Executive Board Composition and Bank Risk Taking

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Abstract

Little is known about how socioeconomic characteristics of executive teams affect corporate governance in banking. Exploiting a unique dataset from Germany which operates a two-tier system of corporate governance that separates inside directors (i.e., executives that run the bank) into a management board, and outside directors into a supervisory board, we show how age, gender, and education composition of executive teams affect risk taking. First, we establish that age, gender, and education of the management board jointly affect the variability of bank performance. Second, we use difference-in-difference estimations that focus on mandatory executive retirements and find that younger executive teams increase risk taking, as do board changes that result in a higher proportion of female executives. In contrast, if board changes increase the representation of executives holding Ph.D. degrees, risk taking declines.

Keywords: banks, top management teams, corporate governance, risk taking, age, gender, education

JEL Classifications: G21, G34, I21, J16

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Abstract

Little is known about how socioeconomic characteristics of executive teams affect corporate governance in banking. Exploiting a unique dataset from Germany which operates a two-tier system of corporate governance that separates inside directors (i.e., executives that run the bank) into a management board, and outside directors into a supervisory board, we show how age, gender, and education composition of executive teams affect risk taking. First, we establish that age, gender, and education of the management board jointly affect the variability of bank performance. Second, we use difference-in-difference estimations that focus on mandatory executive retirements and find that younger executive teams increase risk taking, as do board changes that result in a higher proportion of female executives. In contrast, if board changes increase the representation of executives holding Ph.D. degrees, risk taking declines.

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I. Introduction

Corporate governance research has devoted tremendous effort to studying boards of directors.[1] Those studies focus on board independence in terms of inside and outside directors (Hermalin and Weisbach (1988); Linck, Netter, and Yang (2008)), how composition affects CEO turnover (Weisbach (1988)); determinants of board size (e.g., Boone, Field, Karpoff, and Raheja (2007)), conditions under which boards are controlled by insiders (Harris and Raviv (2006)), ownership structure and board composition (Denis and Sarin (1999)), and performance effects of outsiders (e.g., Hermalin and Weisbach (1991); Dahya and McConnell (2007); Coles, Daniel, and Naveen (2008); Nguyen and Nielsen (2010)). Recent studies relate board diversity in terms of gender to performance (Farrell and Hersch (2005); Adams and Ferreira (2009); Huang and Kisgen (2009); Faccio, Marchica, and Mura (2001); Ahern and Dittmar (2012)).

Despite this large literature, economists have given less consideration to the socioeconomic composition of top management teams, i.e., the inside directors that are charged with the day-to-day running of the firm such as the CEO, the CFO, and the COO. While some studies show that individual executives matter for firm behavior (Bertrand and Schoar (2003); Adams, Almeida, and Ferreira (2005); Malmendier and Tate (2005, 2008, 2011)), we are not aware of any study that explores the ramifications arising from top management team composition in terms of age, gender, and education for risk-taking.[2] Our research aims to fill this gap using a unique dataset for the German banking industry that covers the entire population of executives.

1 Adams, Hermalin, and Weisbach (2010) offer a literature review about boards in corporate governance.

2 Standard agency models underscore that managers have discretion they use to affect corporate decisions and advance their own interests. However, such models do not necessarily suggest that corporate outcomes vary with individual executives, because such models do not focus on differences among top executives. An alternative view focuses on the match between executives and firms. In these studies, firms choose certain managers because of their characteristics (Jovanovic (1979)). For instance, a distressed bank may appoint a CEO with a track record of turning around troubled institutions. Similarly, gender may also be a selection criterion for becoming CEO (Faccio *et al.* (2011)). This literature illustrates the endogeneity of board composition, an issue we address in our empirical strategy.

We argue a team perspective is crucial because executives form a team and interact dynamically with each other in the decision-making process.[3] Theoretical work by Holmstrom (1982) and Bolton and Dewatripont (2005) highlights the importance of moral hazard in multi-agent settings. The individual effort provided by a group member is likely to be influenced by group characteristics that determine the degree of mutual monitoring. In the case of executive boards, this may have important consequences for corporate outcomes.

Further, top management team heterogeneity may play a significant role in the decision making of corporate boards. Diversity in terms of differences of socioeconomic characteristics of the management team might contribute to a more thorough decision-making process, since heterogeneous board members are influenced by different experiences which enable a more extensive analysis. Homogeneous executive boards by contrast may result in unbalanced decisions because of groupthink (Janis (1982)). Alternatively, it is possible that a very heterogeneous board complicates communication. If individuals come from much different backgrounds, this might harm their cooperation and restrict their ability to decide appropriately.

We add to the corporate governance literature as follows: We argue that corporate outcomes reflect decisions reached among executives who may have diverse opinions reflecting differences in executive board members' socioeconomic backgrounds. Specifically, we examine executive boards' exhibit heterogeneity due to individual managers' age, gender, and education.

In a first step, we document that socioeconomic characteristics of executive teams affect the variability of bank performance using Glejser's (1969) heteroskedasticity test. In a second step, we address the specific question of how characteristics of the executive team in terms of age,

3 Adams and Ferreira (2010) show individuals place riskier bets than groups who arrive at more moderate decisions, reflecting deliberation within groups that leads to better information sharing. Their evidence is consistent with results by Adams, Almeida, and Ferreira (2005), who find firms with powerful CEOs have more variable stock returns. Similarly, Adam and Güttler (2012) report mutual funds managed by teams are less likely to use credit default swaps (a relatively risky strategy) than funds managed by individuals.

gender, and education affect risk taking using difference-in-difference methods.[4] Unlike previous work, we home in on risk taking because the literature in sociology and economics yields precise predictions about the associations between these socioeconomic characteristics and risk taking.

In contrast to previous studies (Bertrand and Schoar (2003); Farrell and Hersch (2005)), we do not exclude regulated industries. Rather, we focus on the banking industry. Although restricting the empirical analysis comes at the cost in terms of industry representativeness, our approach has the advantage that the findings are based on a homogeneous set of firms. While female executives are well represented in the consumer products industry due to self-selection (Huang and Kisgen (2009)), we highlight in Section III below that the average board representation of women executives in the German banking industry is very similar to the overall representation of females among all executives in Germany. Our focus also contributes to the scant literature on corporate governance arrangements in banking (Caprio, Laeven, and Levine (2007); Fahlenbrach and Stulz (2011); Berger, Imbierowicz, and Rauch (2012); Schaeck, Cihak, Maechler, and Stolz (2012); Adams and Mehran (forthcoming)).

This is particularly important against the background of the recent financial crisis. Anecdotal and emerging empirical evidence suggests that poor governance arrangements in banking have far-reaching consequences for society (Hau and Thum (2009); Illueca, Norden, and Udell (2011)). In banking, governance arrangements differ from those of nonfinancial firms in that regulators have vested interests as well as shareholders and debtholders. Following major repercussions from the recent financial crisis, a lively debate has ensued about how to improve governance arrangements in banking. While numerous explanations have been invoked for why

[4] We also considered focusing our analysis on the executive team's work experience. However, such analysis is unlikely to yield additional insights beyond those that we report in this study because age and female gender are highly correlated with work experience (see also Section V.C.). Moreover, defining work experience is difficult because executives with higher education such as Ph.D. degrees have substantially less many years job experience than executives who do not hold a Ph.D. degree. Consequently, measurement problems relating to job experience impede such analysis.

banks take excessive risk, e.g., executive pay and too-important-to-fail considerations, our research adds a new dimension to this literature by enhancing the understanding of how socioeconomic factors affect collective decision making about risky project choices. Moreover, the empirical regularities we uncover offer pointers for how to inform the debate about improving governance in banking, since little is known about the effect of executive board composition on risk taking, despite its immediate relevance for policy and regulation.

We analyze this question in the context of a corporate governance system with two-tier boards. In two-tier systems, the executive board, chaired by the CEO, runs the corporation, takes the decisions relating to the day-to-day operations, and reports to the supervisory board which is designated with the monitoring role equivalent to the role of non-executive directors in the one-tier system. The supervisory board appoints and dismisses members of the executive board on behalf of shareholders, and also sets executives' remuneration. Such a two-tier system limits the scope that insiders, i.e., executives such as the CEO, capture the board to maximize private benefits (Bebchuk and Fried (2005)). Thus, examining the effect of executive board composition on risk taking in the context of a two-tier system offers the benefit of a clear distinction between inside directors (executives that run the firm), and outside directors.

This clear distinction is significant in the context of risk taking. In their analysis of the board's role as advisor and monitor of management, Adams and Ferreira (2007) show that increasing board independence in a one-tier system reduces the CEO's propensity to disclose information to the non-executive directors to avoid interference into management decisions. This has direct implications for risk taking because management decisions are less well informed, since the board cannot effectively perform its advisory role providing input on alternative project choices. Instead, in the two-tier system, the CEO does not face trade-offs in disclosing information to the supervisory board. Since the supervisory board's interests are aligned with those of shareholders, monitoring of the executive board is more intensive, suggesting less risk taking in a two-tier system.[5] To that extent, our research also extends the emerging literature on the design of board structures (for a review, see, e.g., Khanna, Kogan, and Palepu (2006)). In the aftermath of scandals such as Enron, Worldcom, and Tyco, some studies called into question the efficiency of one-tier boards and advocate mandating two-tier boards (Adams and Ferreira (2007); Gillette *et al.* (2008)). While the literature focuses almost exclusively on the one-tier system, it is not the dominant one. Austria, Belgium, China, Croatia, Czech Republic, Denmark, Estonia, Georgia, Germany, the Netherlands, Indonesia, Latvia, Mauritius, Poland, Spain, and Taiwan all rely on two-tier boards, while Bulgaria, Finland, France, and Switzerland allow either one-tier or two-tier boards (Adams and Ferreira (2007)).[6]

In our research, we focus on Germany, a country where two-tier boards are legally mandated (Kaplan (1994); Gorton and Schmid (2004)). Beyond the relevance of two-tier boards in an international context, many similarities exist between the German banking system and those in other countries such as Austria, Switzerland, Spain, and France. These nations also have small numbers of large internationally active financial institutions, but tend to be dominated by small and medium-sized banks that provide financing for firms and households, suggesting that the findings from this study transcend the German context.

We use data from the German central bank (Deutsche Bundesbank), and match executives to banks. The advantage of our dataset is that it contains complete information about executives' age, gender, and education to construct indicators of the composition of the executive board for the period 1994-2010 for 19,750 bank-year observations on 3,525 banks. Our dataset is one of the largest samples used in the academic literature for a single industry within one country.

5 Adams and Ferreira (2007, p. 242) find that increasing the independence of supervisory boards "unambiguously increases shareholder value". Gillette, Noe, and Rebello (2008), in their comparison of different board structures around the world, find two-tiered boards are more conservative in their investment decisions.

6 One-tier boards can be found in Australia, Brazil, Canada, Egypt, India, Italy, Japan, Malaysia, Norway, Philippines, Singapore, South Africa, South Korea, Sweden, Thailand, Turkey, U.S., Ukraine, United Kingdom, and Zimbabwe.

Exploiting exogenous changes in board composition arising from mandatory executive retirements for identification, we use difference-in-difference estimation to address the issue of endogeneity of board composition.

By way of preview, in an initial analysis based on Glejser's (1969) heteroskedasticity tests, we establish that the variability of bank performance is affected by executive board composition. To our knowledge, this is a novel result in the literature. In further analyses, we use difference-in-difference estimation to identify in which direction executive board characteristics affect risk taking in the banking sector. Here we obtain three key results: First, banks take on more risk if they are managed by younger executives. Second, female board members tend to increase risk taking. A detailed exploration suggests that this result reflects that female executives have less expertise on the executive level than their male counterparts, and we obtain this result despite the fact that we control for executive age, which is correlated with experience. Third, raising the proportion of executives with Ph.D. degrees reduces risk taking. Our findings are insensitive to an array of robustness tests in which we use alternative risk measures and employ alternative samples that exclude loss-making banks, merged banks, poorly capitalized banks, and we obtain also similar results when we use banks from alternative control groups. A final placebo test where we pretend that the board change occurred two periods before it actually took place also validates our inferences.

