Regulation, Compensation and Risk Taking in Banks: Evidence from the Credit Crises[☆]

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Abstract

We study regulation, executive incentives and risk taking in banks during the recent credit crises. Using a hand-collected dataset covering 352 banks from 15 countries we find that regulation effectively reduces bank risk as measured by commonly used measures of bank risk. However, bank performance during the recent credit crises is negatively correlated with the level of bank regulation. A more detailed analysis reveals, that incentives of bank executives are more pronounced in countries with stricter bank regulation. This is consistent with the view that shareholders aim to jeopardize the effect of regulation by providing stronger incentives. Also consistent with that view, the level of incentives positively affects the level of bank risk and examining bank performance during the recent credit crises this effect becomes stronger as bank regulation becomes stricter. Overall, the findings suggest that regulatory initiatives should carefully consider their (unintended) consequences for incentive structures within banks.

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Abstract. We study regulation, executive incentives and risk taking in banks during the recent credit crises. Using a hand-collected dataset covering 352 banks from 15 countries we find that regulation effectively reduces bank risk as measured by commonly used measures of bank risk. However, bank performance during the recent credit crises is negatively correlated with the level of bank regulation. A more detailed analysis reveals, that incentives of bank executives are more pronounced in countries with stricter bank regulation. This is consistent with the view that shareholders aim to jeopardize the effect of regulation by providing stronger incentives. Also consistent with that view, the level of incentives positively affects the level of bank risk and examining bank performance during the recent credit crises this effect becomes stronger as bank regulation becomes stricter. Overall, the findings suggest that regulatory initiatives should carefully consider their (unintended) consequences for incentive structures within banks.

1. Introduction

Excessive risk taking in the banking industry is widely considered to be one of the funda-mental causes of the recent credit crisis.[1] Thereby, many commentators have argued that bank executives have engaged in high-risk projects due to inappropriate compensation contracts and lax regulation. Specifically, while ill-designed incentives have created massive (short-term) in-centives for risk taking *(e.g. Bebchuk, 2010)*, existing regulation was unable to set appropriate boundaries and did not effectively restrict the menu of options available to bank executives *(e.g. Acharya and Schnabl, 2009; Levine, 2012)*. Supported by selected anecdotal evidence, this argument began to become commonly accepted and subsequently acted as a starting point for several regulatory initiatives.[2]

However, from an economic perspective this line of arguments has some limitations. Ulti-mately, behavior of economic agents is the results of an endogenous cost-benefit analysis. Now in case of listed banks, shareholders and their boards decide about the level of incentives for bank executives and the cost-benefit analysis of that decision is shaped by the existing regula-tory environment *(e.g. John, Saunders, and Senbet, 2000)*. In other word, rational shareholders and their boards will choose incentives for bank executives that – given the external regulatory setting (*contracting environment*) – are optimal from their point of view. Thereby, they will anticipate behavior of bank executives with respect to the incentive level they choose. In effect, given the level of regulation the level of incentives as well as the level of risk taking will endo-geneously emerge and (on average) be optimal from the perspective of shareholders. From that perspective, the regulator faces the challenge to choose the optimal level of regulation taking into account the response of shareholders (and their boards) to bank regulation.

While it is important to understand the interrelation between regulation, incentives and risk taking, pre-crises literature is sparse and results of the recently emerging literature are mixed

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[1]See for instance the *Communiqué* of the 2009 G20 London Summit (http://www.imf.org) and the the *Leaders' Statement* of the 2010 G20 Summit in Pittsburgh (http://ec.europa.eu).

[2]Starting from the G20 Summits and the *Principles for Sound Compensation Practices* of the Financial Sta-bility Forum (http://www.financialstabilityboard.org) most developed countries have seen compensation regula-tions. For instance, the Dodd-Frank Wall Street Reform and Consumer Protection Act in the US. In Europe, the *High-level principles for Remuneration Policies* of the Committee of European Banking Supervisors, the *Capital Requirements Directive*, and the *Recommendation on remuneration policies in the financial services sector* by the European Commission paved the way for national regulation initiatives.

(e.g. Faulkender et al., 2010). There is, for instance, no clear theoretical or empirical link between bank regulation and risk taking.[3] On the one hand, banking regulation generally intends to reduce a bank's risk taking, for instance by enforcing shareholders to increase their equity stake in the bank (*Koehn and Santomero, 1980*). Also, many countries try to mitigate excessive risk taking in the banking industry by restricting banks from engaging in non-lending activities *(e.g. Boyd, Chang, and Smith, 1998)*. On the other hand, simple diversification arguments suggest that one might expect some diversification benefits from giving banks more latitude *(e.g. Kwan and Ladermann, 1999; Eisenbeis and Wall, 1984)*. Thus, activity restrictions imposed by the regulator may hamper banks' diversification opportunities and thus increase bank-specific risks *(e.g. Mishkin, 1999)*.

Also, the limited empirical evidence provides mixed results so far. While *Klomp and de Haan (2011)* finds that activity restrictions and supervision control reduce bank risk, *Beltratti and Stulz (2012)* hardly find any evidence that bank regulation affected pre-crises risk taking of banks or had an impact on bank performance during the credit crises. Similarly, *Erkens, Hung, and Matos (2012)* find no effect of aggregate governance index as compiled by *Kaufmann, Kraay and Mastruzzi (2009)* or shareholder rights as proxied by the anti-director rights index of *La Porta et al. (1998)* or *Spamann (2010)*, on bank performance during the credit crises. Finaly, *Laeven and Levine (2009)* and *Gropp and Köhler (2010)* find that some dimensions of bank regulation, e.g. activity restrictions, actually fuel risk taking in banks. The authors argue that banks operating in highly regulated countries might seek to offset regulatory restrictions by increasing risk taking outside regulators' focus.

Similarly, the link between executive incentives and risk taking is blurred. From a theoretical perspective, executives are faced with the problem that the value of their human capital is closely linked to the risk of the bank. With executives unable to diversify this risk, this eventually results in inefficient low levels of risk taking. As a response, shareholders might implement incentive schemes for executives in order to promote risk taking.[4] Standard incentive schemes

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[3]A common rationale for bank regulation is the argument that suppliers of finance (i.e. shareholders, creditors, and lenders) are not able to implement appropriate governance mechanisms in banks (*Caprio, Laeven, and Levine, 2007*).

[4]Incentives, however, are always involved with additional risk exposure for the executives (*Lambert and*

for executives comprise bonus plans as well as stock-based incentives *(e.g. John and Qian, 2003)*. While the former generally reward short-term (and even past) performance, the latter provide incentives based on a forward-looking performance measure commonly accompanied with a multi-year vesting period.

However, the interrelation between executive incentives and risk taking remains ambiguous. From an agency perspective, incentives will stimulate risk-taking but high operating risk distorts performance measurement and increases both opportunity costs of incentives *(e.g. Holmstrom and Milgrom, 1987)* and personal risks of executives. In line with these arguments, some US studies find evidence suggesting that CEO incentives determined the level of risk taking in banks *(e.g. Chesney, Stromberg, and Wagner, 2011; Cheng, Hong, and Scheinkman, 2011; Suntheim, 2011)*. However, there are also studies that do not find a strong relationship between compensation practices and risk taking or stock performance during the crisis *(e.g. Murphy, 2009; Fahlenbrach and Stulz, 2011)*. Moreover, while the literature suggests that corporate governance is an important determinant of executive incentives, *Aebi, Sabato, and Schmid (2011)* find no significant relationship between a bank's performance during the crisis and standard firm-level governance variables such as CEO ownership and board independence.[5]

With this paper, we combine the two perspectives by studying the interrelation between regulation, executive incentives and banks' risk taking during the recent credit crises in a uniform setting. The recent credit crisis as a macroeconomic shock is well suited for carving out the relationship between bank risk, executives' incentives and regulatory aspects. In fact, many banks with different compensation practices as well as many countries with different corporate governance and regulatory settings were affected by the recent crisis.

Accordingly, we construct a novel hand-collected data set covering accounting and market data, executive remuneration, as well as ownership and board structures of large listed banks in Europe and the US. We use this data set to examine three issues.

First, we scrutinize whether bank regulation effectively reduces risk taking within banks.

Larcker, 2004, *Demsetz and Lehn, 1985*, *Kane, 1985*). In line with this view, *Murphy (2009)* and *Fahlenbrach and Stulz (2011)* find that bank executives face substantial losses during the recent credit crises.

[5]See *Mehran, Morrison, and Shapiro (2011)* for an overview of studies on corporate governance, particularly on executive compensation in banks in the context of the recent credit crisis.

Investigating two different risk measures we find ambiguous results. When we examine the aggregate of commonly used risk measures (share price volatility, opaqueness, default risk, and the well-known z-score), we find that banks facing stricter regulation take less risks. These findings suggest that regulation is effective with respect to limiting bank risk. However, we note that all components of this aggregate are rather symmetric risk measures with limited ability to capture tail risks. Thus, we also study banks' stock market performance during the recent credit crises as has been pioneered by *Fahlenbrach and Stulz (2011)* and adopted by many others *(e.g. Beltratti and Stulz, 2012; Aebi, Sabato, and Schmid, 2011)*. We find that banks' stock market performance is positively correlated to the level of bank regulation. Interpreting our second risk measure as the realization of tail risks, these findings suggest that banks operating under strict bank regulation were more engaged in projects with limited standard risks but extensive tail risks. In other words, banks operating under stricter regulation seem to engage in risky businesses, e.g. off-balance sheet activities or lending activities, which are not captured by common risk measures.

Second, we examine executive incentives as an *indirect* channel through which bank regulation may affect risk taking of banks. Investigating various measures of executive incentives we find convincing evidence that incentives are more pronounced in banks facing stricter regulation. These findings are in line with existing findings suggesting that shareholders take into account the contracting environment, when deciding about executive remuneration *(e.g. Bryan, Nash, and Patel, 2010)*. Moreover, they suggest that shareholders aim to jeopardize regulation by implementing high (pay-for-performance) sensitivities to incentivize managers to outperform competitors in a restricted business.

Finally, we examine the effect of executive incentives and bank regulation on risk taking of banks simultaneously. Our findings from this analysis are threefold. First, we find that executive incentives actually fuel risk taking in banks. Second, we find that regulation affects risk taking as measured by standard measures negatively, even after controlling for the level of executive incentives. Third, once we control for executive incentives bank regulation has no effect on tail risk as measured by banks' stock market return during the financial crises. However, the effect of executive incentives on tail risk becomes more pronounced as the level

of regulation increases. These findings suggest that while there is some *bright side* of bank regulation, i.e. it reduces *standard* risks of banks, there is also a *dark side* of bank regulation, since shareholders will increase executive incentives and this will fuel tail risks. Overall, our findings thus suggest that regulatory initiatives should carefully consider their (unintended) consequences for incentive structures within banks, since the latter may represent an important indirect channel how regulation can affect risk taking of banks.

