perquisites, and inferior shareholder returns. Journal of Financial Economics, 80(1), 211-242.

Zhang, X., Zhang, S. (2001). Technical efficiency in China’s iron and steel industry: Evidence from a new census data. International Review of Applied Economics, 15(2), 199-211.

Zwiebel, J. (1994). Dynamic capital structure under managerial entrenchment. American Economic Review, 86(5), 1197-1215.

Table 1: Selected Summary Statistics

Table 1 reports selected summary statistics for endogenous variables, board characteristics and additional compensation data for executives other than CEOs.

	Mean	Standard Deviation	25^{th} Percentile	Median	75^{th} Percentile
Endogenous Variables					
Delta ($000s)	714,366	870,707	256,287	503,388	503,388
Vega ($000s)	228,792	326,509	78,224	139,284	261,595
Profit Efficiency	0.494	0.061	0.480	0.501	0.512
Board Characteristics					
Female	0.212	0.408	0	0	0
Tenure	8.807	2.73	8.415	8.7	9.12
Duality	0.638	0.481	0	1	1
Age	60	6.453	55	60	65
CRO	.0728	0.259	0	0	0
Addendum: Details of Remuneration					
Total Compensation ($000s)	4,976,938	5,378,354	2,089,783	3,185,667	5,725,500
Salary ($000s)	1,387,997	631,172	961,495	1,288,889	1,683,638
No. Options Granted	19.615	24.955	19.615	67.6	168
Other Compensation ($000s)	403,127	1,220,027	87,924	164,216	348,543

Table 2: Profit efficiency regressions: all banks

Dependent Variable: Profit Efficiency	FE	2SLS	GMM	3SLS
Executive Delta	-0.0273	-0.0311	-0.0171	-0.0303***
	(-1.358)	(-1.415)	(-1.105)	(-4.375)
Executive Vega	0.0619**	0.0739**	0.0515**	0.0726***
	(2.107)	(2.364)	(2.260)	(12.341)
Options Granted	-0.0016	-0.0012	-0.0007	-0.0009
	(-0.577)	(-0.411)	(-0.283)	(-0.384)
Total Compensation	-0.0166**	-0.0057	-0.0072	-0.0061
	(-2.402)	(-0.864)	(-1.494)	(-1.299)
Other compensation	0.0131***	0.0114***	0.0100***	0.0121***
	(5.635)	(5.044)	(5.541)	(5.209)
Salary	0.0171**	0.0151*	0.0115	0.0151
	(2.314)	(1.673)	(1.371)	(1.481)
Female	0.0003	0.0062	0.0008	0.0066
	(0.043)	(0.818)	(0.121)	(1.204)
Tenure	0.0003	-0.0029	0.0013	-0.0019
	(0.043)	(-0.392)	(0.197)	(-0.261)
Duality	-0.0058	-0.0092	-0.0076	-0.0094*
	(-1.043)	(-1.585)	(-1.396)	(-1.696)
Age	-0.2054	-0.1259	-0.0688	-0.1099
	(-0.987)	(-0.553)	(-0.397)	(-0.575)
CRO	0.0148**	0.0155	0.0224***	0.0147
	(1.994)	(1.601)	(2.623)	(1.596)
Income diversification	0.0194	0.0194	0.0205	0.0239
	(1.100)	(0.894)	(1.417)	(1.193)
Loan portfolio diversification	-0.0998**	-0.1379***	-0.1162**	-0.1367*
	(-2.260)	(-2.744)	(-2.409)	(-1.954)
Relative market power	0.0294***	0.0281***	0.0235***	0.0270***
	(3.208)	(3.382)	(4.292)	(3.111)
Leverage	-0.1416	-0.0492	-0.1114	-0.0733
	(-1.035)	(-0.322)	(-1.061)	(-0.694)
Total Assets	0.0159*	0.0158	0.0196*	0.0154
	(1.787)	(1.287)	(1.749)	(1.079)
GLB	-0.0141	-0.0192	-0.0180	-0.0149
	(-0.912)	(-1.395)	(-1.364)	(-1.466)
SOX	-0.0196	-0.0117	-0.0181	-0.0188*
	(-0.897)	(-0.609)	(-0.963)	(-1.870)
Crisis	0.0257	0.0220	-0.0050	0.0236**
	(0.588)	(0.552)	(-0.132)	(2.366)
Constant	-1.0171***	-1.0576***	-0.9965***	-1.0468***
	(-12.067)	(-11.012)	(-11.051)	(-12.687)
Controls	YES	YES	YES	YES
Observations	2,366	2,009	2,009	2,009
R-squared	0.176	0.251	0.239	0.251
Kleibergen-Paap Rank LM Statistic		190.268 (0.00)	190.268 (0.00)	
Kleibergen-Paap Rank Wald F Statistic		109.284	109.284	
Hansen J Statistic		7.630 (0.1061)	7.630 (0.1061)	
Endogeneity Test		0.4340 (1.669)	0.4340 (1.669)	
Stock-Yogo (2005) Weak Instruments Test		13.97	13.97	13.97
ExecDelta		612.77 (0.00)	612.77 (0.00)	612.77 (0.00)
ExecVega		1274.90 (0.00)	1274.90 (0.00)	1274.90 (0.00)
Hausman (1978) Specification Test				
GMM v 2SLS. 2SLS v 3SLS.			3.12 (1.00)	21.99 (0.8832)