The remainder of the paper is organized as follows. Section II develops hypotheses about the effect of the socioeconomic characteristics of banks' executive boards on risk taking. Section III introduces the dataset. We discuss our econometric approach in Section IV. We report on hypothesis tests in Section V, and provide concluding remarks in Section VI.

II. HYPOTHESIS DEVELOPMENT

The starting point of our research is the consideration that executive board composition influences decision making. Both characteristics of individual executives and top management team heterogeneity are important determinants of board behavior. This idea finds support in work by Graham, Harvey, and Puri (2008) and Adams and Ferreira (2009). As a consequence, we anticipate being able to document that bank risk taking is affected by board composition.

A. Executive board age composition and risk taking

Our first enquiry concerns the effect of executive board's age composition on risk taking.

Several studies suggest risk taking decreases with an individual's age. Prendergast and Stole (1996) and Graham (1999) offer theories based on career considerations. These theories suggest reputational considerations increase in age.

In terms of investment behavior, Campbell (2001) also reports a negative age effect on participation in equity investments. Examining risk attitudes of households, Bucciol and Miniaci (forthcoming) find risk tolerance declines in age, and survey evidence by Sahm (2007) and Grable, McGill, and Britt (2009) indicates older individuals are less risk tolerant. Grable *et al.* (2009) attribute this result to an increase in attained knowledge of risk and risky situations relative to younger people. Agarwal, Driscoll, Gabaix, and Laibson (2009) complement this literature by analyzing lifecycle patterns in financial decisions relating to credit behavior. They report younger individuals make more mistakes than older people, e.g., they are less able to value properties and they pay excessively high fees. Overconfidence also plays a role. Gervais and Odean (2001) suggest inexperience in younger individuals causes misattribution of success resulting in upward revisions of the ability to control risk. Over time, individuals better assess their abilities and risk tolerance decreases.

These considerations suggest our ***Age hypothesis***.

HI. Age hypothesis: Risk taking decreases in board age.

B. Executive board gender composition and risk taking

Our second hypothesis about the effect of executive board's composition on risk reflects a growing debate in the economics and finance literature about gender and its effect on economic outcomes (e.g., Schubert, Brown, Glysler, and Brachinger (1999); Croson and Gneezy (2009)).

Risk-taking behavior with respect to investment decisions and gender differences has been investigated by Barsky, Juster, Kimball, and Shapiro (1997), Jianakoplos and Bernasek (1998), Sundén and Surette (1998), and Agnew, Balduzzi, and Sundén (2003). The consensus in these studies is that women are more risk averse in financial decision making. This finding seems attributable to the observation by Barber and Odean (2001) and Niederle and Vesterlund (2007) who consider women to be less overconfident than their male counterparts. Since overconfident managers invest less into information acquisition, they make poorer investment decisions (Goel and Thakor (2008)).[7]

A burgeoning literature analyzes the effects of gender in the context of corporate governance arrangements. These studies do not fully support these results obtained for individual investment decisions. While Farrell and Hersch (2005), Huang and Kisgen (2009), and Faccio *et al.* (2011) find an inverse link between firm risk and female directors, Adams and Funk (2011) show that female directors are more prone to take risks than men. The effect of female board representation on profitability and value is also negative (Adams and Ferreira (2009); Ahern and Dittmar (2012)). This result suggests female directors engage in excessive monitoring that decreases shareholder value (Almazan and Suarez (2003); Adams and Ferreira (2007)), and that women make poorer investment decisions since they face bigger obstacles than men obtaining information about investment projects (Bharat, Narayan, and Seyhun (2009)).

Only two studies focus on gender in banking and this research is limited to loan officers. Agarwal and Wang (2009) show that default rates for loans originated by female loan officers tend to be slightly higher than for those originated by male loan officers, and Beck, Behr, and Güttler (2009) rule out that female loan officers are more risk averse.

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[7] Malmendier and Tate (2008) show that overconfident CEOs overpay for target companies in decisions that result in value-destroying mergers.

The possibility that female bank executives have less outside options (Olivetti and Petrongolo (2008)) and the evidence that women have strong monitoring incentives (Almazan and Suarez (2003)) suggests bank risk is likely to decrease if more female executives are present. However, there is also evidence for negative effects on corporate outcomes arising from female board representation. Ahern and Dittmar (2012) find that female directors negatively influence firm value in Norway and attribute this result to the significantly lower job experience of women. Since the effect of female executives is a priori unclear, we formulate two alternatives for our ***Female risk hypothesis***.

HIIa. Female risk-reduction hypothesis: A higher representation of female executives reduces risk taking.

HIIb. Female risk-increasing hypothesis: A higher representation of female executives increases risk taking.

C. Executive board education composition and risk taking

Next, we develop a hypothesis about the effect of educational attainment on risk taking, since a growing number of studies discuss the links between educational background and individual investment behavior on the one hand, and corporate officer's education on firm performance on the other hand.

Several studies associate education with risk-taking behavior in household financial matters. Carducci and Wong (1998) and Grable (2000) demonstrate that higher educational attainment increases individuals' propensity to take risk in financial decisions, and Christiansen, Schröter Joensen, and Rangvid (2008) show that higher education increases participation in stock market investments. Bucciol and Miniaci (forthcoming), in contrast, do not find significant correlations between education and risk attitudes of households.

Evidence on the effect of inside directors', i.e., executives' educational background on firm financing policies is presented by Graham and Harvey (2001). Their survey evidence underscores executives with MBA degrees more frequently use sophisticated project valuation techniques and tend to rely more on the CAPM for estimating cost of capital than executives without such degrees. Intuitively, the use of more sophisticated techniques should reduce firm risk. However, Bertrand and Schoar (2003) report that executives with MBAs tend to be more aggressive and run more levered firms, suggesting MBA graduates engage in riskier firm policies.[8] Based on these two conflicting views in the literature, we formulate two alternative variations of the ***Education hypothesis.***

HIIIa. Positive education hypothesis: Better educated executives engage in less risk taking.

HIIIb. Negative education hypothesis: Better educated executives engage in greater risk taking.

In Table I, we provide an overview about our three hypotheses using two measures of risk taking – risk-weighted assets to total assets (RWA/TA, measured in percentage terms), and a Herfindahl-Hirschman index for loan portfolio concentration (HHI, log)) based on 8 sectors.[9] The concept of risk-weighted assets is widely used as a standard measure of risk in banking supervision (Basel Committee on Banking Supervision (2010)), and has also been used in the empirical banking literature because it is perceived to be a true ex ante measure of risk (Avery and Berger (1991); Shrieves and Dahl (1992); Berger (1995); Berger and Bouwman 2011)). This ratio weights assets and off-balance sheet activities according to their perceived risk to allow inferences about the soundness of the bank, and allows picking up the fact that certain executives may shift assets into categories of assets with low risk

[8] A related strand of literature examines how non-executive directors' financial expertise affects firm outcomes. DeFond, Hann, and Hu (2005) show that stock markets respond positively to the appointment of non-executive directors with financial expertise, and Dionne and Triki (2005) find financially knowledgeable non-executives improve firms' hedging and risk management policies. Similarly, Güner, Malmendier, and Tate (2008) report that directors with financial expertise have significant influence on firms' financing policies and acquisition strategies. For banks, Fich and Fernandes (2009) report that a lack of financially experienced non-executives correlates positively with the failure of financial institutions during the financial crisis, suggesting the absence of financial expertise reflects poor ability to monitor risky activities. Consequently, international efforts that aim to curtail bank risk taking embrace the idea that banks should have directors with sufficient knowledge of banking activities to enable effective governance (Basel Committee on Banking Supervision (2006)).

[9] The eight sectors include agriculture, forestry and fishing; mining, energy and water supply; manufacturing; building and construction; commerce; maintenance and repair of vehicles and durables; transportation and communication; financing and insurance; and services (real estate, renting and leasing, IT services, research and development, hotel business and catering industry, health and veterinarian, other public and personal services).

weights. We use this measure as our main dependent variable because unlike other widely used proxies of bank risk such as non-performing loans and loan loss provisions, our measure is more likely to reflect changes in risk-taking behavior of the bank without any time lags. The HHI reports the degree of concentration in banks' loan portfolio and is used here as an alternative measure of risk taking in a robustness check below.

[Table I: HYPOTHESES]

III. DATA

For the empirical analysis, we match managers with bank-specific data to track the movements of individual managers among banks over time for the period 1994 - 2010. Our approach accounts for the fact that firm-specific effects are correlated with manager characteristics, which requires a separation of manager characteristics from bank fixed effects (Bertrand and Schoar (2003)). To do so, we combine two datasets from the Deutsche Bundesbank. The first dataset is a novel dataset that provides information about the entire population of executives at banks in Germany. This file contains the identity and selected biographical information of all top managers such as the CEO, CFO, COO, and the managers of subdivisions such as the chief loan officer, the chief internal auditor, and the chief risk officer that are active in a function required to be reported to the supervisory authority by the German Banking Act. The Act stipulates a set of criteria, e.g., adequate theoretical and practical knowledge of the banking business, as well as managerial expertise, which must be met before a candidate can be appointed to an executive position, and the appointment requires prior approval by the regulator.[10] We define an executive as an individual who is a member of the executive board. Since this database also contains information about the employment history of each executive with different banking firms, we match the manager

[10] The Banking Act clearly sets out the details of when an individual can be considered as having relevant managerial experience. This experience is normally assumed if the candidate has the professional qualifications necessary for managing an institution and if the person can demonstrate three years' managerial experience at an institution of comparable size and type of business.

data to the second dataset which provides bank-specific information filed annually with the regulatory authority for 19,750 bank-year observations.

We first provide a brief overview about the German banking sector, where three different types of banks operate: Private banks, public sector banks, and credit cooperatives. While all these are universal banks, they differ in terms of ownership structure (Brunner, Decressin, Hardy, and Kudela (2004)). The private bank pillar contains large nationwide banks, and regional banks. The larger private banks are organized as joint-stock companies whereas their smaller counterparts are partnerships, private limited companies, or sole proprietors. The public sector banks include savings banks and Landesbanks owned by governments at the city-, county-, or state-level. The cooperative banking pillar comprises cooperative banks and central credit cooperatives.

Starting from the entire population of private, public, and cooperative banks, we remove 826 banks from the sample that were subject to regulatory interventions, capital support measures, and distress mergers (Berger, Bouwman, Kick, and Schaeck (2011)) to allow a clean identification of the effect of changes in board composition on bank risk taking in a sample of banks that does not contain seriously troubled institutions. Doing so reduces the number of bank-year observations from 19,750 to 15,414 observations. Next, we split our sample on an annual basis into mutually exclusive groups of banks that experienced changes in executive board composition (treatment group) and the remaining set of banks that did not experience changes in board composition (control group). A bank that experienced any one of the types of board change we study cannot be in the control group.

We restrict our samples to changes in board composition that do not alter the size of the executive board, i.e., we keep board size constant and only examine executive replacements following retirements. Our reasoning for this restrictive criterion is as follows: a change in board size may affect the strategic alignment and corporate outcomes of banks. For example, adding a senior executive to the bank’s executive board, such as a chief risk or chief loan officer, may impact the team’s decision-making process and may be driven by endogenous factors, e.g., supervisory or shareholder pressure to contain risk taking, or organizational considerations such as merger and acquisition activities. Since we are interested in the effects of how socioeconomic characteristics of executives affect bank risk taking and we want to exclude the possibility that board changes are driven by organizational considerations, this assumption of only examining board replacements is necessary to allow identification of the parameters of interest.[11]

Specifically, we construct three samples on which our estimations are performed. For the analysis of the effect of age composition on risk taking, we construct the treatment group of banks that observe a decrease in average board age following mandatory retirement of executives. To avoid confounding effects, we only consider one board change per bank. We achieve this by examining the seven-year time window surrounding the board change and consider the three years prior to, the three years following, and the actual year of the board change. We follow the same approach for changes in gender and education composition.