We contribute to the literature in two important ways. *First*, we examine executive incentives as an indirect channel how external regulation may affect risk taking of banks. There is substantial evidence suggesting that the contracting environment may (or may not) affect bank behavior. However, it is important to understand the channels behind theses relations. *Second*, there is only little evidence on bank behavior and performance during the recent credit crises *(e.g. Erkens, Hung, and Matos, 2012; Beltratti and Stulz, 2012)*. This is mainly due to the lack of available data. Therefore, we construct a novel data set to expand the focus of existing studies.

The remainder of the paper is structured as follows. Section 2 describes the dataset, defines the variables we use in the analysis and provides some descriptive statistics. Section 3 presents the empirical analysis. Section 4 concludes.

2. Data

This section describes the sample generation process, the variable definition and provides descriptive statistics. Details on all our variables are summarized in Table A.1 in Appendix A.

2.1. Sample construction

Our main objective is to study the interrelation between regulation, executive incentives and risk taking in the banking industry against the background of the recent credit crises. Therefore, we construct a novel data set covering large listed banks located in 14 European countries and the US. The European countries are Austria, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, Switzerland, and the United Kingdom.

We generate our sample in four steps. *First*, we extract all listed firms from these countries tracked in the Thomson Reuters One Banker Database. *Second*, we restrict the sample to (i) firms in Industry Classification Benchmark (ICB) Subsector 8355 (Banks) and (ii) with assets in excess of $1 billion at the end of 2006 (which corresponds to 0.8 bn €).[6] *Third*, we exclude banks without basic balance sheet information or with missing stock price data prior to 2006. *Finally*, we exclude banks whenever the annual report is unavailable or does not provide sufficient information on executive compensation and the bank's board structure. Overall, we end up with a sample of 352 banks. Table A.2 provides the geographical distribution of banks in our sample.

[– Table A.2 goes about here –]

2.2. Bank risk

In our empirical analysis, we proxy risk taking of banks using two measures. The *first* risk measure (*Standard risk*) aggregates four standard risk measures commonly studied in the banking literature (e.g. *Song and Xie, 2012*; *Demirg-Kunt and Huizinga, 2010*; *Laeven and Levine, 2009* and others) into a single measure. The data used to construct *Standard risk* are collected as of the end of 2006. Thus, we consider this measure as an *ex-ante* measure of bank risk, which could have been observed (e.g. by regulators) at the outset of the credit crises. The *second* risk measure (*Tail risk*) is an *ex-post* measure of tail risks, where we follow the recently emerging post-crises literature *(e.g. Fahlenbrach and Stulz, 2011)* and measure banks' stock market performance during the peak of the credit crises.

Below, we describe the two risk measures in more detail. Data to calculate bank risk is mainly drawn from Thomson Financial.

Standard risk: There are various risk measures used in the banking literature, which all have their own merits. However, we are interested in a comprehensive risk measure covering different aspects of bank risk. Therefore, we combine four well-established risk measures to

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[6]The Industry Classification Benchmark (ICB) is an industry classification scheme by Dow Jones and FTSE. Firms are categorized into subsectors primarily according to the source of the majority of revenues.

end up with an aggregaste risk measure. More precisely, we calculate *Standard risk* as the equally-weighted average of the z-transformation of each of the following four measures[7]:

1. *Share price risk* is the annualized standard deviation of the stock returns *(e.g. Demirg-Kunt and Huizinga, 2010; Laeven and Levine, 2009)*. Specifically, *Share price risk* is defined as monthly stock returns measured over the period January 2004 to December 2006. Adopting the standard view, higher values of *Share price risk* indicate higher bank risk.

2. *Opaqueness* is the annualized standard deviation of residuals of the bank-specific regression *(e.g. Pathan, 2009; Chen, Steiner, and Whyte, 2006)*

$$Return_t = \alpha + \beta_1 \times Market\ return_t + \beta_2 \times Interest_t + \varepsilon_t, \tag{1}$$

where (*Market return*, *Interest*) equals (S&P 1500, three-month US T-bill), (MSCI Europe, three-month EURIBOR) and (FTSE 350, three-month LIBOR) for US, EU and UK banks, respectively. Again, the time period examined is January 2004 to December 2006 and higher values of *Opaqueness* indicate higher bank risk.

3. *Default risk* is the logarithm of the one-year *expected default frequency* (EDF) from Moody's KMV.[8] Because the EDF is skewed, we follow *Covitz and Downing (2007)* and *Cheng, Hong, and Scheinkman, 2011* and use the natural logarithm of EDF in our analysis. Again, higher values of *Default risk* indicate higher bank risk.

4. *Inv. z-score* is the inverse of the well-known *z-Score*, which in turn is defined as the average bank's return on assets plus the capital asset ratio divided by the standard deviation

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[7]We apply the the z-transformation ($z_i = \frac{x_i - \bar{x}}{\sigma_x}$) to each of the measures. The mean (standard deviation) of a z-transformed variable is zero (one). Thus the mean of our aggregate measure *Standard risk* should be close to zero.

[8]Moody's KMV determines the EDF based on the probability of default derived from a modification of Merton's (1974) structural credit risk model. By construction EDF ranges from 0.01% to 35% (effectivly, if the probability of default within one-year exceeds 35%, it is winsorized to 35%).

of asset returns, i.e.

$$z\text{-}Score_i = \frac{\emptyset(ROA_i + CAR_i)}{\sigma(ROA_i)}, \quad \text{where } CAR_i = \frac{Equity_i}{Total\ assets_i}. \qquad (2)$$

$z\text{-}Score_i$ represents the number of standard deviations of ROA that are needed to take the capital asset ratio to zero. Thus, it indicates how thick or thin the bank's capital cushion is relative to its earnings risk or more broadly the bank's distance from bankruptcy (*Roy, 1952*; *Boyd, Graham, and Hewitt, 1993*; *Laeven and Levine, 2009*). We calculate *Inv. z-score* over the 2003-2006 period. Again, higher values of *Inv. z-score* indicate higher bank risk.

Three things are worth noting. *First*, for each of the four measures higher values indicate higher bank risk. Accordingly, when we aggregate them to *Standard risk*, higher values of *Standard risk* also indicate higher bank risk. *Second*, *Standard risk* reflects information that was available at the end of 2006. Therefore, consider this an *ex-ante* risk measure. *Third*, all four measures used to calculate *Standard risk* are based on symmetric risk concepts, e.g. volatilities and related concepts. Thus, these measures (by construction) face problems in capturing tail risks.

Tail risk: The credit crisis – interpreted as a large macroeconomic shock to the banking industry – is likely to reveal tail risks taken by the managers prior to the crisis *(e.g. Fahlenbrach and Stulz, 2011)*. Hence, we interpret banks' share price performance during the crises period as an ex-post outcome of ex-ante risk taking (*Fahlenbrach and Stulz, 2011* pioneered the approach to examine banks' share price performance during the credit crises).

Accordingly, we determine for each bank in our sample buy-and-hold stock returns (*BAHSR*) during the crisis period. Thereby, we follow *Fahlenbrach and Stulz (2011)*, *Aebi, Sabato, and Schmid (2011)*, *Erkens, Hung, and Matos (2012)*, *Beltratti and Stulz (2012)* and others and define the relevant time period as starting in July 2007 and ending in December 2008 (or the date on which the bank was delisted, whichever is earlier). With these stock returns, we define *Tail risk* of a bank's *negative BAHSR* from July 2007 to December 2008 (or the date on which the firm was delisted, whichever is earlier). Note, that according to that definition higher values

of *Tail risk*, again, indicate higher levels of risk taking.

For robustness tests, we also calculate *BAHSR* for the calendar year 2008 *(e.g. Erkens, Hung, and Matos, 2012)*. The corresponding risk measures, i.e. the inverse of the 2008 *BAHSR*, is labeled *Tail risk (2008)*.

Correlation analysis of bank risk: Table A.4 provides a correlation analysis of our various bank risk measures. Therefore, we estimate various univariate cross-sectional quantile and OLS regressions. Panel A of the table shows that there is some positive correlation between our two key risk measures, *Standard risk* and *Tail risk*. However, the statistical significance of the coefficient of interest in the median regression is only weak. This is further illustrated in Panel B, where *Default risk* is negatively correlated with *Tail risk*. Finally, Panel C illustrates that our aggregate *Standard risk* is a reasonable proxy for the risk covered by the standard risk measures used in the banking literature.

[– Table A.4 goes about here –]

2.3. Executive compensation

To study the interrelation between executive incentives and risk taking in banks, we are interested in various dimensions of executive compensation within banks. Accordingly, we need detailed information about executive remuneration within banks. However, we face two problems. *First*, there is only little information provided by public or commercial databases. Thus, we mainly have to collect information from primary sources. In the end, while compensation data for large US banks is from ExecuComp, for small US banks as well as for all European banks information is hand-collected from annual reports and 10k-filings.[9] *Second*, many European banks in our sample do not report compensation data for executive directors individually. Thus, in case of European banks even careful reading of annual reports generally does not allow us to figure out compensation of individual executives. However, basically all our sample banks report the level of aggregate executive compensation measured over all executives. Hence, we opt for an *average approach* and calculate the average annual compensation

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[9]As *Fahlenbrach and Stulz (2011)* note, studies that only use data from ExecuComp database suffer from a bias towards larger banks. Since we are interested in the *average* bank, we manually collect the data for smaller banks to include them in our analysis.

per executive.[10] Additionally, whenever possible we collect information on CEO compensation in order to challenge the results of our average approach.

To examine executive incentives, we are particularly interested in performance-based pay, i.e. accounting-based (generally short-term) bonuses and stock-based incentives. Accordingly, we collect detailed information on (i) salary, (ii) bonus, (iii) (fair) value of stock and stock option grants, and (iv) any other compensation (e.g. perks).[11] With *Fix compensation* denoting the sum of fixed salary and any other compensation and *Stock-based incentives* denoting the sum of (fair) values of stock-based incentive grants, the level of total pay (*Total compensation*) is given by the sum *Fix compensation*, *Cash bonus* and *Stock-based incentives*.

Adopting the idea of *Adams (2012)* and others, we calculate various measures of executive incentives in the bank:

1. *Aggregate incentive level:* To measure the overall level of incentives, we calculate the ratio of *Total incentives*, defined as the sum of *Stock-based incentives* and *Cash bonus*, to *Total compensation*

$$Incentive\text{-}to\text{-}total_i = \frac{Stock\text{-}based\ incentives_i + Cash\ bonus_i}{Total\ compensation_i} \qquad (3)$$

and the logarithm of the ratio *Total incentives* to *Fix compensation*

$$Incentive\text{-}to\text{-}fix\ (log)_i = \ln\left(1 + \frac{Stock\text{-}based\ incentives_i + Cash\ bonus_i}{Fix\ compensation_i}\right). \qquad (4)$$

2. *Stock-based incentive level:* To measure the level of equity-based incentives, we calculate

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[10]Therefore, we collect aggregated compensation data for all executives in the bank, as well as the time served on the management boards for each of the executives. To arrive at the average compensation per executive, we standardize the former by the latter.