Robust t-statistics in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 3: Profit efficiency regressions: small-size banks

Dependent Variable: Profit Efficiency	FE	2SLS	GMM	3SLS
Executive Delta	-0.0085	-0.0140	-0.0090	-0.0135
	(-0.981)	(-1.561)	(-1.244)	(-1.573)
Executive Vega	0.0500**	0.0667***	0.0513***	0.0656***
	(2.635)	(3.363)	(3.625)	(7.407)
Options Granted	0.0000	-0.0015	-0.0053	-0.0010
	(0.002)	(-0.342)	(-1.589)	(-0.274)
Total Compensation	-0.0349***	-0.0362***	-0.0380***	-0.0368***
	(-2.903)	(-2.948)	(-3.839)	(-4.082)
Other compensation	0.0220***	0.0202***	0.0183***	0.0209***
	(3.636)	(3.528)	(3.864)	(5.219)
Salary	0.0378**	0.0408***	0.0444***	0.0412***
	(2.485)	(2.662)	(3.281)	(2.709)
Female	0.0129	0.0220	0.0202	0.0226**
	(0.927)	(1.520)	(1.549)	(2.345)
Tenure	0.0297***	0.0277***	0.0258***	0.0274**
	(3.064)	(2.761)	(2.884)	(2.369)
Duality	-0.0411***	-0.0591***	-0.0497***	-0.0581***
	(-3.253)	(-4.140)	(-4.739)	(-5.975)
Age	-0.7837**	-0.9126***	-0.9855***	-0.8968**
	(-2.291)	(-2.720)	(-3.405)	(-2.550)
CRO	-0.0043	-0.0563	-0.0433	-0.0583**
	(-0.082)	(-1.006)	(-0.882)	(-2.415)
Income diversification	0.0258	0.0032	0.0059	0.0086
	(0.451)	(0.048)	(0.093)	(0.154)
Loan portfolio diversification	-0.0131	-0.0442	-0.0161	-0.0448
	(-0.253)	(-0.641)	(-0.246)	(-0.579)
Relative market power	0.0210**	0.0271**	0.0256**	0.0263*
	(2.084)	(2.463)	(2.411)	(1.728)
Leverage	-0.3891**	-0.4426***	-0.4592***	-0.4496***
	(-2.597)	(-2.942)	(-3.258)	(-3.139)
Total Assets	0.0970*	0.1008*	0.1024**	0.1008***
	(1.896)	(1.742)	(1.963)	(2.629)
GLB	-0.0326**	-0.0356**	-0.0342**	-0.0322**
	(-2.149)	(-2.320)	(-2.553)	(-1.983)
SOX	0.0033	0.0046	0.0039	0.0017
	(0.165)	(0.244)	(0.214)	(0.105)
Crisis	0.0245	0.0404	0.0204	0.0408**
	(0.686)	(1.093)	(0.623)	(2.434)
Constant	-1.4676***	-1.4996***	-1.5061***	-1.4813***
	(-2.970)	(-2.616)	(-3.395)	(-3.981)
Controls	YES	YES	YES	YES
Observations	691	577	577	577
R-squared	0.333	0.412	0.391	0.412
Kleibergen-Paap Rank LM Statistic		98.085 (0.00)	161.221 (0.00)	
Kleibergen-Paap Rank Wald F Statistic		130.556	122.992	
Hansen J Statistic		4.923 (0.2953)	4.308 (0.230)	
Endogeneity Test		2.983 (0.2250)	4.309 (0.116)	
Stock-Yogo (2005) Weak Instruments Test		13.97	13.97	13.97
ExecDelta		601.67 (0.00)	4560.61 (0.00)	190.78 (0.00)
ExecVega		1264.15 (0.00)	3246.93 (0.00)	418.18 (0.00)
Hausman (1978) Specification Test				
GMM v 2SLS. 2SLS v 3SLS.			2.77 (1.00)	2.36 (1.00)