For the analysis of gender composition and risk taking, banks with an increase in the proportion of female board members after the board change are classified as the treatment group. Finally, to test our education hypothesis, banks that experience an increase in the representation of board members holding Ph.D.s form our treatment group.[12] The use of three different subsamples has the benefit of allowing a clean identification of the effect of board changes. Making this adjustment further reduces the sample to 10,719 bank-year observations for 2,490 banks that are available for our main regressions (Table VII).

To obtain control groups for the three samples of banks experiencing board changes in age, gender, and education composition, we match the treatment banks with banks of similar

[11] That is, we exclude „endogenous “executive turnovers, i.e. we do not want to measure a drop in bank risk-taking after an executive was dismissed because of his or her risk-loving behavior.

[12] In unreported tests, we also exploit information on the presence of MSc and MBA degrees using the biographical information about bank executives. Those tests are qualitatively identical to the results shown in the paper using Ph.D. degrees. They are available from the authors upon request.

characteristics that experienced no change of any kind in the executive board in the respective year.

As matching criteria, we use size, time period, and bank type to account for the considerable heterogeneity among banks in terms of scale and scope of activities, ownership structures, and business models. The size criterion ensures comparing banks with similar operations in terms of scale and scope and business model. Specifically, we match bank *i* to other banks whose total assets range between 80 and 120% of bank *i*'s total assets in the same year. The bank type criterion ensures comparing banks from the same banking pillar (private, public sector, or credit cooperative). As a final criterion, we match on previous performance, captured by return on assets (ROE) to reflect on the fact that accounting measures of firm performance are mean reverting over time (Barber and Lyon (1996); Schaeck *et al.* (2012)).[13] For the match on previous performance, we select banks whose ROE lies between 80 and 120% of the ROE of the bank where the executive retired in the period prior to the retirement. Our matching procedure is a *1:n* matching method that ensures we have at least one control bank for each bank that experienced a board change.

Table II presents means and standard deviations for characteristics of executive boards and banks. The first column refers to characteristics of the treatment group. This sample contains bank-year observations of banks that experience a change in board composition. We have 855 observations with a decrease in average board age, 28 observations with an increase in female board share, and 46 observations with an increase in the proportion of board members with Ph.D.s. For each treated bank, at least three and at most seven bank-year observations around the treatment period are included. In the empirical tests below, we only consider one board change per bank, and we delete banks whose board change of any one type coincides with another board change of the same type in a time window of +/-

[13] The problem of mean reversion may be particularly relevant in instances when there are changes among executive board members because this resembles mean reversion around treatment.

three years. While removing banks with regulatory interventions, capital support measures, banks that exited the market via forced mergers and those that had their charter revoked from the sample, and imposing the criterion to focus only on changes if no other board change occurred within a three-year time window reduces the number of board changes we can use for our analysis, our conservative approach avoids influences from endogenous effects arising from risk taking. It also mitigates the scope for confounding effects arising from two board changes taking place within a short span of time to be better able to have a clean sample to identify the effect of replacing executives.

[Table II: SUMMARY STATISTICS]

In Table II, the second column describes our control banks in more detail. We include the matched banks that do not experience any of the considered board changes here. The last column describes the entire set of banks that are used in our estimations. Treated banks are similar to control banks in terms of average board age and female board representation. They tend to have a slightly higher share of board members holding a Ph.D.

In Table III and Figure I, we show how executive board composition has evolved since 1994. We present mean values of board characteristics and the number of board changes in each year. During this time period, executive board size has increased significantly by almost 70%.[14] The number of board changes inducing a decrease in average board age suggests that this shift mainly took place in the 1990s. Although still on a very low level, female representation has risen during the observation period. Whereas in 1994, just 1% of all board seats were filled by women, this share tripled by 2010. However, in the last years, the female share has not increased much, thus stimulating a discussion about gender quotas.[15]

[Table III: EVOLUTION OF BOARDS]

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[14] Note that focusing on executive boards in a two-tier system results in average board sizes that appear small relative to studies of boards in one-tier systems.

[15] The representation of females on an executive level in Germany is very similar to other countries. The Economist (2011b) reports that women only make up 3 % of Fortune 500 CEOs, and that women only hold 3.2 % of all executive board seats in Germany's 200 biggest non-financial firms.

[Figure I: EVOLUTION OF BOARDS]

IV. EMPIRICAL METHODOLOGY

A. Glejser tests for heteroskedasticity

Prior to estimating the effect of board changes on risk taking, we conduct Glejser (1969) tests for heteroskedasticity to establish that board composition matters for variability in performance. The purpose of this exercise is not yet to offer insights into whether age, gender, and education composition affect risk-taking. Rather, the intention is to provide an empirical underpinning that that these board characteristics have implications for the variability of bank performance.

Recent work by Adams *et al.* (2005) exploits Glejser (1969) tests to examine how characteristics of firm's boards and their members affect firm performance. The Glejser (1969) test proceeds in two steps. First, we estimate a regression of bank performance on the variables of interest and controls. The variables of interest contain information on board composition as detailed below. Second, we use the absolute value of the residuals obtained from this estimation and regress them on the same set of independent variables.

$$\begin{aligned} \boldsymbol{RORWA_{it}} = {} & \boldsymbol{\alpha_o + \alpha_1 avg\_Age_{it} + \alpha_2 share\_female\ board\ members_{it}} \\ & \boldsymbol{+ \alpha_3 share\_Ph.D.s + \alpha_4 total\ assets_{it} + \alpha_5 Total\ Asset\ Growth_{it}} \\ & \boldsymbol{+ \alpha_6 \left[\frac{Core\ deposits}{TA}\right]_{it} + \alpha_7 Capital\ Adequacy\ Ratio_{it}} \\ & \boldsymbol{+ \alpha_8 \left[\frac{Customer\ Loans}{TA}\right]_{it} + \alpha_9 \left[\frac{OBS\ items}{TA}\right]_{it} + \alpha_{10} Merger_{it}} \\ & \boldsymbol{+ \alpha_{11} Powerful\ CEO_{it} + \alpha_{12} Board\ Size_{it} + \alpha_{13} GDP\ growth_{it}} \\ & \boldsymbol{+ \alpha_{14} interest\ rate\ spread_t + \alpha_{15} Population_{it} + \eta_{it}} \end{aligned} \qquad \textit{(1)}$$

The dependent variable is the ratio of return to risk-weighted assets (RORWA) as measure of performance.

Our three main explanatory variables in the Glejser (1969) tests are **average board age** (avg_age), the **share of female board members** (share_female board members) and the **share of board members with Ph.D.s** (share_Ph.D.s). These variables indicate how the executive board of bank *i* is composed during year *t* in terms of age, gender, and education.

Next, we introduce the controls. Since these variables are also included in our main regressions for the effect of board composition on risk taking, our exposition discusses the effect of the control variables on risk taking. While the difference-in-difference estimator is well suited to deal with endogeneity concerns, incorporating control variables further mitigates the risk of uncovering spurious correlations (Faccio *et al.* (2011)).

Control variables

We include bank size, measured by **Total assets (log, deflated[16])** to account for the fact that larger banks have more subdivisions and larger branch office networks that are more complex. Since larger banks have a greater capacity to absorb risk and may be considered to be too important to fail, we anticipate a positive relation between size and risk taking.

In times of fast growth, banks may be characterized by a different degree of risk taking than during normal times. To control for this effect, we add **total asset growth**.

Keeley (1990) has shown that risk-taking incentives are reduced if banks have high charter values. To proxy for charter value, we include the ratio of **core deposits to total assets**, and expect an inverse relation between risk taking and charter value.[17]

We control for the **Capital adequacy ratio (measured by Tier 1 and Tier 2 capital to risk-weighted assets)** because theory suggests that capital reduces moral hazard incentives,

[16] Nominal variables are deflated to the base year 2000.

[17] The charter value reflects economic rents banks can obtain via access to markets that are protected from competition. Traditionally, charter values are measured using Tobin's q. However, in the absence of a large number of listed banks, an alternative measure of charter value is needed. Hutchison and Pennacchi (1996) show that the ratio of demand deposits to total deposits is informative about a bank's charter value.

and encourages monitoring incentives (e.g., Morrison and White (2005); Allen, Carletti, and Marquez (2011). We expect an inverse relation between capital and risk taking.

To account for differences in balance sheet composition, we include the ratio of **Customer loans to total assets**, and the ratio of **Off-balance-sheet items to total assets**.[18] While we anticipate a risk-increasing effect arising from loan exposure, the effect of off-balance sheet activities is not clear ex ante. On the one hand, corporate hedging by the use of off-balance-sheet items can reduce risk substantially. Dionne and Triki (2005) report that hedging increases a firm's return on equity which indicates that it has effects on corporate outcomes. On the other hand, off-balance-sheet items also represent an alternative way of risky investments for banks which may imply a positive relation.

To consider the effect of corporate control activities, we incorporate a **Merger dummy**. This variable takes on the value one if the bank engaged in a merger or acquisition in any previous year during the sample period and zero otherwise. Accounting for mergers is important because they frequently coincide with changes in board composition. [19]

To reflect on findings by Adams *et al.* (2005) that CEOs can directly affect risk, we include **Powerful CEO**, captured by the current CEO's tenure. The effect of a powerful CEO can be counterbalanced by other executives. We therefore consider **Executive board size**. Group decision making gives rise to more diverse opinions, and the decisions are compromises that reflect the group members' views on risky projects, which may result in rejection of relatively risky projects, reducing risk taking (Sah and Stiglitz (1991)).

---

[18] Off-balance-sheet items are defined as the sum of contingent liabilities (contingent liabilities from bills of exchange; liabilities from guarantees and contracts of indemnity; liabilities from furnishing of securities for outside liabilities) and other undetermined liabilites (repurchase obligations from reverse purchase agreements; placement obligations and underwriting obligations; unconditional loan commitments including obligations from interest rate-related options, forwards and futures).

[19] In unreported tests, we replicate our estimations from Table VII below and omit all banks that were involved in mergers and acquisitions during the sample period. The number of observations decreases from 6,440 in Column (I) of Table VII to 3,782, from 3,073 (Column II) to 1,378, and from 1,229 (Column III) to 632. Similarly, we drop all bank that are poorly capitalized, defined as banks whose capital adequacy ratio is in the first percentile of the distribution of that variable. Doing so means dropping a further 386 observations for 62 banks. In both tests, our results remain unaffected with respect to sign and significance of the estimated coefficients. The results are available upon request.

GDP growth is the annual percentage change of real GDP per capita on the federal state level. This variable adjusts the regressions for the macroeconomic environment. We anticipate a positive relation between GDP growth and risk since episodes of economic prosperity coincide with increased risk taking (Dell'Ariccia and Marquez (2006)).

We include the **interest rate spread** between German 10-year and 1-year government bonds. The spread captures the effect of inflation expectations and has implications for bank risk. Further, a large spread allows banks to issue long-term loans at high rates while refinancing cheaply at low rates via short-term debt. This gives rise to maturity mismatch.

Finally, we consider market size since banks may be able to realize economies of scale in their business activities. To this end, we add **population (log)** of the state where the bank has its headquarters as a proxy for market size to our set of control variables.