[11]Regarding the value of stock-based incentives, we have to differentiate between US and European banks. For US banks, we follow the standard approach of *Fahlenbrach (2009)* and others and use the Execu-Comp fair value figures for restricted stock and stock options (ExecuComp items OPTION_AWARDS_FV and STOCK_AWARDS_FV) if available. For other (European and US) banks, we generally use the fair value of stock and stock option grants as reported in the annual report. If this information is not available, we evaluate the stock-based incentives using the Black/Scholes option pricing model. Note, however, that in case of European banks stock-based incentives often consist of rather complex structures (see *Sautner and Weber, 2011* and *Rapp, Schaller, and Wolff, 2009* for a description of incentive programs in European industrial and service firms). Finally note, that due to transparency issues we do not consider pensions.

the ratio of *Stock-based incentives* to *Total compensation*

$$Equity\text{-}to\text{-}total_i = \frac{Stock\text{-}based\ incentives_i}{Total\ compensation_i} \tag{5}$$

and the logarithm of the ratio *Stock-based incentives* to *Fix compensation*

$$Equity\text{-}to\text{-}fix\ (log)_i = \ln\left(1 + \frac{Stock\text{-}based\ incentives_i}{Fix\ compensation_i}\right). \tag{6}$$

3. *Short-term incentive level:* To measure the level of short-term incentives, we calculate the ratio of *Cash bonus* to *Total compensation*

$$Bonus\text{-}to\text{-}total_i = \frac{Cash\ bonus_i}{Total\ compensation_i} \tag{7}$$

and the logarithm of the ratio *Cash bonus* to *Fix compensation*

$$Bonus\text{-}to\text{-}fix\ (log)_i = \ln\left(1 + \frac{Cash\ bonus_i}{Fix\ compensation_i}\right). \tag{8}$$

We acknowledge that these are rather rough measures of executive incentives, compared to what we know from the literature. However, we have to pay tribute to the limited transparency level with regard to compensation policies in European banks. Accordingly, our incentive measures eventually adopt the structure of measures used by *Bergstresser and Philippon (2006)*, *Cornett, McNutt, and Tehranian (2010)* and *Fernandes et al. (2010)*.

For our empirical analysis, we are also interested in a measure for the level of executive compensation within a bank. Two things are important in that respect. *First*, the level of compensation is highly sensitive to the size of the bank. Thus, we will use a measure of *excess compensation (e.g. Fahlenbrach, 2009). Second*, such a measure should not be distorted by the incentive level. Thus, we explicitly focus on the level of *Fix compensation* when determining our measure of excess compensation. Specifically, we regress annual *Fix compensation* on bank size, country- and industry-effects and define *Excess compensation* as a dummy variable indicating whether the bank-specific residual of the regression is positive. This measure allows

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us to account for the level of executive pay in our sample banks.[12]

Table A.7 provides the geographical distribution of executive compensation and incentives in banks in our sample. It becomes obvious that there is substantial cross-country variation.

[– Table A.7 goes about here –]

2.4. Bank regulation

We are interested in the effect of bank regulation on remuneration structures of bank executives and bank risk taking. A well-established approach to examine cross-country differences in bank regulation is provided by survey results of *Barth, Caprio, and Levine (2001, 2004, 2006)* and the four indices of bank regulation provided by *Caprio, Laeven, and Levine (2007)*:

(I) *Official*: Index of the capabilities and power of the bank supervisory authority. It includes the rights of auditors, possibility of changing the internal organizational structure, suspension of board decisions, and power to intervene in a bank. The scale is from 1 to 14 (higher values indicate stronger supervisory power).

(II) *Restriction*: Index of regulatory restrictions on bank activities. This index measures regulatory barriers for banks engaging in real estate activities (e.g. real estate investments), securities market activities (e.g., underwriting, brokering, dealing), insurance activities (e.g., insurance underwriting), and the ownership of nonfinancial firms. The scale is from 1 to 14 (higher values indicate tighter restrictions in bank activities).

(III) *Independence*: Index of independence of supervisory authority from the government. It measures the extent to which the supervisory agency is legally secured from the banking system and independent from the government. The scale is from 1 to 6 (higher values indicate a higher independence of supervisory authority).

(IV) *Capital*: Index of bank capital regulation. The index incorporates regulatory restricts on bank capital and capital stringency. It measures the regulatory approach to assessing and

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[12]Note, that our sample selection process ensures that our sample consists of large listed banks, the sample constituents, however, still differ with regard to their business model. See the discussion in *Aebi, Sabato, and Schmid (2011)*. We account for these differences by adding a set of *industry dummies*, which we define based on the SIC classification of the bank.

verifying the degree of capital at risk in a bank. The scale is from 1 to 9 (higher values indicate stricter capital requirements).

Again, we are interested in a comprehensive measure of bank regulation and thus aggregate the four indices into *Bank regulation*.

Moreover, in our regression analyses we also control for (i) the level of shareholder protection, as measured by the revised anti-director rights index *ADRI* from *Djankov et al. (2008)* as well as (ii) the development of stock markets proxied by the ratio of market capitalization of listed firms to GDP (*Stock market development*).

Table A.6 illustrates the cross-country variation in bank regulation and country controls.

[– Table A.6 goes about here –]

2.5. Ownership, board governance, and bank characteristics

In the empirical analysis we control for (i) ownership (*Management* and *Blockholder*) *(e.g. Beltratti and Stulz, 2012; Fahlenbrach and Stulz, 2011; Haw et al., 2010)* and board structure (*Boardsize* and *CEO Duality*) *(e.g. Pathan and Faff, 2012; Adams, 2012; Pathan, 2009)* and (ii) a comprehensive set of bank characteristics (e.g. *Bank size* and *Loans-to-assets*). Details on these variables are described in Panel D and E of Table A.1 in Appendix A.

2.6. Summary statistics

Table A.3 reports summary statistics of the entire sample. We summarize relevant facts about bank risk, executive incentives, regulation and bank characteristics.

[– Table A.3 goes about here –]

First, we note from Panel E, that the average (median) bank in our sample has a market capitalization at the end of 2006 of 7.96 bn. € (700 m €). The relatively low median value compared to the mean suggests that our sample covers a lot of small and mid-size banks, but also some very large banks. Also note that our median bank is relatively small compared to other existing studies *(e.g. Fahlenbrach and Stulz, 2011; Beltratti and Stulz, 2012; Erkens, Hung, and Matos, 2012)*. Moreover, in 2006 the average sample bank has a *Market-to-book*

close to 2 and a *ROE (2006)* of some 13%. From Panel D we find that the average bank has a board of some 17 individuals, and a blockholder owning some 17% and inside ownership of some 4%.

Second, regarding bank risk the average *Standard risk* is – by construction – close to zero, however, with substantial variation.[13] Average *Share price risk* and *Opaqueness* for December 2006 as proxies for risk taking prior to the crisis are 18.70% and 16.86% respectively. This relatively low stock volatility is due to the high stock market growth in the years 2004-2006, because volatility tends to go down when stock prices increase (*Dumas, Fleming, and Whaley, 1998*). The mean (median) logarithm of the one-year probability of default is -2.76 (-2.69) which equals a 0.06% (0.07%) default probability.[14] The mean (median) *z-Score*, i.e. the inverse of a bank's distance to default, is 0.03 (0.02). These values are similar to those reported by *Beltratti and Stulz, 2012* for the same period.

In contrast, *Tail risk*– measuring negative shareholrder returns during the crises period – is (on average) substantially positive. In fact, average total shareholder return during the July 2007 – December 2008 period is significantly negative with -40.64% and only 57 banks in our sample show positive total shareholder returns during that period. The second measure of tail risk, *Tail risk (2008)*, reveals a similar pattern. Thus, in line with the findings of *Erkens, Hung, and Matos (2012)*, *Beltratti and Stulz (2012)* and others, we find that the majority of European and US banks were substantially affected by the credit crisis.

Table A.5 provides country-level evidence for our bank risk measures. Although there are many factors determining bank risk, the high variation across countries might be a first indication that country-level effects play a role in bank risk taking.

[– Table A.5 goes about here –]

Third, the mean value of total compensation for an average executive is 1,250 tsd. €. Although there are some banks without executive incentives, the average (median) *Incentive-to-*

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[13]*Standard risk* is calculated as the average of the z-transformations of the four ex-ante risk measures. As we could not calculate all risk measures for every bank we end up with a different number of observations for each risk measure. Otherwise the mean of the average of z-transformed variables would be exactly zero.

[14]Note, that *Default risk* is the log-transformation of a variable restricted between 0 and 0.35, which explains the negative values of *Default risk*.

total ratio is 39.24% (38.11%) and the average (median) *Incentive-to-fix (log)* ratio is 3.93% (4.14%). The mean (median) value of *Bonus-to-total* for 2006 performance is 23.27% (22.56%) and the mean (median) value of *Equity-to-total* granted in 2006 is 15.45% (8.73%). The difference between the mean and median value of stock-based incentives suggests that there are some banks which grant relatively high stock-based packages. Moreover, annual bonus compensation as a short-term incentive seems to play an important role in motivating and incentivizing bank managers.

Fourth, summary statistics of our regulatory indicators show that there is a large variation in bank regulation in our sample. Moreover, the variables of bank regulation are negatively skewed. Table A.6 provides more details on country-level regulation. It gives an overview of the bank regulation across the countries and underlines the heterogeneity across countries. We observe the highest regulation of the banking sector in the US. The banking system in the US has the most powerful supervisory authorities, the tightest bank activity restrictions, the highest independence of the supervisory, and the strictest capital requirements (except for Austria). Thus, the overall bank regulation index (*Bank regulation*) of the US ranks highest with a score of 8.30. Surprisingly, Portugal has the second highest overall regulation score. France and Denmark exhibit the most lax regulatory system. Interestingly, there are some countries such as Italy and Austria that have a great heterogeneity across different regulatory dimensions. For instance, while Austria implemented a powerful supervisory authority it has only minor bank activity restrictions. By contrast, Italy has a weak banking supervisory authority, but implemented tight restrictions on bank activities.

[– Table A.6 goes about here –]

3. Empirical results

In this section, we present our empirical results on the interrelation of bank regulation, bank executives' incentives, and risk taking in banks.

We start in Section 3.1 by analyzing the effect of bank regulation on risk taking in large listed banks in a simple regression setting. In Section 3.2 we examine the effect of bank regulation on executive incentives in banks. We combine both perspectives in Section 3.3 and 3.3,

where we examine the effect of bank regulation and the effect of executive incentives on bank risk taking, simultaneously.

3.1. Bank regulation and risk taking in banks

In this section we examine the effect of bank regulation on risk taking in large listed firms using a simple linear regression design taking into account bank characteristics and banks' ownership structure.

Empirical design: Essentially, we estimate variants of the following *simple risk taking model*:

$$Risk\ taking_i = \beta_0 + \beta_1 \times Regulation\ and\ country\ controls_i + \beta_2 \times Ownership\ structure_i \\ + \beta_3 \times Bank\ characteristics_i + \varepsilon_i. \tag{9}$$

Given our dataset the standard analysis is a cross-sectional regression. Robustness tests address the issue of endogeneity by estimating an IV-version of Model (9) . Here, as well as in all following regressions, we account for the fact that our data set spans across countries by estimating standard errors that allow for clustering at the country-level *(e.g. Petersen, 2009)*.