Robust t-statistics in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 4: Profit efficiency regressions: medium-size banks

Dependent Variable: Profit Efficiency	FE	2SLS	GMM	3SLS
Executive Delta	-0.0215	-0.0293	-0.0216	-0.0271*
	(-0.826)	(-0.960)	(-0.985)	(-1.863)
Executive Vega	0.0550	0.0715*	0.0544**	0.0686***
	(1.637)	(1.902)	(2.009)	(6.161)
Options Granted	-0.0123***	-0.0113***	-0.0073***	-0.0112**
	(-3.837)	(-3.365)	(-2.911)	(-2.479)
Total Compensation	-0.0175*	-0.0065	-0.0078	-0.0077
	(-1.702)	(-0.513)	(-0.739)	(-0.844)
Other compensation	0.0072***	0.0059*	0.0078***	0.0072
	(2.880)	(1.921)	(3.080)	(1.644)
Salary	0.0140	0.0138	0.0116	0.0135
	(1.000)	(0.838)	(0.815)	(0.758)
Female	-0.0126	-0.0042	-0.0059	-0.0034
	(-1.075)	(-0.380)	(-0.739)	(-0.376)
Tenure	0.0072	0.0030	0.0067	0.0051
	(0.876)	(0.322)	(0.875)	(0.456)
Duality	0.0113*	0.0080	0.0091	0.0098
	(1.952)	(1.043)	(1.408)	(0.945)
Age	-0.1194***	-0.6954*	-0.8860***	-0.6783*
	(-2.198)	(-1.809)	(-2.721)	(-1.893)
CRO	0.0254*	0.0284*	0.0321**	0.0289**
	(1.796)	(1.771)	(2.065)	(2.134)
Income diversification	-0.1194***	-0.1316***	-0.1259***	-0.1282***
	(-3.903)	(-3.541)	(-3.699)	(-2.746)
Loan portfolio diversification	-0.5595**	-0.7270	-0.5516	-0.6876*
	(-2.417)	(-1.622)	(-1.282)	(-1.905)
Relative market power	0.0250	0.0300	0.0226	0.0268
	(1.164)	(1.378)	(1.383)	(1.558)
Leverage	-0.3127	-0.0809	-0.2851*	-0.1885
	(-1.545)	(-0.352)	(-1.702)	(-0.814)
Total Assets	0.0404	0.1466	0.0267	0.1424
	(0.379)	(1.298)	(0.335)	(1.203)
GLB	-0.0060	-0.0116	-0.0030	-0.0075
	(-0.347)	(-0.707)	(-0.191)	(-0.424)
SOX	-0.0122	-0.0098	-0.0063	-0.0171
	(-0.555)	(-0.543)	(-0.358)	(-0.926)
Crisis	0.0206	0.0154	-0.0040	0.0143
	(0.477)	(0.401)	(-0.117)	(0.774)
Constant	-1.2158	-2.5877	-1.3295	-2.4037
	(-0.756)	(-1.531)	(-1.111)	(-1.448)
Controls	YES	YES	YES	YES
Observations	771	657	657	657
R-squared	0.176	0.216	0.209	0.216
Kleibergen-Paap Rank LM Statistic		56.687 (0.00)	56.687 (0.00)	
Kleibergen-Paap Rank Wald F Statistic		52.158	52.158	
Hansen J Statistic		8.261 (0.0825)	8.261 (0.0825)	
Endogeneity Test		0.435 (0.8044)	0.435 (0.8044)	
Stock-Yogo (2005) Weak Instruments Test		15.72	15.72	15.72
ExecDelta		156.57 (0.00)	156.57 (0.00)	156.57 (0.00)
ExecVega		301.19 (0.00)	301.19 (0.00)	301.19 (0.00)
Hausman (1978) Specification Test GMM v 2SLS. 2SLS v 3SLS.			46.99 (0.0187)	9.05 (0.9999)

Robust t-statistics in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 5: Profit efficiency regressions: large-size banks