To proceed with the Glejser (1969) test, we model the absolute value of the residuals as a function of the explanatory variables described above:

$$
\begin{aligned}
|\hat{\eta} it| = \ & \beta_o + \beta_1 avg\_Age_{it} + \beta_2 share\_female\ board\ members_{it} \\
& + \beta_3 share\_Ph.D.s + \beta_4 total\ assets_{it} \\
& + \beta_5 Total\ Asset\ Growth_{it} + \beta_6 \left[\frac{Core\ deposits}{TA}\right]_{it} \\
& + \beta_7 Capital\ Adequacy\ Ratio_{it} \\
& + \beta_8 \left[\frac{Customer\ Loans}{TA}\right]_{it} + \beta_9 \left[\frac{OBS\ items}{TA}\right]_{it} \\
& + \beta_{10} Merger_{it} + \beta_{11} Powerful\ CEO_{it} \\
& + \beta_{12} Board\ Size_{it} + \beta_{13} GDP\ growth_{it} \\
& + \beta_{14} interest\ rate\ spread_t + \beta_{15} Population_{it} + \mu_{it}
\end{aligned}
\qquad (2)
$$

where $\hat{\eta}_{it}$ denotes the residuals from the performance regression in Eq. (1). In this test, we are interested in the significance of the variables that capture board composition. The results of the Glejser (1969) test are shown in Table IV. For the dependent variable, we show the regression results from the first step in Columns (1) – (3), and focus in our discussion on the results from the second step in Columns (4) - (6). The tests show that the variability in bank performance significantly depends on banks' board composition. Average board age is negatively related to the variability in performance while the share of female board members shows a positive relationship. For the share of board members with Ph.D. degrees, we find no significant influence on the variability of performance within the age, gender and education subsamples. Moreover, we also reject the null hypothesis that $\beta_1, \beta_2,$ and β_3 are jointly zero (p-value = 0) in two of the three regressions. This test indicates that after controlling for the influence of the control variables, composition of the board in terms of age and gender determines how bank performance varies.

[Table IV: GLEJSER TEST]

B. Identification strategy

The preceding tests suggest that board composition matters for risk taking. In the subsequent analysis, we focus on the question of which socioeconomic characteristics of board members are relevant and, more specifically, how they influence risk taking.

Changes in board structure are likely to be endogenous. For example, changes in the ownership structure of a bank could be associated with new shareholders forcing a riskier conduct of business while, at the same time, replacing old executives with younger ones. A naive analysis of the effect of board age on risk taking would attribute the changes in risk taking to board age, whereas the underlying reason is ownership structure. Therefore, we only analyze board changes which are a consequence of executives reaching retirement age, and we do not consider other types of departures from the executive board. Thereby, we avoid a range of possible confounding factors. The impacts of board changes are analyzed using a difference-in-difference matching (DDM) estimator.

The difference-in-difference (DID) estimator is frequently used in the program evaluation literature (Meyer (1995)). The estimator compares a treatment group to a control group both before and after treatment. Here, the treated group consists of banks experiencing a board change of one of the three types of changes mentioned above due to retirement. The control group consists of banks with similar characteristics which do not experience a board change during the same time period. The construction of the control groups is described in Section III.B. By analyzing the time difference of the group differences, the estimator accounts for omitted variables which affect treated and untreated banks alike. For example, regulatory changes might coincide with changes in board structure. But as such changes affect banks similarly, the estimator only attributes the *additional* changes in risk to a board change.

We combine the DID estimator with a matching strategy to establish three relevant control groups for the three samples of treatment banks. The combined difference-in-difference matching (DDM) estimator has been introduced by Heckman, Ichimura, and Todd (1997). Smith and Todd (2005) document the superior performance of a DDM estimator relative to other matching estimators. Our DID approach is based on estimating a regression, whereby the parameter of interest is the coefficient γ_3 of the interaction term:

$$\boldsymbol{Y_{it} = \gamma_0 + \gamma_1 Treated_{it} + \gamma_2 Post_{it} + \gamma_3 Post_{it} \times Treated_{it} + \varepsilon_{it}} \qquad \textbf{\textit{(3)}}$$

where $\boldsymbol{\varepsilon_{it}}$ is an idiosyncratic error term.

We denote by Y_{it} our risk-taking measure. The variable $Treated_{it}$ is a dummy for a bank belonging to the treatment group, i.e., it takes on the value one if the bank experienced either a decrease in board age, an increase in the proportion of female executives, or an increase in the proportion of executives with Ph.D. degrees, respectively. The slope parameter γ_1 captures the difference in means between treatment and control group before the treatment takes place. The variable $Post_{it}$ is a dummy variable for the post-treatment period. While γ_2 picks up common shocks of both treatment and control group, γ_3

quantifies the additional shift of the treatment group's mean after treatment. In an evaluation framework, this parameter corresponds to the mean treatment effect on the treated.

[Table V: EXCLUDED CONTROL VARIABLES]

Table V indicates which of the key explanatory variables are excluded from our regressions to avoid overcontrolling. Additionally, we include bank fixed effects c_i. Our final specification can be written as:

$$\boldsymbol{Y_{it} = \delta_0 + \delta_1 Treated_{it} + \delta_2 Post_{it} + \delta_3 Post_{it} \times Treated_{it} + \delta_4 X_{it} + c_i + v_{it}} \qquad \textbf{\textit{(4)}}$$

The identifying assumption for a matching strategy with controls is that, conditional on the control vector X_{it}, treatment is quasi-random: After matching banks and accounting for differences in observables X_{it}, we require the control group to constitute a valid counterfactual scenario for the treatment group. The combination of matching with a DID estimator weakens this requirement: we allow for *time-invariant* differences between treatment and control groups. For our empirical strategy to be valid, we only require the absence of *time-varying* differences in unobservables between the two groups after the matching procedure, conditional on control variables X_{it}.

We include the control variables discussed above. We control for board characteristics which might change simultaneously with the variable we investigate. An increase in female board membership is likely to reduce board age, as the replacement is triggered by retirement. Hence, controlling for average board age is necessary to identify the effect of gender on risk. Similarly, since educational attainment covaries with age (Besedes, Deck, Sarangi, and Shor (forthcoming)) the test that focuses on the effect of age composition on risk taking also controls for the average representation of executives with Ph.D. degrees.

The control vector X_{it} consists of *Average board age*, *share of females, share of Ph.D.s, Total assets (log, deflated), Growth of total assets, Capital adequacy, Charter value, Merger dummy, Powerful CEO, Executive Board Size, Customer loans to total assets, Off-*

balance sheet items to total assets, and *GDP per capita growth.* While limiting the number of observations to three years prior to and following the board change already mitigates problems relating to serial correlation in each panel, we follow a conservative approach and also include a *Time trend* (Bertrand, Duflo, and Mullainathan (2004)).[20]

V. RESULTS

In this section, we provide empirical evidence for the hypotheses discussed in Section II.

Prior to discussing the results of our difference-in-difference estimations, we verify that there is no systematic change in risk taking prior to the board changes. A systematic increase in risk could render our inferences about the relationship between changes in board composition and risk taking invalid. Table VI shows mean values of risk-weighted assets to total assets (RWA/TA) of the treatment banks over three periods prior to the board changes.

In addition, we present the evolution of loan portfolio concentration measured by a Herfindahl Hirschman Index (HHI, log) calculated for 8 sectors before the change in board composition, our alternative risk measure in subsequent robustness tests. While this series fluctuates, there is no evident trend in risk taking of banks prior to the board change. We interpret these patterns as suggestive evidence that changes in board composition are not triggered by poor performance.

[Table VI: PERFORMANCE PRIOR TO BOARD CHANGES]

Table VII contains our main results of the difference-in-difference estimations. For each type of change in executive board composition, we present the coefficients and t-statistics, the regressions use heteroskedasticity-robust standard errors. We show results with our main measure of risk taking, RWA/TA. Our regression setup of using separate regressions for

[20] Note that we do not have data for executive remuneration. Our sample is dominated by public and cooperative banks that operate executive remuneration schemes with very limited bonus payments for executives. In particular, the ownership structure of these two types of banks that account for 94 percent of our sample renders the use of incentive type compensation schemes using stock options infeasible.

each type of board change allows tracing out the specific effect of the respective board change on risk.

[Table VII: MAIN RESULTS]

A. Main results

The results of Table VII, Column (1), confirm our first hypothesis (H1), i.e., for H1 the null is rejected. The coefficient on the interaction term between the board change and the period following the board change enters positively and significantly. A board change causes a decrease in the average age of board members and raises the bank's risk profile significantly relative to the control group. At different stages of their careers, executives have different attitudes towards risk.

Column (2) suggests that board changes that increase the representation of female executives are not conducive to reducing risk. Rather, a higher proportion of female board members significantly increases risk taking. This outcome is consistent with hypothesis (HIIb), but inconsistent with studies concluding females are more risk averse in economic experiments (Croson and Gneezy (2009)) and corporate settings (Barber and Odean (2001); Niessen and Ruenzi (2007)). However, these authors either look at nonprofessional populations or at fund managers that are not top managers. Risk preferences are likely to differ between these groups and board members. Adams and Funk (2011) show that Swedish female top executives are less risk-averse than their male counterparts, and anecdotal evidence also suggests that women can be more aggressive than men when they work in male-dominated environments.[21] We acknowledge, however, that our findings cannot rule out that the remaining male board members behave differently upon arrival of female executives which could also result in increased risk taking.

[21] A report in The Observer (2011, p. 12) about females in charge of managing money or putting capital at risk for banks tend to be extraordinarily aggressive, presumably to compensate for their supposed difference. The report argues “Fighting their way through a male-dominated environment to a position in which they can invest/punt/ risk-manage, many women develop an ultra-masculine persona so as to be thought of as ballsy…".

In sum, our results suggest women affect corporate governance of banks significantly and are not marginalized by a male-dominated board culture. This observation is in line with previous research for U.S. firms (see Adams and Ferreira (2008); Ahern and Dittmar (2012)) and indicates that female board representation has real implications.

In view of the ongoing public debate in European countries about the introduction of gender quotas for executive positions, it is important to emphasize this influence. Norway and France have adopted legislative measures that regulate female board representation. Recently, the European Parliament passed a non-legislative resolution demanding 40 per cent of supervisory and executive positions of large European firms to be filled by women (The Economist (2011a)).[22] In Germany, policy makers are also considering introducing a gender quotas. The Secretary of State for Employment, Ursula von der Leyen, envisages a law that mandates firms to increase female board representation to 30 per cent from 2018 onwards.[23] The political movement towards gender quotas is based on the desire to establish equality on the top management team level. The effects of this legislation, however, are less discussed.

We examine the effect of education, in terms of Ph.D. degrees in Column (3). In line with hypothesis (HIIIa), adding better educated individuals to the board reduces risk, suggesting such executives may apply better risk management techniques. Survey evidence presented by Graham and Harvey (2001) supports this consideration.

Among the control variables, we find that a higher charter value reduces risk taking. Large banks are less exposed to risk, and a higher capital adequacy ratio is inversely related to risk taking. Banks that are active in lending business have more risky investments, and risky banks also hold on average more off-balance-sheet items. This indicates that these

[22] The Economist (2011a) devotes considerable attention to gender quotas that promote the representation of women in the boardroom. While the underrepresentation of females highlights that companies that tend to only recruit men for the boardroom lose out on attracting qualified females, the Economist (2011a) concludes that imposing gender quotas is not conducive to achieving the desired objective because quotas promote females who would otherwise not get the job. This conclusion is in line with the results obtained by Ahern and Dittmar (2012) in their study of the effects of gender quotas in Norway.

[23] Interview given to Handelsblatt, June 17th, 2011: “Eine Ohrfeige für eine ganze Generation“.

items are not used to offset risks on the balance sheet, but rather as an additional instrument to engage in risky investments.

B. Economic significance

The results thus far offer empirical evidence that board composition has statistically significant effects on risk taking. In Table VIII, we now examine whether these effects are also economically significant. To this end, we trace out the impact of a decrease in age, and increases in gender and education composition by a magnitude of one standard deviation in our key independent variables.

[Table VIII: ECONOMIC SIGNIFICANCE]

Panel A indicates that the age structure of the board is highly relevant for the degree of risk taking and banks' return. We find that if average board age decreases by roughly 5 years, which corresponds to one standard deviation, the ratio of risk-weighted assets to total assets increases by 2.66 percentage points. With a sample mean of RWA/TA equal to 59.88 percent in our observation period, the effect is clearly economically significant.