Results: Results are reported in Table A.8, where Specification (1) and (2) examine *Standard risk*, (3) – (6) examine the four components of *Standard risk*, and Specification (7) and (8) analyze *Tail risk*. The choice of right hand side variables is inspired by *Fahlenbrach and Stulz (2011)*, *Aebi, Sabato, and Schmid (2011)*, *Beltratti and Stulz (2012)* and others, but clearly limited due to data availability issues for cross-country data sets.

[– Table A.8 goes about here –]

In Specification (1) and (2) we find a negative correlation between the level of bank regulation and the level of risk taking as measured by *Standard risk*. The coefficient of -0.094 translates into an economic effect of -16% (the standard deviation of *Standard risk* is 0.74, the standard deviation of *Bank regulation* is 1.30). Similar results are found for *Share price risk*, *Opaqueness*, and *Inv. z-score*, while we do not find a significant correlation between *Bank regulation* and *Default risk*. Overall, these findings suggest that bank regulation reduces bank risk

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as measured by risk proxies commonly used in the banking literature.

Things are, however, remarkably different, when we look at the results from specification (7) and (8). There we find a positive correlation between the level of bank regulation and *Tail risk*. An average coefficient of 7 translates into an economic effect of some 25% (the standard deviation of *Tail risk* is 38). Interpreting the measure *Tail risk* as the realization of tail risks, these findings suggest that banks operating under strict bank regulation are more engaged in projects with limited standard risks but extensive tail risks.

Robustness: We challenge the robustness of the results reported in Table A.8 in several ways. *First*, we acknowledge that endogeneity concerns are a challenge for our cross-sectional setting. Specifically, reverse causality might be an issue with regard to *Standard risk* and its four components. We address the endogeneity issue by estimating a cross-sectional IV-version of Model (9) . Thereby, we use a country's legal origin as reported by *La Porta et al. (1998)* to instrument *Bank regulation*. The results, which are reported in Table A.12, fully confirm our baseline results. *Second*, we acknowledge that the banks in our sample may differ with respect to their business model. Accordingly, in unreported additional tests, we include a set of industry dummies (based on the 4-digit SIC code). Again, the results confirm our baseline results. *Third*, we acknowledge that the sample is somehow skewed towards US firms. Accordingly, in unreported additional tests, we (i) restrict our sample to European banks and re-estimate Model (9) and (ii) we estimate WLS-versions of Model (9) weighting banks with the inverse of the number of banks in the same country.[15] The results again support our baseline results.

3.2. Bank regulation and executive incentives

In this section we examine the effect of bank regulation on incentives of bank executives in large listed firms using a simple linear regression design taking into account bank characteristics, ownership and board governance.

Essentially, we are interested in the question whether shareholders consider the level of bank regulation when it comes to designing compensation contracts for their executives. In other words, do executive incentives reflect the level of bank regulation?

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[15]Examining European firms substantially reduces our sample size (see Table A.2 and A.11. This is associated with a loss in statistical power of our results.

Empirical design: Effectively, we estimate variants of the following *incentive model*:

$$\textit{Executive Incentives}_i = \beta_0 + \beta_1 \times \textit{Regulation and country controls}_i$$
$$+ \beta_2 \times \textit{Ownership \& board governance}_i + \beta_3 \times \textit{Bank characteristics}_i + \varepsilon_i,$$
$$(10)$$

where we explain executive incentives (*Total incentives*, *Stock-based incentives*, and *Cash bonus*) by various measures of ownership, board and bank characteristics. Again, our baseline model is a cross-sectional regression model, which we challenge estimating an IV-version of Model (10) .

Results: The results are reported in Table A.9, where we regress various measures of executive incentives (*Incentive-to-total*, *Incentive-to-fix (log)*, *Equity-to-total*, *Equity-to-fix (log)*, *Bonus-to-total*, and *Bonus-to-fix (log)*) on the level of bank regulation (*Bank regulation*) and various control variables. The choice of control variables follows our strategy for Model (9) . Also we add various measures of bank performance, which we expect to determine the extend of incentives and *Staff incentives* in order to measure the bank's overall incentive culture.

[– Table A.9 goes about here –]

The picture emerging from Table A.9 is quite clear: We find a strong positive association between the level of external bank regulation and the level of executive incentives within the bank. Thereby, the economic effect is quite substantial. For instance, the coefficient of Specification (1) translates into an economic effect of some 70% (the standard deviation of *Incentive-to-total* is 23).

Overall, executive incentives reflects the level of bank regulation suggesting that shareholders take into account the level of external regulation when deciding about the incentive structure for their executives.[16] These findings are particularly interesting when we recall the findings

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[16]These findings are in line with recent evidence by *Bryan, Nash, and Patel (2010)* and *Hüttenbrink, Rapp, and Wolff (2011)* which find that the country-specific contracting environment is an important determinant of executive remuneration.

from section 3.1, which suggest that banks operating under strict bank regulation are more engaged in projects with limited standard risks but extensive tail risks. Accordingly, in the next section we examine the effect of bank regulation and executive compensation on risk taking in banks simultaneously.

Robustness: Similarly, to the discussion in Section 3.1, we challenge the robustness of the results reported in Table A.9 in several ways. *First*, again we acknowledge that endogeneity concerns are a challenge for our cross-sectional setting. And again we address this issue by estimating a cross-sectional IV-version of Model (10) , where we use a country's legal origin to instrument *Bank regulation*. The unreported results fully confirm our baseline results. *Second*, we use the data on CEO compensation to re-estimate Model (10) . The results, which are not reported here, again confirm our baseline results. *Third*, we do all the remaining robustness tests described in Section 3.1. The results again support our baseline results.

3.3. Executive incentives, bank regulation and risk taking in banks

In this section we examine the effect of executive incentives and bank regulation on risk taking by banks simultaneously using a simple linear regression design. Essentially, we are interested in two questions:

(i) whether the level of executive incentives is an important determinant of risk taking within banks even after controlling for the level of bank regulation and

(ii) whether the level of bank regulation is (still) an important determinant of risk taking within banks when controlling for the level of bank regulation.

Empirical design: Essentially, we estimate variants of the following *linear risk taking model*:

$$Risk\ taking_i = \beta_0 + \beta_1 \times Executive\ incentives_i + \beta_2 \times Regulation\ and\ country\ controls_i$$
$$+ \beta_3 \times Ownership\ \&\ board\ governance_i + \beta_4 \times Bank\ characteristics_i + \varepsilon_i.$$

$$(11)$$

Given our dataset the standard analysis is a cross-sectional regression. Again, we use IV-methods to address the issue of endogeneity.

Results: Results are reported in Table A.10, where Specifications (1)–(6) are concerned with *Standard risk* and Specifications (7)–(12) with *Tail risk*. With respect to right hand side variables, Specification (1)–(4) and (7)–(10) use *Incentive-to-total* and the remaining Specifications use *Incentive-to-fix (log)* to measure executive incentives. The choice of the remaining right hand side variables is inspired by Table A.8.

[– Table A.10 goes about here –]

Regarding our first issue of interest, the results of Specifications (1)–(6) reported in Table A.10 strongly suggest that executive incentives positively affect risk taking in banks (even after controlling for the level of bank regulation). The results of Specifications (7)–(12) suggest a similar story for executive incentives and *Tail risk*, however at only marginal significance levels.

Given the results from Section 3.2 we argue that the association between executive incentives and *Tail risk* is due to the fact that the association is sensitive to the level of bank regulation. Accordingly, we re-estimate Model (11) allowing β_1 to be a function of *Bank regulation*. Specifically, we estimate a version of Model (11) where we interact *Total incentives* and *Bank regulation*.

The results of this exercise are reported in Table A.11 and provide convincing evidence for our hypothesis. All interaction coefficients are positive and – for our standard risk and incentive measures – highly significant.[17] Overall, we find that the association between executive incentives and bank performance during the credit crises (our tail risk measure) becomes more pronounced in countries with stricter bank regulation.

[– Table A.11 goes about here –]

A final issue that warrants attention in this respect, is the problem of causality. Of course, our cross-sectional regressions in Table A.10 and A.11 only proof correlations. Still, we are

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[17]*Haw et al. (2010)* also find that legal institutions moderate the effects of internal governance mechanisms such as concentrated ownership on bank risk taking.

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confident that our correlations actually capture causation. This is due to various arguments. *First*, standard agency theory suggests that high risk will induce lower levels of executive incentives *(e.g. Holmstrom and Milgrom, 1987)*, a fact that was subsequently confirmed by empirical studies *(e.g. Aggarwal and Samwick, 1999)*. *Second*, with respect to the association between *Total incentives* and *Tail risk* we follow *Fahlenbrach and Stulz (2011)* and *Beltratti and Stulz (2012)* who in effect argue that in 2005 (the time when the executive compensation plans were designed) boards could hardly foresee the credit crises. Technically, we consider the credit crises to represent an exogenous shock that allows us identify causality. *Finally*, with respect to the association between *Total incentives* and *Standard risk* we estimate an IV-version of Model (11) where we instrument the level of incentives by the the country-average of incentives for bank-executives. The results, which are reported in Table A.13, suggest that causality runs from executive incentives to risk taking and not vice versa.

Overall, thus our findings suggest that level of executive incentives is an important determinant of risk taking within banks (even after controlling for the level of bank regulation) and that the effect of incentives on bank risk taking becomes more pronounced in countries with stricter bank regulation.

Regarding our second issue of interest, the results of Specifications (1)–(6) reported in Table A.10 suggest that (even after controlling for executive incentives) bank regulation may limit bank risk taking as measured by standard (symmetric) risk measures commonly used in the banking literature. Note, that this finding differs from the results of *Beltratti and Stulz (2012)* which hardly find any evidence that bank regulation affected pre-crises risk taking of banks. Regarding *Tail risk* the results of Specifications (7)–(12) suggest that (after controlling for executive incentives) the level of bank regulation has no effect on risk taking in banks. While this result is in line with the findings of *Beltratti and Stulz (2012)*, the comparison with the results from Section 3.1 and 3.1 suggests that it is important to consider executive incentives in the analysis of bank risk.

Robustness: Again, we challenge the robustness of the results reported in Table A.10 in several ways. *First*, we use the data on CEO compensation to re-estimate Model (11) . *Second*, as already documented in Table A.11 we restrict our sample to European banks. Also, we ad-

ditionally restrict our sample to large banks. The results, which are not reported here, again confirm our baseline results.

4. Conclusion

In the aftermath of the recent credit crisis much attention is paid to bank behavior. It is widely believed that excessive risk taking by banks did not only contribute to the credit crises but was the starting point of the subsequent economic crisis. Based on anecdotal evidence many critics argue that ill-designed compensation contracts of executives were the driver of excessive risks taken by many banks. Also, it has been argued that lax regulatory regimes facilitated managers' wrongdoing and banks' excessive risk taking.