Dependent Variable: Profit Efficiency	FE	2SLS	GMM	3SLS
Executive Delta	-0.0600	-0.0533	-0.0213	-0.0464*
	(-1.587)	(-1.257)	(-0.638)	(-1.958)
Executive Vega	0.0985**	0.1020**	0.0603*	0.0963***
	(2.435)	(2.429)	(1.838)	(5.333)
Options Granted	0.0098	0.0110	0.0054	0.0110**
	(1.628)	(1.564)	(1.257)	(2.066)
Total Compensation	-0.0281**	-0.0161	-0.0170*	-0.0148*
	(-2.450)	(-1.398)	(-1.912)	(-1.865)
Other compensation	0.0164***	0.0135***	0.0135***	0.0139***
	(4.224)	(3.160)	(3.574)	(3.346)
Salary	0.0187	0.0092	0.0050	0.0082
	(1.152)	(0.482)	(0.363)	(0.342)
Female	0.0046	0.0063	0.0028	0.0065
	(0.672)	(0.952)	(0.465)	(0.666)
Tenure	-0.0360	-0.0331	-0.0237	-0.0318*
	(-1.607)	(-1.535)	(-1.161)	(-1.953)
Duality	-0.0072	-0.0066	-0.0037	-0.0090
	(-0.640)	(-0.558)	(-0.447)	(-0.807)
Age	0.0853	0.2436	0.0476	0.2926
	(0.349)	(0.966)	(0.203)	(0.901)
CRO	-0.0023	0.0099	0.0140	0.0084
	(-0.204)	(0.726)	(1.142)	(0.566)
Income diversification	0.0108	0.0095	-0.0249	0.0153
	(0.247)	(0.203)	(-0.736)	(0.401)
Loan portfolio diversification	0.2794	0.2578	0.3130	0.2771
	(1.321)	(1.237)	(1.554)	(1.102)
Relative market power	0.0415***	0.0264*	0.0131	0.0289*
	(2.949)	(1.861)	(1.208)	(1.648)
Leverage	-0.6647*	-0.5763	-1.0163***	-0.6284**
	(-1.768)	(-1.440)	(-3.009)	(-2.508)
Total Assets	0.0178	0.0089	0.0115	0.0124
	(0.995)	(0.368)	(0.493)	(0.474)
GLB	-0.0285	-0.0414**	-0.0309*	-0.0372**
	(-1.419)	(-2.240)	(-1.939)	(-2.202)
SOX	-0.0227	-0.0164	-0.0120	-0.0241
	(-1.069)	(-0.852)	(-0.632)	(-1.543)
Crisis	0.0582	0.0434	0.0450	0.0457***
	(1.184)	(1.011)	(1.286)	(2.704)
Constant	-1.1177***	-1.1147***	-0.8611***	-1.2023***
	(-3.393)	(-3.359)	(-3.358)	(-4.191)
Controls	YES	YES	YES	YES
Observations	904	775	775	775
R-squared	0.262	0.350	0.292	0.350
Kleibergen-Paap Rank LM Statistic		148.668 (0.00)	148.668 (0.00)	
Kleibergen-Paap Rank Wald F Statistic		37.424	37.424	
Hansen J Statistic		6.023 (0.1974)	6.023 (0.1974)	
Endogeneity Test		1.929 (0.3811)	1.929 (0.3811)	
Stock-Yogo (2005) Weak Instruments Test		15.72	15.72	15.72
ExecDelta		297.71 (0.00)	297.71 (0.00)	303.49 (0.00)
ExecVega		564.20 (0.00)	564.20 (0.00)	578.47 (0.00)
Hausman (1978) Specification Test				
GMM v 2SLS. 2SLS v 3SLS.			16.70 (0.9666)	13.98 (0.9915)

Robust t-statistics in parentheses *** p<0.01, ** p<0.05, * p<0.1

Appendix 1: Calculation of executive pay sensitivities

To calculate Delta and Vega sensitivities, we employ the extended version of the Black-Scholes pricing formula which allows for dividends (following Core and Gray, 2002):

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

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

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

in which, for 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.

We compute executive Delta and Vega using information contained in the latest bank proxy statements using a vested and unvested options approach. This approach uses information from ExecuComp supplemented by financial information from SNL Financial. Option maturities for unvested options are set by deducting 4 quarters from the maturity of the most up to date options. In contrast, vested options are set to a maturity three years less than equivalent unvested options. Finally if no options are granted in a year option maturities for vested options are set at typical maturity rates; six years for vested and nine for unvested. The vested and unvested formulae are:

$$K_{vested} = S_{year} - end - \frac{V_{vest}}{Nvest} \qquad [A4]$$

$$K_{unvested} = S_{year-end} - end - \frac{V_{unvest}}{Nunvest} \qquad [A5]$$

Where K is the option strike price and S the underlying bank stock price.