Panel B suggests the impact of additional female board members on bank outcomes is less important. An increase in the female share of executives by 13 percentage points increases our measure of risk taking only by 0.15 percentage points. The same conclusion holds for an increase in the number of board members holding Ph.D. degrees. Panel C indicates that changes in the proportion of individuals with Ph.D.s does not influence risk taking to an economically significant degree.

C. Exploring the mechanisms

In this section, we turn to a detailed exploration of the mechanisms that drive the results obtained with the difference-in-difference estimator in Section V.A. Specifically, we exploit t-tests to home in on differences in board characteristics of the treatment group before and after the composition change. In addition to analyzing changes in the treatment group, we compare differences in characteristics between treatment and control groups to draw firm conclusions. Table IX presents the results.

[Table IX: MECHANISMS]

Changes in age composition

Our first key finding that a change in board age composition increases risk may relate to age heterogeneity. Consequently we examine age range, defined as the difference between the oldest and the youngest executive per bank. Board members from similar age cohorts share the same experiences which favor board cohesiveness and groupthink (Janis (1982)). If mutual decision-making is characterized by a distinctive sense of togetherness, this might hinder a reasonable individual assessment of possible risks of corporate strategies. Panel A of Table VIII shows that age heterogeneity of boards remains unchanged prior to and following the board change, and difference also remains insignificant. This suggests that groupthink arising in a more homogeneous top management team and the lack of diversifying influences in board meetings are not the main factors that can account for the observed increase in risk taking.

Changes in gender composition

Panel B of Table IX explores the reasons for the increase in risk taking following board changes that give rise to a higher representation of females. If appointed women differ with respect to characteristics compared to their male counterparts, risk taking may be changed for reasons other than gender-specific risk preferences. Such considerations can explain the increase in risk through a higher female representation reported above despite the commonly held view that women are more risk averse than men (Niessen and Ruenzi (2007)).

First, we focus on differences in terms of job experience, captured by the number of years an individual served over an entire career as an executive at any bank in Table IX. New female executives are significantly less experienced, suggesting that lack of expertise may drive the increase in risk. A similar argument is provided by Ahern and Dittmar (2012). They propose that the introduction of a gender quota had adverse effects on firm values because the appointed female directors lacked experience and were younger on average.

The lower job experience of appointed female executives and the fact that women only occupy a small share of executive positions suggest that the heterogeneity of board composition is significantly higher after the board change.[24] This offers an explanation for the increase in risk. Bantel and Jackson (1989) argue that group heterogeneity disturbs communication which can restrict the exchange of ideas among board members that is needed to arrive at well founded decisions. If group members come from heterogeneous backgrounds this might increase the potential for conflict inside the group. Our results indicate that the board changes increasing the female share of board members lead to higher group diversity at the executive level with effects on the bank's risk-strategy.

The question also arises as to whether women select certain types of firms as employers. We compare bank characteristics prior to the increase in female board representation between the treatment and the control groups in Table IX. We find that treatment banks have significantly more capital prior to increasing the proportion of women. Female executives appear to self-select into boards of well capitalized banks. A homogeneous board is supposedly more valuable in risky environments, making a female appointment less likely in times of uncertainty.

In addition, the observation that women are more likely to become board members of less risky and seemingly more stable banks is also interesting in connection to the glass ceiling hypothesis. The hypothesis states that career advancement is more difficult for women than for men and prevents them from rising above a certain hierarchical stage of organizations. Evidence on the existence of a glass ceiling in the context of corporate boards and CEO

[24] While the reduction from over 15 years to less than 8 years for all executives in Panel B of Table IX appears striking at first glance, we note that the size of executive boards is relatively small with a mean value of 3 individuals and even fewer board members at the beginning of the sample period.

positions suggests that women still face difficulties in reaching top executive positions, although this problem has seemingly mitigated (Daily, Certo, and Dalton (1999)). Our test indicates that women have to overcome more severe obstacles than men in entering boards of banks, i.e., by having to accept a higher risk exposure.

Finally, the comparison between treatment and control group indicates that women are more likely to be appointed to executive boards that are chaired by a female CEO, consistent with a prior finding that females are more likely to be appointed when there are other women on the board (Berger, Kick, Koetter, and Schaeck, 2011). This finding suggests that female executives play an important role in recruiting new board members of the same gender. Additionally, it may be more attractive for women to serve on a board that is already diversified and not dominated by men (Farrell and Hersch (2005)).

Changes in education composition

We focus on the mechanisms for the effect of higher education in Panel C of Table IX. Graham and Harvey (2001) and Bertrand and Schoar (2003) show executives' education affects investment, financing, and business strategies. To assess the extent to which such changes in these strategies are responsible for the observed reduction in risk, we examine the structure of banks' balance sheets in the treatment group following the board change with respect to funding, income, and capital structure.

The significant increase in core deposits suggests that better educated executives adjust the liability composition towards more stable funding. If banks rely more on core deposits, they are less exposed to sudden withdrawals of funds. This change in liability composition implies a lower degree of risk exposure. Moreover, the increase in core deposits raises the bank's charter value which serves as a disincentive to take on risk. Additionally, Table IX shows that board members with higher academic degrees are more likely to diversify the banks' income streams. Fee income is significantly larger in banks that experienced a board change of this type relative to the control group. Non-traditional income through fees may depend less on the cyclicality of overall business conditions than interest income. A higher share of fee income may therefore decrease volatility in income streams by decoupling revenues from business cycles. This enhances bank soundness. We do not find support for the idea that better educated executives decrease risk by changing the capital adequacy ratio. Similarly, the share of off-balance-sheet is not the driving force in reducing risk.

These findings do not indicate that higher educated managers follow more aggressive business strategies characterized by higher risk as stated by Bertrand and Schoar (2003). They rather indicate that top executives with higher education tend to act moderately. It is likely that executives with Ph.D.s are not as risk prone as their counterparts. One reason may be that managers without such degree may have to climb up the job ladder without the signaling advantage of a Ph.D. degree. To reach top executive positions, they have to prove their ability by extraordinary performance, which is likely to be related to higher risk taking.

Our results suggest that an increase in highly educated board members has consequences for the decision-making process taking place on the executive level. Adams and Ferreira (2010) argue that group decision making is characterized by reaching a consensus between different opinions and involves sharing all relevant information available to group members. An executive with a Ph.D. degree presumably exhibits the needed expertise and increases the pool of useful information available to the board considerably. Consequently, board decisions tend to be more moderate because they rely increasingly on appropriate evidence which prevents excessive risk taking. This hypothesis finds support in our findings.

D. Robustness tests

We now investigate the robustness of our findings. First, we exclude all loss-making banks from the estimations. We do this because badly performing banks which incur losses may have incentives to change boards in specific ways to restore profitability (Schaeck *et al.* (2012)). This might lead to an endogeneity problem because they may appoint directors that personify certain managerial traits. Second, we use the Herfindahl Hirschman Index of loan concentration (HHI, log) as an alternative measure of bank risk. Third, we apply an alternative matching procedure to determine the control banks in our matching procedure. Fourth, we conduct a placebo test to rule out that our results are driven by spurious correlations.

Columns (1), (3), and (5) of Table X present the results for the estimations that exclude loss-making banks from our sample. The signs of the coefficients on the interaction terms are qualitatively identical to the signs obtained in the full-sample estimation of Table VII. These coefficients are highly significant as well. These tests confirm that our results in Table VII are not driven by appointments of poorly performing banks.

[Table X: ROBUSTNESS TESTS - Part A]

In columns (2), (4), and (6) of Table X, we check the robustness of our results with respect to a different measure of risk taking. The dependent variable in these regressions is the Herfindahl Hirschman Index (HHI, log). As it shows the banks' vulnerability towards idiosyncratic sector-specific shocks, it indicates the degree of risk exposure inherent in the banks' lending activities. Our previous results are robust to this alternative concept of risk measurement with respect to the results for changes in terms of age and gender. The result for the effect of education composition is now rendered statistically insignificant.

Next, we verify that our matching strategy does not drive our inferences, and use an alternative strategy that considers regulatory capital as an additional matching criterion, and we also narrow our matching band. Our intuition is that differences in regulatory capital across banks induce differences in the degree of monitoring by the regulator. A bank with lower regulatory capital is subject to more intense supervision and may therefore not be able to engage in risk taking (Ashcraft (2008)). Specifically, we match bank *i* to other banks whose capital adequacy ratios and ROEs lie between 90 and 110% of bank *i*'s capital adequacy ratio and ROE, respectively, in the same year. We also adjust the previously used matching criteria accordingly and narrow the matching window also to 90 and 110% of the treatment bank's size, and we keep the matching on year and bank type in Table XI. Our previous findings are robust to this alternative matching strategy.

[Table XI: ROBUSTNESS TESTS – Part B]

Finally, we consider a last experiment and run a placebo regression to verify that the changes in risk are indeed caused by changes in board composition. Specifically, we repeat the difference-in-difference estimations with one modification – redefining the dummy variable ***Treatment*** to take on the value 1 in the period two years prior to the actual board change. If the estimated coefficient on the interaction term is insignificant, this placebo treatment test suggests that the change in risk taking is indeed caused by the new board composition. A significant coefficient on the interaction term, however, would indicate that the treatment group differs significantly from the control group even before the change actually occurs and invalidate our previous inferences. A further benefit of this final test is that it helps address the phenomenon of job matching (Jovanovic (1979)) which posits that banks hire executives with certain characteristics.

Results of this test are shown in Table XII. All coefficients on the interaction terms are insignificant. These findings suggest that the adjustments in risk taking and behavior do not occur prior to the change in board composition.

[Table XII: PLACEBO TESTS]

VI. CONCLUDING REMARKS

In this paper, we raise the question of how the composition of a bank's executive team affects risk taking. Unlike previous papers, we take a team perspective and only focus on managers, rather than non-executive directors. Specifically, we analyze three dimensions of team composition: age, gender, and education.

Exploiting a unique dataset from the Deutsche Bundesbank that provides detailed information about executives' biographies that we combine with bank data for the period 1994-2010, we conduct heteroskedasticity tests in an initial step of our analysis to show that the socioeconomic composition of an executive team significantly determines the variability of bank performance. To better understand the direction in which age, gender, and education affect the propensity to take risk, we subsequently use difference-in-difference estimation with matching techniques to exploit exogenous variation in mandatory executive retirements to formulate and test hypotheses about how these three dimensions of team composition correlate with risk taking.

Our main findings can be summarized as follows.

First, decreases in average board age are robustly associated with increased bank risk taking. This effect is statistically and also economically large. A one standard deviation decrease in board age of approximately 5 years raises the ratio of risk-weighted assets to total assets from 59.88 to 62.54 percent.

Second, female executives self-select into stable and well-capitalized banks. However, in the three years following the increase in female board representation, risk taking increases, although the change is economically marginal. Additional tests indicate this result is highly correlated with the fact that female executives have less experience than their male counterparts. While this finding offers some suggestive evidence for the mechanism that is driving this finding, our empirical analysis does not rule out the possibility that male executives change their behavior following the appointment of women executives which could also drive up bank risk taking.

Third, educational attainment, measured by the presence of executives with Ph.D. degrees is associated with a decrease in risk taking. Our estimations suggest the decrease is relatively small but highly statistically significant. Further analyses that focus on the mechanism underlying this result point towards adjustments of the banks' business models towards more diversified income streams and more stable funding sources.

We try to remain cautious drawing causal inferences. While our difference-in-difference estimator combined with matching methods, the control variables, and our placebo tests mitigate endogeneity concerns, we acknowledge that executive retirements change the composition of the executive board along many socioeconomic characteristics simultaneously. Since we still obtain significant effects for risk taking upon controlling for the levels of the executive team's socioeconomic characteristics when we run our difference-in-difference estimator for the individual changes in age, gender, and education composition, we believe our research has started opening the black box of the behavior of management teams in the banking industry.