Consequently, many governments overhauled corporate law and compensation guidelines and tried to tie compensation to long-term performance. For instance, in the US according to the Dodd-Frank Wall Street Reform and Consumer Protection Act, Section 951 n., Federal regulators are endowed with the power to prohibit any compensation structure that encourages inappropriate risk taking in regulated financial institutions. Similarly, European countries such as the UK, France, and Germany have adopted overhauled compensation regulations following recommendations of the Financial Stability Board. Moreover, according to the draft for the CRD IV regulation, the transformation of the Basel III proposals into EU law, detailed rules will govern compensation policies of European banks. However, only little empirical evidence on the recent crisis suggests that regulation of the banking sector had an impact on bank risk taking (*Beltratti and Stulz, 2012*).

Until recently, the academic literature examining the interrelation between regulation, executive compensation, and risk in the banking industry was remarkably sparse and the recently emerging literature provides mixed results so far. This paper aims to contribute to that emerging literature by analyzing the interrelation between regulation, executive incentives and bank taking risk during the recent credit crises in a uniform setting.

Specifically, we empirically examine three issues based on a novel hand-collected data set covering large listed banks in Europe and the US. *First*, we analyze whether bank regulation effectively reduces risk taking within banks. *Second*, we examine executive incentives as an

indirect channel through which bank regulation may affect risk taking of banks. *Third*, we investigate the effect of executive incentives and bank regulation on risk taking of banks simultaneously.

Our results can be summarized as follows. While we find some evidence that bank regulation may effectively reduce bank risk, this finding comes for two drawbacks. First, interpreting a bank's stock market performance during the recent financial crises as a measure for a bank's tail risks, this result solely holds for standard measures of (symmetric) bank risk. In other words, banks operating under stricter regulation seem to engage in risky businesses, e.g. off-balance sheet activities or lending activities, which are not captured by common risk measures. Second, we find evidence that shareholders aim to jeopardize regulation by designing executive remuneration policies with strong emphasis on performance-oriented pay structures as to incentivize managers to outperform competitors in a restricted business. Finally, we find that while there is a general effect of executive incentives on bank risk taking, this effect is more pronounced in banks facing strict regulations.

Taken together our results suggest that while there is some *bright side* of bank regulation, i.e. it reduces *standard* risks of banks, there is also a *dark side* of bank regulation, since shareholders will increase executive incentives and this will fuel tail risks. Accordingly, the main implication of our results for policymakers and regulators is that they should consider shareholders' reaction to regulation. The interactions of regulation and incentives may jeopardize the efforts to stabilize and regulate the banking system in order to prevent the next financial crises.

Appendix

Appendix A. Variable Description

Table A.1: Definition of variables

Variable	Description
Panel A: Bank risk	
Standard risk	Bank risk defined as the equally-weighted average of the z-transformation of following four risk measures: *Share price risk*, *Opaqueness*, *Default risk*, and *Inv. z-score*
Share price risk	The standard deviation of the bank's monthly stock returns measured from January 2004 to December 2006
Opaqueness	The standard deviation of error terms from a two-index market model as specified by eq. (1)
Default risk	Natural logarithm of the average monthly Expected Default Frequency from Moody's KMV as of 2006
Inv. z-score	The inverse of the bank's z-score, where the latter is defined according to eq. (2) , i.e. as the average of the bank's return on assets plus the capital asset ratio divided by the standard deviation of the bank's return on assets both measured over the period 2003-2006
Tail risk	Bank performance during the financial crises, defined as the negative total shareholder return (i.e. capital gains plus dividends) from July 2007 to December 2008 (or the date on which the bank was delisted, whichever is earlier)
Tail risk (2008)	Negative total shareholder return (i.e. capital gains plus dividends) from January 2008 to December 2008 (or the date on which the bank was delisted, whichever is earlier)
Panel B: Regulation proxies and country controls	
Bank regulation	Equally-weighted average of the following four bank regulation indices: *Official*, *Restriction*, *Independence*, and *Capital*
Official	Index of bank supervisory power taken from *Caprio, Laeven, and Levine (2007)*
Restriction	Index of regulatory restrictions on bank activities taken from *Caprio, Laeven, and Levine (2007)*
Independence	Index of independence of supervisory authority from the government taken from *Caprio, Laeven, and Levine (2007)*
Capital	Index of bank capital regulation taken from *Caprio, Laeven, and Levine (2007)*
ADRI	(Revised) Anti-director rights index pioneered by *La Porta et al., 1998* and recently revised by *Djankov et al. (2008)*
Stock market development	Market capitalization of all listed firms in a country divided by the gross domestic product (GPD) in percent
Panel C: Executive compensation	
Incentive-to-total	Incentive level, defined as the cash bonus plus (fair value of) equity-based compensation normalized by total compensation (all values for 2006)
Incentive-to-fix (log)	Alternative proxy for the incentive level, defined as the logarithm of cash bonus plus (fair value of) equity-based compensation normalized by total fix compensation (all values for 2006)
Bonus-to-total	Bonus level, defined as the cash bonus normalized by total compensation (all values for 2006)
Bonus-to-fix (log)	Bonus level 2, defined as the logarithm of cash bonus divided by total fix compensation (salary + other) (all values for 2006)
Equity-to-total	Stock-based incentive level, defined as the (fair value of) stock-based compensation (LTIP, restricted shares, and stock options) normalized by total compensation (all values for 2006)
Equity-to-fix (log)	Stock-based incentive level 2, defined as the logarithm of (fair value of) stock-based compensation (LTIP, restricted shares, and stock options) divided by total fix compensation (salary + other) (all values for 2006)
Excess compensation	Excessive compensation dummy indicating whether the bank-specific residual of a regression explaining the logarithm of the bank executives' fix remuneration (i.e. salary plus others) by *Bank size*, industry and country dummies is positive (all values for 2006)

Table 1 (continued)

Variable	Description
Panel D: Ownership & board governance	
Management	Fraction of voting rights owned by the management board
Blockholder	Fraction of voting rights owned by outside investors
CEO Duality	Dummy variable which takes the value 1 in case that the CEO also chairs the board of directors (in 2006)
Boardsize	Number of directors (executives and non-executives) serving on the board of the bank
Panel E: Bank characteristics	
Bank size	Natural logarithm of *Market capitalization* at the end of fiscal year 2006
Tier 1	Tier-1-capital divided by risk weighted assets at the end of fiscal year 2006
Loans-to-assets	Loans divided by total assets at the end of fiscal year 2006
Market-to-book	Market-to-book value of equity measured as year end market cap divided by common equity at the end of 2006
Leverage	Leverage measured by long-term debt to common equity at the end of fiscal year 2006
ROE (2006)	Net income divided by the book value of common equity at the end of fiscal year 2006
ROE(-1)	Net income divided by the book value of common equity at the end of fiscal year 2005
TSR (2006)	Total shareholder return (defined as capital gains plus dividends) for the year 2006
TSR(-1)	Total shareholder return (defined as capital gains plus dividends) for the year 2005
Staff incentives	Sensitivity of average employee salary to return on equity measured by the coefficient of return on equity in a simple regression of staff costs per employee on market capitalization and return on equity for the period 2002-2006.

Notes: The table describes the set of variables that we use in our empirical analysis. We use accounting and capital market data from Thomson Financial Worldscope and Datastream. Compensation data for US banks are from ExecuComp (if available) and SEC filings (otherwise). For European banks we hand-collect the data from annual reports. Ownership and board data are from SEC filings (US banks) and annual reports (European banks). Regulation proxies are from the existing literature as cited in the table. *Stock market development* is from the Worldbank. Finally, all (absolute) values are translated into €-values using the average over the corresponding monthly exchange rate.

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Tables

Table A.2: Sample

Country	All banks	Large banks	Small banks
Austria	8	5	3
Denmark	15	4	11
Finland	1	0	1
France	5	4	1
Germany	12	8	4
Greece	4	4	0
Ireland	3	3	0
Italy	12	10	2
Netherlands	2	2	0
Portugal	5	4	1
Spain	7	7	0
Sweden	4	4	0
Switzerland	22	14	8
United Kingdom	9	9	0
Europe	*109*	*78*	*31*
United States	243	98	145
Total	**352**	**176**	**176**

Notes: The table reports the geographical distribution of our sample. Overall we examine 352 banks from 15 countries. The table also reports the distribution of large and small banks across countries, where banks classify as large (small) banks whenever their market capitalization in 2006 is above (below) the sample median of 700 mill. € (see Table A.3).

Table A.3: Summary statistics

VARIABLE	MEAN	MEDIAN	MIN	MAX	Obs.
Panel A: Bank risk					
Standard risk	-0.01	-0.10	-1.24	4.60	275
Share price risk	18.70	17.56	2.10	68.89	331
Opaqueness	16.86	15.56	2.09	68.03	329
Default risk	-2.76	-2.69	-4.61	3.56	334
z-Score	0.03	0.02	0.00	0.27	293
Tail risk	40.64	43.56	99.99	-67.37	349
Tail risk (2008)	31.94	34.48	99.99	-67.91	349
Panel B: Regulation proxies and country controls					
Bank regulation	7.41	8.25	4.50	8.25	352
Official	12.04	13.00	6.00	13.00	352
Restriction	10.37	12.00	5.00	12.00	352
Independence	3.59	4.00	1.00	4.00	352
Capital	3.65	4.00	1.00	5.00	352
ADRI	3.12	3.00	2.00	5.00	352
Stock market development	141.22	145.66	53.44	309.92	352
Panel C: Executive compensation					
Incentive-to-total	39.24	38.11	0.00	97.42	329
Incentive-to-fix (log)	3.93	4.14	0.00	8.24	329
Bonus-to-total	23.27	22.56	0.00	79.74	329
Bonus-to-fix (log)	63.43	37.50	0.00	956.00	329
Equity-to-total	15.45	8.73	0.00	97.41	352
Equity-to-fix (log)	64.91	14.96	0.00	3,778.60	329
Excess compensation	0.41	0.00	0.00	1.00	329
Panel D: Ownership & board governance					
Management	4.39	1.43	0.00	86.65	352
Blockholder	16.89	11.08	0.00	97.09	352
CEO Duality	0.37	0.00	0.00	1.00	352
Boardsize	16.53	16.00	5.00	36.00	352
Panel E: Bank characteristics					
Market capitalization	7,963.65	699.97	25.34	218,000.00	352
Bank size	7.01	6.55	3.23	12.29	352
Tier 1	10.96	10.25	6.54	23.65	328
Loans-to-assets	69.46	70.92	30.67	91.44	352
Market-to-book	2.03	1.98	0.46	3.65	352
Staff incentives	-0.04	0.00	-14.04	2.05	352
ROE (2005)	13.18	13.16	2.01	24.54	350
ROE (2006)	12.78	12.62	2.64	26.08	351
Leverage	22.83	18.72	3.35	67.79	352
TSR(2005)	9.17	4.45	-27.82	74.87	338
TSR (2006)	17.72	16.03	-17.43	81.82	347

Notes: The table reports summary statistics for our main variables. The initial sample consists of 352 European and US banks. Compensation levels are measured in thousand €, market capitalization (*Market capitalization*) in million €. Accounting-based bank characteristics are winzorized at the 2%-level All variables are described in Table A.1.

Table A.4: Correlation analysis of bank risk

Regression method		25%-Quantile	Median	Mean	75%-Quantile	
Dep. variable	Expl. variable	coeff.	coeff.	coeff.	coeff.	Observations
Panel A: Tail risk versus Standard risk						
Tail risk	*Standard risk*	9.846 **	11.530 *	9.845 ***	9.953 ***	275
		(2.00)	(1.90)	(3.30)	(2.71)	
Panel B: Tail risk versus the four components of Standard risk						
Tail risk	*Share price risk*	0.834	1.523 ***	0.964 ***	0.988 ***	331
		(1.57)	(2.66)	(3.36)	(3.43)	
Tail risk	*Opaqueness*	0.989 *	1.700 ***	1.035 ***	1.178 ***	329
		(1.70)	(2.63)	(3.36)	(3.99)	
Tail risk	*Default risk*	-2.724	-2.454	-1.308	3.154 **	334
		(-1.08)	(-0.68)	(-0.70)	(2.05)	
Tail risk	*z-Score*	225.836 **	306.717 ***	223.543 ***	222.272 ***	290
		(2.49)	(2.78)	(3.72)	(4.30)	
Panel C: The four components of Standard risk versus Standard risk						
Share price risk	*Standard risk*	8.013 ***	8.654 ***	8.393 ***	8.783 ***	274
		(22.70)	(53.54)	(37.79)	(33.90)	
Opaqueness	*Standard risk*	7.120 ***	7.956 ***	7.871 ***	8.010 ***	274
		(34.62)	(31.68)	(36.23)	(28.24)	
Default risk	*Standard risk*	1.162 ***	1.211 ***	0.973 ***	1.117 ***	275
		(8.76)	(12.86)	(15.36)	(23.81)	
z-Score	*Standard risk*	0.008 ***	0.013 ***	0.027 ***	0.029 ***	275
		(9.71)	(9.75)	(10.79)	(11.95)	

Notes: The table reports results from univariate cross-sectional 25%-quantile, median, OLS, and 75%-quantile regressions to study the correlation structure among our bank risk measures. *Tail risk* measures bank risk by looking at the stock-market performance of the bank during the recent financial crises (July 2007 - December 2008) following *Fahlenbrach and Stulz (2011)*. *Standard risk* measures bank risk as the equally-weighted average of the z-transformation of four classical measures of bank risk. The four components of *Standard risk* are: *Share price risk*, *Opaqueness*, *Default risk*, and *Inv. z-score*. All variables are described in Table A.1. * if p<0.1, ** if p<0.05, *** if p<0.01

Table A.5: Country-level bank risk

	Standard risk		Share price risk		Opaqueness		Default risk		Inv. z-score		Tail risk		Tail risk (2008)	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Austria	-0.028	-0.106	18.22	19.66	15.91	16.97	0.13	0.05	0.06	0.06	27.44	11.13	26.13	9.16
Switzerland	-0.483	-0.569	13.56	12.95	12.30	11.42	1.65	0.05	0.02	0.02	21.94	18.16	17.06	10.80
Germany	1.367	1.111	24.29	19.47	24.01	18.13	0.19	0.11	0.13	0.12	37.35	31.31	36.78	37.70
Denmark	0.177	0.251	21.02	21.42	20.22	20.92	0.05	0.04	0.03	0.03	70.84	69.26	67.00	69.53
Spain	-0.423	-0.454	15.35	14.81	12.97	11.63	0.02	0.02	0.04	0.05	50.10	49.06	43.42	45.68
Finland	-0.546	-0.546	11.24	11.24	10.52	10.52	0.06	0.06	0.02	0.02	28.72	28.72	35.65	35.65
France	-0.278	-0.541	15.92	14.84	13.70	11.48	0.05	0.06	0.04	0.03	71.72	69.65	64.83	60.58
United Kingdom	-0.302	-0.255	14.88	15.85	12.38	12.97	0.08	0.04	0.04	0.03	71.87	75.32	57.41	65.98
Greece	1.053	0.603	28.01	22.98	24.99	19.40	0.06	0.07	0.08	0.09	70.18	69.63	66.28	70.79
Ireland	-0.531	-0.531	16.25	15.09	12.99	11.95	0.02	0.01	0.04	0.04	94.06	93.36	92.03	90.41
Italy	-0.021	-0.058	17.91	17.09	16.02	15.61	0.09	0.05	0.04	0.04	48.65	48.46	40.48	41.63
Netherlands	0.326	0.326	18.32	18.32	16.21	16.21	0.04	0.04	0.10	0.10	10.64	10.64	16.03	16.03
Portugal	0.830	0.463	21.92	20.78	20.21	19.39	0.06	0.03	0.08	0.03	67.88	71.25	61.40	64.22
Sweden	-0.114	-0.248	16.18	16.10	14.19	14.30	0.04	0.04	0.06	0.04	57.14	59.01	54.32	54.35
United States	-0.022	-0.068	19.01	17.73	17.12	16.00	0.12	0.09	0.02	0.01	36.88	35.17	26.47	27.03
Total	**-0.012**	**-0.100**	**18.70**	**17.56**	**16.86**	**15.56**	**0.21**	**0.07**	**0.03**	**0.02**	**40.64**	**43.56**	**31.94**	**34.48**

Notes: The table reports descriptive statistics on our bank risk measures. Our first key measures is *Standard risk*, which aggregates *Share price risk*, *Opaqueness*, *Default risk*, and *Inv. z-score*. Our second key measure is *Tail risk*. *Tail risk (2008)* is used for robustness tests. All variables are described in Table A.1.

Table A.6: County-level bank regulation and controls

	Bank regulation	Official	Restriction	Independence	Capital	ADRI	Stock market development
Austria	6	13	5	1	5	2.5	60
Denmark	4.8	8	8	1	2	4	84
Finland	5	8	7	1	4	3.5	128
France	4.5	7	6	3	2	3.5	107
Germany	5	10	5	4	1	3.5	56
Greece	5.8	10	9	1	3	2	79
Ireland	5.5	9	8	4	1	5	74
Italy	5.5	6	10	2	4	2	55
Netherlands	5.3	8	6	4	3	2.5	115
Portugal	7.3	13	9	4	3	2.5	53
Spain	5.8	9	7	3	4	5	107
Sweden	5.3	6	9	3	3	3.5	144
Switzerland	6	13	5	3	3	3	310
United Kingdom	5.8	11	5	4	3	5	156
United States	8.3	13	12	4	4	3	146
Median	5.5	9	7	3	3	3.5	107

Notes: The table reports descriptive statistics on our bank regulation indicators and country controls. The country-level indicators *Official*, *Restriction*, *Independence*, and *Capital* are from *Caprio, Laeven, and Levine (2007)*. *Bank regulation* aggregates them (by simply summing all four indicators). *ADRI* is from *Djankov et al. (2008)*, and *Stock market development* from the Worldbank. All variables are described in Table A.1.

Table A.7: Country-level compensation of bank executives

	Total compensation (in tsd. €)		Incentive-to-total		CEO total compensation (in tsd. €)	
	Mean	Obs.	Mean	Obs.	Mean	Obs.
Austria	650	8	34.6	6	2,668	1
Belgium	1,254	5	45.5	5	1,597	4
Switzerland	1,508	23	35.9	9	555	3
Germany	1,388	14	49.2	11	2,795	9
Denmark	446	15	12.1	13	474	7
Spain	2,017	7	51.5	6	3,112	5
Finland	217	1	0.0	1	635	1
France	1,665	5	55.8	4	2,045	5
United Kingdom	6,199	9	72.3	9	9,330	9
Greece	491	4	3.6	4	n.a.	0
Ireland	1,498	3	45.2	3	3,390	3
Island	1,354	2	48.0	1	1,328	2
Italy	2,520	12	33.3	11	2,867	12
Netherlands	1,657	2	55.4	2	2,124	2
Norway	247	7	7.9	7	323	7
Portugal	1,038	5	55.5	5	n.a.	0
Sweden	723	4	25.1	4	1,124	4
United States	1,029	243	39.1	243	1,921	243
Total	1,229	369	38.5	344	2,096	317

Notes: The table reports descriptive statistics on executive compensation and incentives in banks. *Total compensation (in tsd. €)* measures the compensation level for the average executive. *Incentive-to-total* is our main incentive measure. It is defined as the fraction (in percent) of incentives in the total compensation, i.e. the performance-oriented part of total compensation due to bonus and/or stock-based incentives. *CEO total compensation (in tsd. €)* measures the compensation level for the chief executive officer. Note, that disclosure requirements vary within Europe. Accordingly, the number of observations for CEO compensation is smaller than for the average executive. CEO compensation for banks in Portugal and Greece is not credibly available.

Table A.8: Regulation and risk taking in banks

Specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Components of *Standard risk*				
Dep. variable	*Standard risk*		*Share price risk*	*Opaqueness*	*Default risk*	*Inv. z-score*	*Tail risk*	
Regulation and country controls								
Bank regulation	-0.078*	-0.094***	-0.380**	-0.386**	0.021	-0.007**	7.162**	6.872**
	(-2.011)	(-3.390)	(-2.735)	(-2.304)	(0.295)	(-2.644)	(2.537)	(2.165)
ADRI	-0.052	-0.040	-0.254	-0.387	-0.006	-0.004	11.437**	10.999**
	(-0.618)	(-0.499)	(-0.573)	(-0.892)	(-0.049)	(-0.945)	(2.688)	(2.642)
Stock market development	-0.001**	-0.002**	-0.015***	-0.015***	0.002**	-0.000	0.022	0.031
	(-2.246)	(-2.313)	(-5.361)	(-5.905)	(2.481)	(-0.771)	(0.626)	(0.967)
Ownership								
Management		0.012***	0.120***	0.113***	0.007**	0.000		0.211**
		(3.295)	(4.483)	(3.734)	(2.166)	(1.541)		(2.914)
Blockholder		0.002	0.008	0.006	0.003	0.000		-0.051
		(0.821)	(0.306)	(0.263)	(1.247)	(1.205)		(-0.370)
Bank characteristics								
Bank size	-0.214***	-0.199***	-1.518***	-1.444***	-0.374***	-0.002**	0.237	0.429
	(-9.901)	(-11.474)	(-6.864)	(-13.977)	(-3.994)	(-2.761)	(0.246)	(0.376)
Tier 1	-0.019***	-0.019**	0.029	0.027	-0.061***	-0.001***	-2.475***	-2.570***
	(-3.897)	(-2.929)	(0.307)	(0.415)	(-10.080)	(-3.328)	(-4.063)	(-4.166)
Loans-to-assets	-0.006	-0.006	-0.063*	-0.033	-0.012***	-0.000***	0.366	0.365
	(-1.357)	(-1.513)	(-2.103)	(-1.024)	(-3.224)	(-3.711)	(1.369)	(1.398)
Leverage	0.007*	0.007	0.035***	0.030***	0.008**	0.001*	0.280	0.300*
	(1.766)	(1.648)	(3.158)	(3.765)	(2.428)	(2.142)	(1.506)	(1.796)
Market-to-book	0.219***	0.221***	1.850**	1.670***	0.037	0.006**	-27.001***	-27.450***
	(3.944)	(4.808)	(2.625)	(3.040)	(0.458)	(2.467)	(-7.528)	(-7.671)
Staff incentives		-0.003	0.214***	0.318***	-0.059***	-0.001***		-4.121***
		(-0.677)	(4.567)	(7.939)	(-4.655)	(-3.274)		(-9.536)
ROE (2006)							-0.451	-0.326
							(-0.813)	(-0.561)
ROE (2005)							2.229***	2.170***
							(3.942)	(3.755)
TSR(2005)							0.146	0.146
							(1.299)	(1.393)
TSR (2006)							0.723***	0.727***
							(8.530)	(7.718)
# Observations	257	257	308	308	313	274	313	313
Adj. R^2	0.245	0.284	0.206	0.230	0.344	0.319	0.312	0.324