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Table I: Hypotheses and empirical predictions

Dependent variable		RWA/TA	HHI (log)
Age hypothesis			
HI	*Risk tolerance decreases in board age*	-	-
Female risk taking hypothesis			
HIIa	*Female risk-reduction hypothesis*	-	-
HIIb	*Female risk-increasing hypothesis*	+	+
Education hypothesis			
HIIIa	*Positive education hypothesis*	-	-
HIIIb	*Negative education hypothesis*	+	+

Risk taking is measured by the ratio of risk-weighted assets to total assets (RWA/TA), and in a robustness test, we use the concentration of the loan portfolio HHI (log) as an alternative risk measure.

Table II: Characteristics of executive boards and banks

	Treatment Group (1)		**Control Group** (2)		**All banks** (3)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Executive board characteristics						
Board size	3.74	1.99	2.59	1.70	3.00	1.89
Board age composition	50.03	4.87	50.00	5.01	50.01	4.96
Board gender composition	0.03	0.10	0.02	0.11	0.02	0.10
Board education composition (Ph.D. degree)	0.05	0.13	0.01	0.07	0.03	0.10
Board tenure composition	10.34	5.58	13.07	6.13	12.07	6.07
# of board changes (increases only)	929		0		929	
# increases (females)	28		0		28	
# decreases (age)	855		0		855	
# increases (education, Ph.D. degree)	46		0		46	
Bank characteristics and macroeconomic environment						
Total assets (log, deflated)	19.93	1.47	19.09	1.21	19.38	1.36
ROE	13.25	10.97	16.33	9.05	15.25	9.879
Charter value	17.81	8.11	16.69	6.69	17.08	7.236
CEO power	7.22	7.49	7.04	7.24	7.10	7.33
Capital adequacy ratio	19.90	130.2	12.52	4.31	15.12	77.35
GDP growth (per capita)	1.59	3. 58	1.68	3.32	1.64	3.41
Private bank dummy	0.13	0.34	0.02	0.12	0.06	0.23
Public bank dummy	0.36	0.48	0.15	0.36	0.22	0.42
Cooperative bank dummy	0.51	0.50	0.84	0.37	0.72	0.45
Merger dummy	0.03	0.16	0.06	0.23	0.05	0.21
Risk measures						
RWA/TA	58.00	14.93	60.62	10.92	59.70	12.54
HHI (log)	3.39	0.38	3.24	0.25	3.29	0.31

We present summary statistics of the banks in our sample. Column (1) refers to the sample of banks that experienced board changes altering the average board age, the female share of executives, or the share of executives with Ph.D.s. Column (2) refers to the sample of banks that experienced no board change altering their socioeconomic board composition. In Column (3), all banks of our sample are included. We present mean values and standard deviations of the variables. Board size refers to the number of executives. Board age composition denotes the board age. Board gender composition denotes the share of female executives. Board education composition denotes to the share of executives holding Ph.D.s. Board tenure composition refers to the average amount of years spent working in the bank. # of board changes presents the total number of board changes. # increases (females) denotes the number of board changes increasing the female share of executives. # increases (education, Ph.D. degree) denotes the number of board changes increasing the share of executives with Ph.D.s. Bank size is measured by the log of total assets (deflated). Performance is measured by return on equity (ROE). Charter value is defined as core deposits to total assets. CEO power captures the current CEO's tenure. The capital adequacy ratio is calculated as the ratio of Tier 1 + Tier 2 to total assets. GDP growth refers to the state where the bank is registered. Private (public, cooperative) dummy takes on the value one if the bank is private (public, cooperative). Merger dummy equals 1 if the bank was engaged in a merger during the observation period. RWA/TA is defined as the ratio of risk-weighted assets to total assets, and HHI (log) is the Herfindahl Hirschman index (log) based on 8 sectors to measure loan portfolio concentration.

Table III: Evolution of executive board composition

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Evolution of board characteristics																	
Board size	2.26	2.35	2.52	2.61	2.86	3.20	3.44	3.51	3.56	3.52	3.62	3.49	3.55	3.53	3.51	3.52	3.78
Board age composition	48.36	48.84	49.24	49.73	50.11	50.29	50.18	50.31	50.44	50.62	50.79	51.12	51.16	51.10	51.02	50.86	51.35
Board gender composition	0.01	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Board education composition (Ph.D.)	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03
Board tenure composition	11.65	11.84	11.96	12.34	12.23	11.85	11.62	11.77	11.79	11.89	12.17	12.72	12.70	12.55	12.36	12.22	12.27
# of board changes	29	23	16	22	11	13	22	20	19	14	19	12	5	5	15	13	2
# increases (females)	*1*	*2*	*3*	*1*	*1*	*0*	*4*	*3*	*2*	*3*	*3*	*1*	*0*	*2*	*4*	*1*	*1*
# decreases (age)	*17*	*11*	*9*	*11*	*10*	*4*	*10*	*9*	*7*	*7*	*10*	*5*	*4*	*3*	*5*	*8*	*1*
# increases (education, Ph.D. degree)	*5*	*5*	*2*	*4*	*0*	*4*	*4*	*4*	*4*	*2*	*3*	*3*	*0*	*0*	*3*	*2*	*0*

We present the evolution of board characteristics over time. This table exhibits the evolution over time of board size (number of board members), board age composition (average board age), board gender composition (fraction of women on the board), board education composition (fraction of board members with a PhD) and board tenure composition (years of experience within the bank). The number of relevant board changes in the respective year is listed, where a board change of interest is defined as a board change leading to an increase in the average age/ fraction of females/average education (PhD). We require the board change to happen due to the retirement of a board member to avoid endogeneity concerns. We only consider board changes in which the size of the board remains constant.

Table IV: Glejser's (1969) heteroskedasticity tests

Dependent variable	*(1)*	1st step *(2)* ***RORWA***	*(3)*	*(4)*	2nd step *(5)* ***Absolute value of RORWA residuals***	*(6)*
	Age sample	Gender sample	Education sample	Age sample	Gender sample	Education sample
Board age composition (average board age)	***-0.01*****	***-0.01*****	***0.01***	***-0.00****	***-0.00******	***-0.01***
	[-2.33]	***[-2.35]***	***[1.44]***	***[-1.94]***	***[-2.64]***	***[-1.20]***
Board gender composition (average female board representation)	***0.29****	***-0.14***	***1.50*****	***0.41******	***0.06***	***0.33***
	[1.77]	***[-1.11]***	***[2.56]***	***[3.38]***	***[0.76]***	***[1.07]***
Board education composition (average Ph.D. board representation)	***-0.72******	***0.26***	***-0.94******	***0.19***	***0.06***	***0.12***
	[-3.37]	***[0.64]***	***[-3.80]***	***[1.14]***	***[0.24]***	***[0.78]***
Total assets (log, deflated)	0.08***	0.07***	0.23***	0.03**	0.00	0.12***
	[3.93]	[4.48]	[4.71]	[1.97]	[0.28]	[4.31]
Core deposits/Total assets	-0.01*	-0.01***	-0.01	-0.01***	-0.00	-0.01**
	[-1.94]	[-5.61]	[-0.81]	[-3.32]	[-0.91]	[-2.04]
Powerful CEO	0.00*	0.00	-0.00	-0.00	-0.00	-0.00**
	[1.75]	[1.05]	[-0.60]	[-0.08]	[-0.80]	[-2.29]
Capital adequacy ratio	0.02	0.06***	-0.02	0.03***	0.02***	0.06***
	[1.20]	[9.99]	[-0.59]	[5.28]	[4.44]	[10.82]
Customer loans/Total assets	-0.02***	-0.01***	-0.02***	-0.01***	-0.01***	0.01
	[-8.38]	[-8.79]	[-3.23]	[-3.54]	[-4.90]	[1.60]
Off balance sheet items/Total assets	-0.01	-0.00	-0.01	0.00	0.01***	0.00
	[-1.42]	[-0.35]	[-1.18]	[0.66]	[2.63]	[0.88]
Total asset growth (deflated)	0.00	0.01*	0.04***	0.00	0.00*	0.01*
	[0.75]	[1.93]	[3.76]	[0.68]	[1.65]	[1.71]
Board size	-0.15***	0.04	-0.22**	0.02	0.04*	-0.09*
	[-3.53]	[0.97]	[-2.50]	[0.46]	[1.76]	[-1.68]
Interest rate spread	0.28***	0.24***	0.30***	0.03**	0.02	0.02
	[17.98]	[14.90]	[8.22]	[2.45]	[1.63]	[0.93]
GDP growth (county)	0.00	-0.00	-0.01	0.00	-0.01*	0.01
	[0.34]	[-0.78]	[-0.64]	[0.41]	[-1.96]	[1.26]
Population (log, state)	0.03	-0.04**	-0.05	-0.08***	-0.03**	-0.13***
	[1.45]	[-2.01]	[-1.12]	[-4.89]	[-2.04]	[-4.04]
Merger (dummy)	-0.24***	-0.24***	-0.10	0.11**	0.08	0.11
	[-3.28]	[-3.10]	[-0.49]	[2.16]	[1.44]	[0.80]
Observations	6,417	3,073	1,229	6,417	3,073	1,229
R-squared	0.155	0.210	0.223	0.144	0.055	0.212
F-Statistic for joint significance	***n/a***	***n/a***	***n/a***	***6.50******	***2.69*****	***1.54***
p-value	***n/a***	***n/a***	***n/a***	***0.00***	***0.045***	***0.20***

This table reports estimation results for the Glejser (1969) tests. Bad banks are excluded. Age sample refers to the sample containing banks which experience a decrease in average board age after the board change and their matched control banks. Gender sample refers to the sample containing banks which experience an increase in the proportion of female executives after the board change and their matched control banks. Education sample refers to the sample containing banks which experience an increase in the share of executives with Ph.D. after the board change and their matched control banks. Columns (1)-(3) contain the first step OLS results from regressing return on risk-weighted assets (RORWA) on a set of explanatory variables. Columns (4)-(6) present results from the regression of the absolute value of the first step residuals on our set of explanatory variables. Board age composition denotes the average board age per year, board gender composition refers to the average female board representation per year, and board education composition is the average share of board members with Ph.D. degrees per year. Bank-specific control variables include the log value of total assets (log), the growth rate of total assets, the ratio of core deposits to total assets, Powerful CEO, (captured by CEO tenure), and a dummy variable Merger that equals 1 if the bank was engaged in a merger. Macroeconomic control variables include the interest rate spread between 10-year and 1-year federal government bonds, GDP growth and population in logs of the state where the headquarter of the bank is registered. Columns (4)-(6) present F-statistics and p-values testing the null hypotheses of joint significance of the variables board age composition, board gender composition and board education composition. We present t-statistics in parentheses. Constant terms included but not reported. ***,*,* indicate significance at the 1%, 5%, and 10% significance level, respectively.

Table V: Excluded control variables

Regression	Age composition	Gender composition	Education composition (Ph.D. degree)
Age	excluded	included	included
Gender	included	excluded	included
Ph.D.	included	included	excluded

This table shows whether the levels of average board age (Age), female board representation (Gender) and share of board members with Ph.D. (Ph.D.) are included in the specific regressions. Age composition refers to the regression estimating the impact of average board age on risk taking. Gender composition refers to the regression estimating the impact of female board representation on risk taking. Education composition (Ph.D. degree) refers to the regression estimating the effect of executives with Ph.D. on risk taking.