Notes: The table reports results from cross-sectional OLS regressions of bank risk on regulation and bank characteristics. *Standard risk* measures bank risk as the equally-weighted average of the z-transformation of four classical measures of bank risk (*Share price risk*, *Opaqueness*, *Default risk*, and *Inv. z-score*). *Tail risk* measures bank risk by looking at the stock-market performance of the bank during the recent financial crises (July 2007 - December 2008) following *Fahlenbrach and Stulz (2011)*. Values in parentheses are robust t-statistics clustered at the country-level. Constant is not reported. All variables are described in Table A.1. * if p<0.1, ** if p<0.05, *** if p<0.01

Table A.9: Regulation and executive incentives in banks

Specification	(1)	(2)	(3)	(4)	(5)	(6)
	Total incentives		*Stock-based incentives*		*Cash bonus*	
Dep. variable	*Incentive-to-total*	*Incentive-to-fix (log)*	*Equity-to-total*	*Equity-to-fix (log)*	*Bonus-to-total*	*Bonus-to-fix (log)*
Regulation and country controls						
Bank regulation	12.325***	0.926***	10.430***	1.034***	6.762**	0.840***
	(4.270)	(4.385)	(3.307)	(3.265)	(2.302)	(3.441)
ADRI	3.058	0.249	6.349	0.933**	0.737	0.112
	(1.154)	(1.207)	(1.574)	(2.089)	(0.276)	(0.466)
Stock market development	0.032	0.004	0.137***	0.018***	-0.063	-0.001
	(0.738)	(1.493)	(3.505)	(3.202)	(-1.467)	(-0.340)
Ownership & board governance						
Management	-0.090	-0.003	-0.173***	-0.015***	0.057	0.005
	(-1.379)	(-0.832)	(-3.365)	(-2.869)	(0.986)	(1.028)
Blockholder	0.126	0.010	0.089	0.015	0.113	0.015**
	(1.012)	(1.458)	(0.988)	(1.275)	(1.427)	(2.224)
CEO Duality	-1.121	-0.167	2.356	0.373**	-3.251	-0.193
	(-0.571)	(-1.142)	(1.593)	(2.199)	(-1.309)	(-1.128)
Boardsize	-0.428	-0.024	-0.425**	-0.043	-0.095	-0.020
	(-1.167)	(-1.053)	(-2.113)	(-1.635)	(-0.269)	(-0.849)
Bank characteristics						
Bank size	8.749***	0.490***	7.217***	0.649***	3.131**	0.430***
	(8.933)	(10.131)	(4.951)	(3.896)	(2.439)	(4.533)
Tier 1	-1.389***	-0.103***	-1.166***	-0.157***	-0.579*	-0.078***
	(-4.267)	(-3.271)	(-4.096)	(-5.196)	(-1.771)	(-2.636)
Loans-to-assets	-0.055	-0.006	0.058	-0.005	-0.117	-0.008
	(-0.465)	(-0.760)	(0.488)	(-0.278)	(-1.527)	(-1.348)
Leverage	0.281***	0.024***	0.056	0.001	0.224**	0.020***
	(2.787)	(2.634)	(0.428)	(0.089)	(1.970)	(2.646)
Market-to-book	-3.583	-0.206	-0.516	-0.012	-3.460	-0.228
	(-1.445)	(-1.003)	(-0.236)	(-0.064)	(-1.328)	(-0.962)
ROE (2006)	0.518	0.020	0.267	0.010	0.432	0.057**
	(1.340)	(0.642)	(0.857)	(0.268)	(1.392)	(2.371)
ROE (2005)	0.017	0.002	-0.535	-0.053	0.357	-0.012
	(0.034)	(0.056)	(-1.365)	(-1.197)	(0.789)	(-0.316)
TSR(2005)	0.002	0.004	-0.221	-0.018	0.129*	0.010
	(0.024)	(0.738)	(-1.645)	(-1.154)	(1.851)	(1.543)
TSR (2006)	0.184**	0.012**	0.159	0.018**	0.068	0.001
	(2.395)	(2.415)	(1.614)	(2.115)	(1.588)	(0.206)
Staff incentives	0.206	0.003	-0.447	0.007	1.585	0.237***
	(0.383)	(0.095)	(-1.078)	(0.151)	(1.590)	(2.621)
# Observations	303	303	313	303	303	303
Pseudo R^2	0.0708	0.155	0.0630	0.102	0.0411	0.117

Notes: The table reports results from cross-sectional tobit regressions of executive incentives on regulation, bank-level governance and bank-specific control variables. *Incentive-to-total* is our main incentive measure. It is defined as the fraction (in percent) of incentives in the total compensation, i.e. the performance-oriented part of total compensation due to bonus and/or stock-based incentives. *Equity-to-total* and and *Bonus-to-total* are two alternative incentive measures focusing on stock-based incentives and bonus payments, respectively. Values in parentheses are robust t-statistics clustered at the country-level. Constant is not reported. All variables are described in Table A.1. * if p<0.1, ** if p<0.05, *** if p<0.01

Table A.10: Executive incentives, regulation and risk taking in banks

Specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dep. variable	Standard risk						Tail risk					
Executive incentives												
Incentive-to-total	0.004**	0.004**	0.004***	0.004***			0.371***	0.237*	0.219**	0.220*		
	(2.964)	(2.971)	(3.172)	(3.101)			(3.198)	(2.120)	(2.166)	(2.082)		
Incentive-to-fix (log)					0.084***	0.075**					5.048**	2.430
					(3.081)	(2.846)					(2.252)	(1.287)
Excess compensation	0.065	0.039	0.060	0.061	0.059	0.054	14.852***	7.082**	6.653**	6.858**	13.244***	6.129**
	(1.575)	(1.056)	(1.619)	(1.642)	(1.469)	(1.513)	(8.036)	(2.551)	(2.560)	(2.765)	(8.494)	(2.438)
Regulation and country controls												
Bank regulation	-0.124**	-0.140***	-0.109**	-0.109**	-0.140**	-0.125**	-5.121***	2.385	2.479	3.146	-5.837***	3.376
	(-2.348)	(-3.256)	(-2.566)	(-2.560)	(-2.630)	(-2.790)	(-3.172)	(1.009)	(1.116)	(1.346)	(-3.482)	(1.593)
ADRI	-0.091	-0.080	-0.092	-0.092	-0.099	-0.099	4.740	8.077	6.919	6.843	5.049	7.014
	(-1.180)	(-1.055)	(-1.122)	(-1.125)	(-1.222)	(-1.145)	(1.140)	(1.758)	(1.531)	(1.521)	(1.163)	(1.553)
Stock market development	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.027	0.111**	0.098**	0.100**	-0.032	0.094**
	(-1.041)	(-1.121)	(-1.261)	(-1.260)	(-1.331)	(-1.501)	(-0.758)	(2.730)	(2.606)	(2.775)	(-0.906)	(2.940)
Ownership & board governance												
Management		0.012***	0.013***	0.013***		0.012***		0.212***	0.120**	0.104*		0.093*
		(3.480)	(3.850)	(3.858)		(3.884)		(3.022)	(2.352)	(2.138)		(2.128)
Blockholder		0.002	0.001	0.001		0.001		-0.031	0.026	0.036		0.039
		(0.742)	(0.471)	(0.472)		(0.401)		(-0.234)	(0.192)	(0.265)		(0.291)
CEO Duality			-0.176***	-0.176***		-0.166***			6.462***	6.515***		6.808***
			(-3.653)	(-3.670)		(-3.475)			(5.379)	(5.373)		(5.856)
Boardsize			-0.001	-0.001		-0.001			-0.892**	-0.880**		-0.917**
			(-0.088)	(-0.086)		(-0.069)			(-2.759)	(-2.675)		(-2.753)
Bank characteristics												
Bank size	-0.243***	-0.232***	-0.215***	-0.214***	-0.246***	-0.217***		-0.608	0.705	0.741		1.355
	(-7.970)	(-8.783)	(-6.482)	(-6.508)	(-8.221)	(-6.416)		(-0.577)	(0.497)	(0.511)		(0.951)
Tier 1	-0.013*	-0.014	-0.014*	-0.014*	-0.011*	-0.012		-2.163***	-2.372***	-2.495***		-2.521***
	(-2.137)	(-1.627)	(-1.784)	(-1.765)	(-1.877)	(-1.563)		(-3.744)	(-4.497)	(-4.774)		(-5.113)
Loans-to-assets	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005		0.461*	0.441*	0.445*		0.449*
	(-1.164)	(-1.349)	(-1.264)	(-1.253)	(-1.096)	(-1.193)		(2.019)	(1.931)	(1.967)		(1.914)
Leverage	0.007	0.006	0.006	0.006	0.006	0.006		0.229	0.242**	0.261**		0.264**
	(1.511)	(1.461)	(1.479)	(1.469)	(1.475)	(1.437)		(1.455)	(2.280)	(2.459)		(2.507)
Market-to-book	0.225***	0.224***	0.230***	0.230***	0.224***	0.229***		-24.808***	-25.963***	-26.897***		-27.360***
	(3.661)	(4.236)	(4.370)	(4.357)	(3.602)	(4.242)		(-7.624)	(-8.156)	(-7.911)		(-7.976)
Staff incentives				-0.006		-0.005				-4.265***		-4.223***
				(-0.621)		(-0.524)				(-6.691)		(-7.158)
ROE (2006)								-0.666	-0.435	-0.223		-0.154
								(-1.078)	(-0.726)	(-0.374)		(-0.265)
ROE (2005)								2.106***	1.789***	1.725***		1.724***
								(3.998)	(4.809)	(4.123)		(4.147)
TSR(2005)								0.132	0.140	0.149		0.138
								(1.222)	(1.387)	(1.511)		(1.426)
TSR (2006)								0.628***	0.624***	0.655***		0.668***
								(10.088)	(8.630)	(8.159)		(8.030)
# Observations	248	248	248	248	248	248	326	303	303	303	326	303
Adj. R^2	0.259	0.296	0.310	0.310	0.269	0.316	0.123	0.337	0.351	0.360	0.114	0.355