Table VI: Performance prior to board changes

	Period	RWA/TA (Mean)	Loan portfolio concentration (HHI, log)
Panel A: Age change			
	t_0	58.24	3.33
	t_{-1}	59.01	3.32
	t_{-2}	59.35	3.31
	t_{-3}	58.75	3.31
Panel B: Gender (female) change			
	t_0	54.80	3.30
	t_{-1}	55.72	3.30
	t_{-2}	58.72	3.35
	t_{-3}	57.76	3.34
Panel C: Education (Ph.D. degree) change			
	t_0	56.45	3.53
	t_{-1}	47.33	3.31
	t_{-2}	41.21	3.27
	t_{-3}	44.82	3.53

This table presents the mean values of risk-weighted assets to total assets (RWA/TA), and the Herfindahl Hirschman index (log) based on 8 sectors (HHI) in the three years prior to the board changes. The period t_0 denotes the year of the board change, t_{-1} (t_{-2}, t_{-3}) denotes the period 1 (2, 3) year(s) prior to the board change. Panel A refers to the sample containing banks which experience a decrease in average board age after the board change and their matched control banks. Panel B refers to the sample containing banks which experience an increase in the share of female executives after the board change and their matched control banks. Panel C refers to the sample containing banks which experience an increase in the proportion of executives with Ph.D. degrees after the board change and their matched control banks.

Table VII: Main Results

	Age composition (1) RWA/TA	Gender composition (2) RWA/TA	Education composition (Ph.D. degree) (3) RWA/TA
Board change	-0.02	0.99	-1.48**
	[-0.15]	[1.56]	[-2.18]
Post period	0.13	0.59***	0.23
	[0.86]	[3.27]	[0.84]
Board change * Post period	**0.55*** **	**0.96***	**-2.26*** **
	[2.96]	**[1.89]**	**[-4.07]**
Timetrend	-0.24***	0.79***	0.93***
	[-4.55]	[11.56]	[8.69]
Total assets (log, deflated)	-2.15***	-20.97***	-12.14***
	[-2.84]	[-20.27]	[-7.07]
Core deposits/Total assets	-0.16***	-0.17***	-0.18***
	[-8.39]	[-6.80]	[-4.45]
Powerful CEO	0.02*	0.00	-0.05**
	[1.93]	[0.08]	[-2.00]
Capital adequacy ratio	-0.21***	-1.49***	-1.01***
	[-13.04]	[-35.13]	[-13.58]
Customer loans/Total assets	0.61***	0.37***	0.41***
	[44.04]	[20.01]	[12.97]
Off balance sheet items/Total assets	0.11***	0.19***	0.01
	[6.37]	[7.66]	[1.02]
Growth of total assets (deflated)	0.00	0.01	0.04
	[1.05]	[1.01]	[1.58]
Board size	0.70***	0.38	-0.48
	[3.10]	[1.35]	[-1.10]
Interest rate spread	-1.05***	-0.62***	-0.08
	[-19.31]	[-8.62]	[-0.67]
GDP growth (county)	0.08***	0.08***	0.02
	[6.12]	[5.04]	[0.74]
Population (log, state)	68.10***	48.63***	-24.66*
	[9.64]	[6.22]	[-1.96]
Merger (dummy)	0.34	-0.35	-0.05
	[1.33]	[-1.24]	[-0.09]
Average board age	n/a	0.04*	-0.03
		[1.80]	[-0.80]
Average Ph.D. representation	1.69	11.24***	n/a
	[1.39]	[2.58]	
Average female representation	-0.10	n/a	0.37
	[-0.09]		[0.14]
Observations	6,440	3,073	1,229
R-squared	0.452	0.615	0.358
Number of banks	1,578	652	260
Number of board changes	569	24	25

We report results from difference-in-difference estimations. Board change banks are matched with banks of similar size (+/- 20% of Total assets, log), similar performance (+/- 20% of ROE), bank type (private, public, and cooperative banks) and year. Bad banks are excluded. Column (1) refers to the sample containing banks that experience decreases in average board age after the board change and their matched control banks. Column (2) refers to the sample containing banks which experience an increase in female board representation after the board change and their matched control banks. Column (3) refers to the sample containing banks which experience an increase in the proportion of executives with a Ph.D. degree after the board change and their matched control banks. Board change is a dummy equal to 1 if the bank experienced a board change of the considered type. Post period is a dummy equal to 1 in the period following a board change. We include a time trend, and control for total assets (log), total asset growth, core deposits to total assets, powerful CEO (captured by CEO tenure), and a dummy variable Merger that equals 1 if the bank was engaged in a merger. In addition, Columns (2) and (3) control for average board age to account for the levels of the board characteristics, and Column (1) and (2) control for the average proportion of executives holding a Ph.D. Columns (1) and (3) control for the average share of female executives per year. Macroeconomic control variables include the interest rate spread between 10-year and 1-year government bonds, GDP growth and population (log) of the state where the headquarter of the bank is registered. t-statistics in parentheses. Constant term included but not reported. ***,*,* indicate significance at the 1%, 5%, and 10% level, respectively.

Table VIII: Economic significance

Type of board change	***Mean*** (1)	***Standard deviation*** (2)	***Mean of (RWA/TA)*** (3)	***Effect of one standard deviation change on (RWA/TA)*** (4)
Panel A: Age change				
Age	50.15	4.88	59.88	2.66
Panel B: Gender (female) change				
Proportion of female board members	0.03	0.13	59.79	0.15
Panel C: Education (Ph.D. degree) change				
Proportion of board members with a Ph.D. degree	0.04	0.13	60.36	-0.34

We present the quantitative effect of a one standard deviation change in the variables age (Panel A), proportion of female board members (Panel B), and the share of board members with Ph.D.s (Panel C), respectively, on the dependent variable risk-weighted assets to total assets (RWA/TA) . Panel A refers to the sample containing banks that experience a decrease in average board age after the board change and their matched control banks. Panel B refers to the sample that contains banks experiencing an increase in the share of female executives after the board change and their matched control banks. Panel C refers to the sample containing banks with an increase in the share of executives with Ph.D.s after the board change and their matched control banks. Columns (1) and (2) of each Panel show the mean value and the standard deviation of the respective variable. Column (3) presents the mean value of (RWA/TA) in the considered sample. Column (4) show the change in (RWA/TA) induced by a one standard deviation increase in the respective variable.

Table IX: Exploring the mechanisms

Panel A: Age composition	***Pre board change***	***Post board change***	***t-test***
Age Range	11.80	11.85	-0.25
Number of board changes	569		
Panel B: Gender composition	***Pre board change***	***Post board change***	***t-test***
Average executive experience (all executives)	15.33	7.70	7.74***
Average executive experience (CEO)	11.80	5.34	4.10***
	Treatment banks	***Control banks***	
Capital adequacy ratio	14.27	12.80	-3.81***
Proportion of female executives prior to board change	0.03	0.02	-0.14
Proportion of female CEOs prior to board change	0.04	0.02	-1.75*
Number of board changes	24		
Panel C: Education composition (Ph.D.)	***Pre board change***	***Post board change***	***t-test***
Average executive experience (all executives)	11.85	7.22	5.26***
Average executive experience (CEO)	13.56	8.29	3.11***
Capital adequacy ratio	11.60	12.22	-1.01
Off balance sheet/Total assets	7.94	6.81	1.26
Profitability (ROE)	15.30	14.60	0.33
Fee income	7.80	9.52	-2.04**
Core deposits/Total assets	12.65	16.88	-3.07***
Number of board changes	25		

We present differences in board and bank characteristics between banks that experience a change in board composition (change banks) and control groups. Pre board change (post board change) refers to the observation period before (after) the change in board composition. The final column contains t-statistics that result from testing the null hypothesis that the variable is identical pre board change and post board change (or, respectively in Panel B, that the variable is identical for change banks and control banks). ***,*,* indicate significance at the 1%, 5%, and 10% significance level, respectively. Age Range denotes the difference in age between the oldest and the youngest board member. Average executive experience reports the number of years spent working in the financial industry by the individuals in an executive role (respectively by the CEO). The capital adequacy ratio is defined as the ratio of Tier 1 and Tier 2 capital to total assets. Panel A refers to the sample containing banks which experience a decrease in average board age after the board change and their matched control banks. Panel B refers to the sample containing banks which experience an increase in the share of female executives after the board change and their matched control banks. The proportion of female executives (female CEOs) prior to board change is the average share of female executives (female CEOs) before the change in board composition. Panel C refers to the sample containing banks which experience an increase in the share of executives with Ph.D. after the board change and their matched control banks. Off-balance sheet items are included as share of total assets. Profitability is measured as return on equity. Fee income denotes the share of fee income of total income. Core deposits are scaled by total assets.

Table X: Robustness tests, Loss making banks excluded and Loan portfolio concentration (HHI, log)

	Age Composition (decrease)		Gender Composition (increase)		Education composition (Ph.D. degree, increase)	
	(1)	(2)	(3)	(4)	(5)	(6)
	Loss making banks	Loan portfolio	Loss making banks	Loan portfolio	Loss making banks	Loan portfolio
Board change	-0.04	0.01	1.84**	0.00	-1.96**	0.01
	[-0.22]	[1.57]	[2.52]	[0.01]	[-2.38]	[0.65]
Post period	0.06	-0.01	0.45**	0.00	-0.04	0.01
	[0.38]	[-1.64]	[2.22]	[0.66]	[-0.13]	[1.58]
Board change * Post	**0.60*** **	**0.02*** **	**2.14*** **	**0.03* **	**-2.36*** **	**-0.02**
	[2.92]	**[4.14]**	**[3.66]**	**[1.83]**	**[-3.59]**	**[-1.32]**
Time trend	0.03	0.01***	1.06***	0.01***	1.38***	0.02***
	[0.54]	[3.54]	[12.88]	[4.04]	[10.54]	[5.24]
Total assets (log, deflated)	-4.22***	0.03	-22.08***	-0.08**	-18.53***	-0.02
	[-4.55]	[1.63]	[-15.98]	[-2.36]	[-8.58]	[-0.32]
Core deposits/Total assets	-0.18***	-0.00***	-0.15***	-0.00***	-0.30***	-0.00
	[-8.47]	[-2.82]	[-5.17]	[-3.50]	[-5.82]	[-1.41]
Powerful CEO	-0.01	-0.00	0.03	0.00	-0.03	-0.00*
	[-0.91]	[-0.61]	[1.26]	[0.41]	[-0.97]	[-1.92]
Capital adequacy ratio	-0.49***	-0.00*	-1.80***	-0.00**	-1.28***	-0.01***
	[-20.27]	[-1.78]	[-36.32]	[-2.22]	[-13.07]	[-2.85]
Customer loans/Total assets	0.63***	-0.00	0.36***	-0.00	0.31***	0.00*
	[38.75]	[-0.54]	[16.72]	[-0.21]	[7.28]	[1.78]
Off balance sheet	0.12***	0.00	0.15***	-0.00	0.22***	-0.00
	[6.15]	[1.20]	[5.13]	[-1.02]	[4.03]	[-0.13]
Growth of total assets	-0.04***	0.00	-0.04**	0.00**	0.04	0.00
	[-3.58]	[0.28]	[-2.38]	[2.52]	[1.37]	[1.01]
Board size	0.50**	0.01	0.81**	-0.00	-1.11**	-0.02
	[1.97]	[0.94]	[2.42]	[-0.08]	[-2.08]	[-1.43]
Interest rate spread	-0.84***	-0.01***	-0.44***	-0.00*	-0.12	0.00
	[-13.93]	[-5.58]	[-5.32]	[-1.78]	[-0.90]	[0.50]
GDP growth (county)	0.07***	-0.00	0.08***	0.00	0.01	0.00
	[5.34]	[-0.87]	[4.39]	[0.18]	[0.19]	[0.24]
Population (log, state)	58.22***	-0.64***	36.24***	-0.86***	-18.05	-0.18
	[7.30]	[-3.37]	[3.82]	[-3.55]	[-1.24]	[-0.47]
Merger (dummy)	0.20	-0.02**	-0.51*	0.00	0.26	-0.01
	[0.74]	[-2.47]	[-1.71]	[0.45]	[0.41]	[-0.78]
Average board age	n/a	n/a	0.02	0.00	-0.11**	0.00*
			[0.77]	[0.10]	[-2.17]	[1.73]
Average Ph.D.	2.21	0.03	6.46	0.43***	n/a	n/a
	[1.64]	[0.98]	[1.36]	[3.18]		
Average female	1.11	0.01	n/a	n/a	1.01	0.17**
	[0.93]	[0.47]			[0.35]	[2.24]
Observations	5,080	6,425	2,258	3,073	960	1,220
R-squared	0.493	0.036	0.653	0.034	0.363	0.158
Number of banks	1,284	1,574	490	652	206	258
Number of board changes	432	566	17	24	19	24