Notes: The table reports results from cross-sectional OLS regressions of bank risk on executive incentives, regulation, bank-level governance and bank-specific control variables. *Standard risk* measures bank risk as the equally-weighted average of the z-transformation of four classical bank risk measures (*Share price risk*, *Opaqueness*, *Default risk*, and *Inv. z-score*). *Tail risk* measures bank risk by looking at the stock-market performance of the bank during the recent financial crises (July 2007 - December 2008) following *Fahlenbrach and Stulz (2011)*. Values in parentheses are robust t-statistics clustered at the country-level. Constant is not reported. All variables are described in Table A.1. * if p<0.1, ** if p<0.05, *** if p<0.01

Table A.11: Re-examining executive incentives, regulation and risk taking in banks

Specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Sample	Full sample						European banks			
Dep. variable	*Tail risk*			*Tail risk (2008)*			*Tail risk*		*Tail risk (2008)*	
Executive incentives										
Incentive-to-total	0.306***			0.266***			0.789		0.808	
	(6.762)			(5.247)			(1.567)		(1.700)	
Incentive-to-total x *Bank regulation (centered)*	0.142***			0.168***			0.415*		0.469**	
	(3.215)			(4.062)			(1.782)		(2.273)	
Incentive-to-fix (log)		4.463***			3.963***			9.827		11.192
		(6.253)			(5.326)			(1.502)		(1.712)
Incentive-to-fix (log) x *Bank regulation (centered)*		2.258***			2.439***			4.719		5.691*
		(3.751)			(4.463)			(1.546)		(1.987)
Equity-to-total			0.223***			0.198***				
			(4.318)			(4.207)				
Equity-to-total x *Bank regulation (centered)*			0.088			0.153***				
			(1.601)			(3.289)				
Bonus-to-total			0.428***			0.363***				
			(5.770)			(5.034)				
Bonus-to-total x *Bank regulation (centered)*			0.218***			0.207***				
			(4.018)			(3.726)				
Excess fix compensation	0.007***		0.007***	0.007***		0.007***	0.005		0.005	
	(3.557)		(3.205)	(3.147)		(3.114)	(1.258)		(1.213)	
Excess compensation		7.463***			9.327***			15.839***		15.187***
		(3.623)			(4.661)			(4.190)		(5.489)
Regulation and country controls										
Bank regulation	-2.521	-5.095	-3.470	-3.962	-6.177	-4.690	-21.876	-22.611	-24.898*	-27.734*
	(-0.945)	(-1.471)	(-1.293)	(-1.451)	(-1.689)	(-1.691)	(-1.547)	(-1.481)	(-1.836)	(-1.889)
ADRI	8.655*	7.776*	8.706*	8.799**	7.593*	8.935**	5.332	4.275	5.331	4.006
	(2.064)	(1.871)	(1.985)	(2.258)	(1.968)	(2.173)	(1.428)	(1.181)	(1.479)	(1.172)
Stock market development	0.109***	0.125***	0.110***	0.084**	0.101***	0.091**	0.028	0.031	-0.023	-0.020
	(3.458)	(4.176)	(3.030)	(2.316)	(2.981)	(2.292)	(0.456)	(0.508)	(-0.396)	(-0.350)
Ownership & board governance	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Bank characteristics	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
# Observations	303	303	303	303	303	303	78	78	78	78
Adj. R^2	0.378	0.374	0.383	0.370	0.369	0.372	0.474	0.501	0.469	0.481

Notes: The table reports results from cross-sectional OLS regressions of bank risk on executive incentives, regulation, bank-level governance and bank-specific control variables. *Tail risk* measures bank risk by looking at the stock-market performance of the bank during the recent financial crises (July 2007 - December 2008) following *Fahlenbrach and Stulz (2011)*. Similarly, *Tail risk (2008)* is defined as the bank's stock market performance during the calendar year 2008. Values in parentheses are robust t-statistics clustered at the country-level. All specifications control for ownership & board governance as well as bank characteristics using the proxies employed in Model (3) and (4) in Table A.10. All variables are described in Table A.1. * if $p<0.1$, ** if $p<0.05$, *** if $p<0.01$

Table A.12: Regulation and risk taking in banks – Endogeneity concerns

Specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			Components of *Standard risk*					
Dep. variable (2nd stage)	*Standard risk*		*Share price risk*	*Opaqueness*	*Default risk*	*Inv. z-score*	*Tail risk*	
	2nd stage	psd. 1st stage	2nd stage	2nd stage	2nd stage	2nd stage	2nd stage	psd. 1st stage
Regulation and country controls								
Bank regulation	-0.086***		-0.348**	-0.400**	0.072	-0.008***	10.358***	
	(-2.921)		(-2.387)	(-2.155)	(0.976)	(-2.996)	(3.285)	
ADRI	-0.038	-0.651*	-0.236	-0.395	0.023	-0.004	12.509***	-0.626**
	(-0.513)	(-2.144)	(-0.563)	(-1.003)	(0.196)	(-1.070)	(3.224)	(-2.193)
Stock market development	-0.002**	0.002*	-0.015***	-0.015***	0.002***	-0.000	0.019	0.002*
	(-2.460)	(2.091)	(-5.730)	(-6.196)	(2.622)	(-0.803)	(0.612)	(1.959)
Instruments								
French law origin		-2.200***						-2.126***
		(-4.095)						(-3.880)
German law origin		-2.392***						-2.239***
		(-12.068)						(-7.739)
Scandinavian law origin		-2.599***						-2.364***
		(-9.955)						(-8.195)
Ownership	yes	yes	yes	yes	yes	yes	yes	yes
Bank characteristics	yes	yes	yes	yes	yes	yes	yes	yes
# Observations	257	328	308	308	313	274	313	313
Adj. R^2	0.284	0.913	0.206	0.230	0.342	0.319	0.320	0.918

Notes:

The table reports results from cross-sectional IV-regressions of bank risk on bank regulation. *Standard risk* measures bank risk as the equally-weighted average of the z-transformation of four classical measures of bank risk (*Share price risk*, *Opaqueness*, *Default risk*, and *Inv. z-score*). *Tail risk* measures bank risk by looking at the stock-market performance of the bank during the recent financial crises (July 2007 - December 2008) following *Fahlenbrach and Stulz (2011)*. Specification (1), (3) – (6), and (8) report results from the 2nd stage regression. Model (2) and (7) report results from a standard OLS regression of the endogenous variables of the 2nd stage regression on the instruments and controls (pseudo 1st stage). We use the countries' legal origin (*French law origin*, *German law origin*, and *Scandinavian law origin*) to instrument bank regulation. Values in parentheses are robust t-statistics clustered at the country-level. All specifications control for ownership & board governance as well as bank characteristics using the proxies employed in in Table A.8. Values in parentheses are robust t-statistics clustered at the country-level. Constant is not reported. All variables are described in Table A.1. * if p<0.1, ** if p<0.05, *** if p<0.01

Table A.13: Executive incentives, regulation and risk taking in banks – Endogeneity concerns

Specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	2nd stage	psd. 1st stage	2nd stage	psd. 1st stage	2nd stage	psd. 1st stage	psd. 1st stage	2nd stage	psd. 1st stage	psd. 1st stage
Dep. variable	*Standard risk*	*Incentive-to-total*	*Standard risk*	*Incentive-to-fix (log)*	*Standard risk*	*Equity-to-total*	*Bonus-to-total*	*Standard risk*	*Equity-to-fix (log)*	*Bonus-to-fix (log)*
Executive incentives										
Incentive-to-total	0.017**									
	(2.120)									
Incentive-to-fix (log)			0.185**							
			(2.087)							
Equity-to-total					0.020***					
					(2.612)					
Bonus-to-total					0.017**					
					(1.962)					
Equity-to-fix (log)								0.140***		
								(2.867)		
Bonus-to-fix (log)								0.144*		
								(1.723)		
Excess compensation	0.120***	-5.612***	0.069**	-0.206*	0.127***	-2.760**	-2.519*	0.117***	-0.381**	-0.235
	(2.637)	(-3.141)	(2.185)	(-1.795)	(2.618)	(-2.165)	(-2.138)	(2.622)	(-2.666)	(-1.679)
Instruments										
Incentive-to-total (Country-average)		0.538***								
		(3.049)								
Equity-to-total (Country-average)						0.662***	-0.112			
						(4.491)	(-1.399)			
Bonus-to-total (Country-average)						-0.322*	0.848***			
						(-1.956)	(13.520)			
Incentive-to-fix (log; Country-average)				0.649***						
				(4.351)						
Equity-to-fix (log; Country-average)									0.917***	-0.025
									(8.537)	(-0.293)
Bonus-to-fix (log; Country-average)									-0.394**	0.731***
									(-2.202)	(7.610)
Regulation and country controls										
Bank regulation	-0.222***	5.401***	-0.196***	0.364***	-0.235***	3.144**	1.643***	-0.239***	0.391**	0.254***
	(-2.857)	(3.486)	(-2.769)	(4.469)	(-3.265)	(2.354)	(3.123)	(-3.539)	(2.899)	(3.460)
ADRI	-0.145*	-0.317	-0.130	-0.066	-0.149*	0.298	-1.033	-0.152*	0.028	-0.096
	(-1.860)	(-0.136)	(-1.497)	(-0.494)	(-1.818)	(0.158)	(-1.318)	(-1.838)	(0.178)	(-1.027)
Stock market development	-0.001*	0.018	-0.002**	0.003*	-0.002*	0.020	0.013	-0.003**	0.001	0.002
	(-1.726)	(0.609)	(-2.016)	(1.993)	(-1.647)	(0.961)	(1.058)	(-2.281)	(0.294)	(1.188)
Ownership & board governance	yes	yes	yes	yes	yes	yes	yes			
Bank characteristics	yes	yes	yes	yes	yes	yes	yes			
# Observations	248	317	248	317	248	317	317			
Adj. R^2	0.181	0.485	0.186	0.482	0.151	0.333	0.388			

Notes: The table reports results from cross-sectional IV-regressions of bank risk on executive incentives, regulation, bank-level governance and bank-specific control variables. *Standard risk* measures bank risk as the equally-weighted average of the z-transformation of four classical bank risk measures (*Share price risk*, *Opaqueness*, *Default risk*, and *Inv. z-score*). Model (1), (3), (5), and (8) report results from the 2nd stage regression. Model (2), (4), (6), (7), (9), and (10) report results from a standard OLS regression of the endogeneous variables of the 2nd stage regression on the instrument and controls (pseudo 1st stage). We use country-level averages (*Incentive-to-total (Country-average)*, *Equity-to-total (Country-average)*, and *Bonus-to-total (Country-average)*) to instrument bank-level incentives. Values in parentheses are robust t-statistics clustered at the country-level. All specifications control for ownership & board governance as well as bank characteristics using the proxies employed in Model (3) and (4) in Table A.10. All variables are described in Table A.1.   * if p<0.1, ** if p<0.05, *** if p<0.01