We report robustness tests. Treatment banks are matched with banks of similar size (+/- 20% of Total assets, log), similar performance (+/- 20% of ROE), bank type (private, public, and cooperative banks) and year. Estimation results are shown for regressions with risk-weighted assets over total assets (RWA/TA) as dependent variables in columns (1), (3), and (5). We exclude banks that incur losses. Columns (2), (4), and (6) use loan portfolio concentration, measured by a Herfindahl Hirschman index as dependent variable. Column (1) and (2) refer to the sample with banks that experience decreases in board age after the board change and control banks. Column (3) and (4) refer to the sample containing banks which experience an increase in female board representation after the board change and control banks. Column (5) and (6) refer to the sample containing banks which experience an increase in executives with Ph.D.s after the board change and matched control banks. Board change is a dummy equal to 1 if the bank experienced a board change. Post period is a dummy equal to 1 in the period following a change. We include a time trend, and control for total assets (log), total asset growth, core deposits to total assets, powerful CEO (captured by CEO tenure), and a dummy variable Merger that equals 1 if the bank was engaged in a merger. In addition, Columns (3)-(6) control for average board age to account for the levels of the board characteristics, and Column (1)-(4) control for the average proportion of executives holding Ph.D.s. Columns (1), (2) , (5), and (6) control for the average share of female executives per year. Macroeconomic control variables are identical to the ones used in the main regressions in Table VII. t-statistics in parentheses. Constant terms included but not reported. ***,*,* indicate significance at the 1%, 5%, and 10% level, respectively.

Table XI: Alternative matching strategy on capital adequacy ratio

	Age composition (1) RWA/TA	Gender composition (2) RWA/TA	Education composition (Ph.D. degree) (3) RWA/TA
Board change	-0.05	1.15*	-1.53**
	[-0.33]	[1.78]	[-2.12]
Post period	0.19	0.56***	0.41
	[1.24]	[2.61]	[1.16]
Board change * Post period	**0.46*** **	**1.49*** **	**-2.51*** **
	[2.60]	**[2.84]**	**[-4.19]**
Time trend	-0.10*	1.10***	1.31***
	[-1.96]	[12.88]	[10.38]
Total assets (log, deflated)	-4.49***	-26.77***	-17.97***
	[-6.09]	[-20.98]	[-8.93]
Core deposits/Total assets	-0.15***	-0.27***	-0.22***
	[-8.98]	[-8.98]	[-4.89]
Powerful CEO	0.02*	0.00	-0.01
	[1.87]	[0.07]	[-0.46]
Capital adequacy ratio	-0.35***	-1.87***	-1.26***
	[-20.21]	[-30.39]	[-13.00]
Customer loans/Total assets	0.65***	0.36***	0.43***
	[47.94]	[15.70]	[11.39]
Off balance sheet items/Total assets	0.15***	0.18***	0.01
	[8.06]	[6.26]	[0.91]
Growth of total assets (deflated)	0.00	0.03***	0.04
	[0.93]	[2.90]	[1.34]
Board size	0.68***	0.25	-0.46
	[3.09]	[0.71]	[-0.83]
Interest rate spread	-1.05***	-0.44***	0.01
	[-19.81]	[-5.06]	[0.04]
GDP growth (county)	0.07***	0.06***	0.03
	[5.80]	[3.05]	[0.85]
Population (log, state)	70.08***	79.19***	-37.73***
	[10.22]	[8.46]	[-2.66]
Merger (dummy)	0.56**	-0.04	-1.17*
	[2.17]	[-0.11]	[-1.69]
Average Ph.D. representation	1.86	2.03	n/a
	[1.52]	[0.50]	
Average female representation	-1.10	n/a	-3.22
	[-1.10]		[-0.86]
Average board age	n/a	0.03	-0.11**
		[0.91]	[-2.11]
Observations	6,872	2,178	874
R-squared	0.489	0.615	0.417
Number of banks	1,620	459	186
Number of board changes	569	24	25

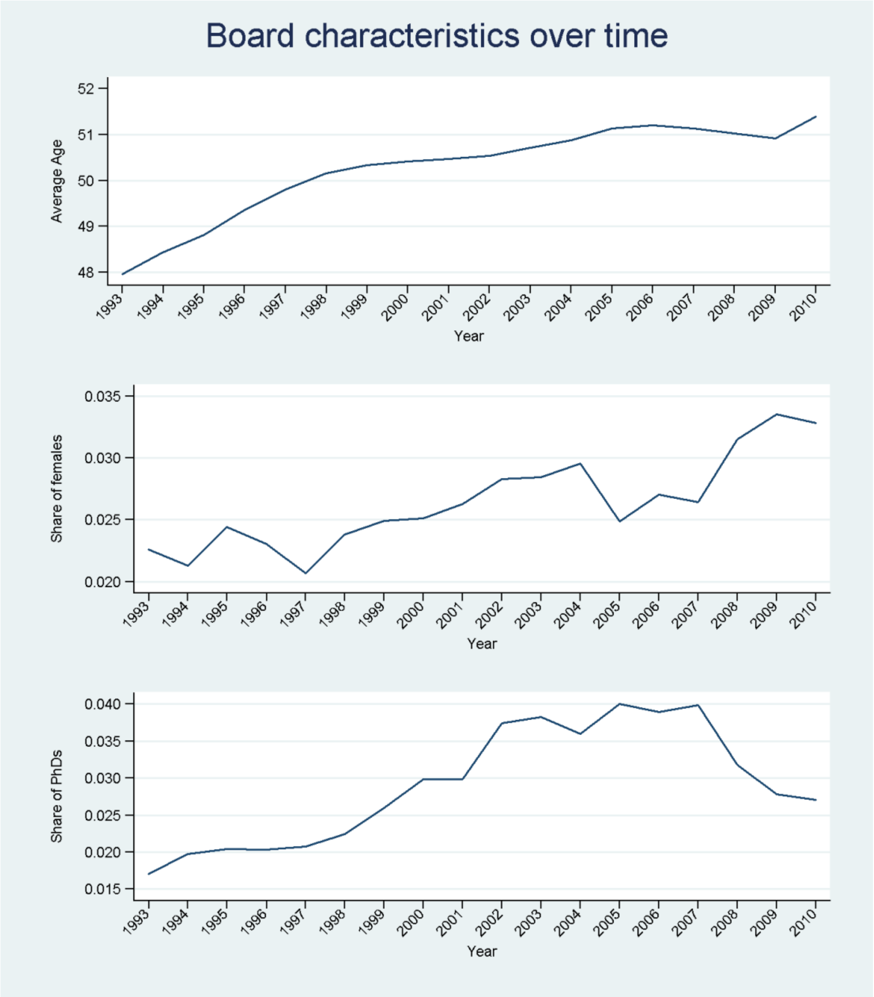
We report results from differences-in-differences estimations. Board change banks are matched with banks of similar capital adequacy ratio (+/- 10%), similar size (+/- 10 % of Total assets, log), similar performance (+/- 10% of ROE), bank type (private, public, and cooperative banks) and year. Bad banks are excluded. Column (1) refers to the sample containing banks that experience decreases in average board age after the board change and their matched control banks. Column (2) refers to the sample containing banks which experience an increase in female board representation after the board change and their matched control banks. Column (3) refers to the sample containing banks which experience an increase in the proportion of executives with a Ph.D. degree after the board change and their matched control banks. Board change is a dummy equal to 1 if the bank experienced a board change of the considered type. Post period is a dummy equal to 1 in the period following a board change. We include a time trend, and control for total assets (log), total asset growth, core deposits to total assets, powerful CEO (captured by CEO tenure), and a dummy variable Merger that equals 1 if the bank was engaged in a merger. In addition, Columns (2) and (3) control for average board age to account for the levels of the board characteristics, and Column (1) and (2) control for the average proportion of executives holding a Ph.D.. Columns (1) and (3) control for the average share of female executives per year. Macroeconomic control variables include the interest rate spread between 10-year and 1-year government bonds, GDP growth and population (log) of the state where the headquarter of the bank is registered. t-statistics in parentheses. Constant terms included but not reported. ***,*,* indicate significance at the 1%, 5%, and 10% level, respectively.

Table XII: Placebo tests

	Age composition (1) RWA/TA	Gender composition (2) RWA/TA	Education composition (Ph.D. degree) (3) RWA/TA
Board change	0.07	-0.78	-0.53
	[0.47]	[-1.30]	[-0.73]
Post period	-0.00	0.02	0.70**
	[-0.01]	[0.12]	[2.42]
Board change * Post period	**0.15**	**-0.76**	**-0.44**
	[0.65]	**[-1.41]**	**[-0.67]**
Time trend	0.39***	1.13***	0.91***
	[7.71]	[17.82]	[8.38]
Total assets (log, deflated)	0.11	-14.11***	-2.62**
	[0.28]	[-13.96]	[-2.55]
Core deposits/Total assets	-0.02	-0.02	-0.02
	[-0.80]	[-0.64]	[-0.34]
Powerful CEO	-0.01	0.02	-0.04*
	[-0.74]	[0.96]	[-1.67]
Capital adequacy ratio	-0.37***	-1.51***	-1.15***
	[-15.73]	[-31.35]	[-13.95]
Customer loans/Total assets	0.58***	0.44***	0.37***
	[41.07]	[24.02]	[11.58]
Off balance sheet	0.18***	0.35***	0.01*
	[10.68]	[13.25]	[1.77]
Growth of total assets	-0.03***	0.04***	-0.06**
	[-8.80]	[3.63]	[-2.23]
Board size	0.30	-0.47*	-0.31
	[1.28]	[-1.90]	[-0.65]
Interest rate spread	0.03	0.17**	0.35***
	[0.56]	[2.23]	[2.79]
GDP growth (county)	-0.01	-0.01	-0.03
	[-0.49]	[-0.92]	[-1.13]
Population (log, state)	-24.30***	-6.31	-95.28***
	[-3.15]	[-0.82]	[-5.90]
Merger (dummy)	0.09	-0.82**	-0.68
	[0.29]	[-2.34]	[-1.01]
Average Ph.D.	2.45**	6.60*	n/a
	[1.98]	[1.67]	
Average female	-1.79*	n/a	-9.56***
	[-1.66]		[-3.67]
Average board age	n/a	0.03	0.03
		[1.09]	[0.62]
Observations	4,518	2,428	915
R-squared	0.513	0.614	0.511
Number of banks	1,373	624	244
Number of board changes	503	21	22

We report results from the placebo test estimations. Board change banks are matched with banks of similar size (+/- 20% of Total assets, log), similar performance (+/- 20% of ROE), bank type (private, public, and cooperative banks) and year. Bad banks are excluded. Column (1) refers to the sample containing banks that experience decreases in average board age after the board change and their matched control banks. Column (2) refers to the sample containing banks which experience an increase in female board representation after the board change and their matched control banks. Column (3) refers to the sample containing banks which experience an increase in the proportion of executives with Ph.D.s after the board change and their matched control banks. Board change is a dummy equal to 1 if the bank experienced a board change of the considered type. Post period is a dummy equal to 1 in the period two years before the board change actually takes place. We include a time trend, and control for total assets (log), total asset growth, core deposits to total assets, powerful CEO (captured by CEO tenure), and a dummy variable Merger that equals 1 if the bank was engaged in a merger. In addition, Columns (2) and (3) control for average board age to account for the levels of the board characteristics, Columns (1) and (2) control for the average proportion of executives holding a Ph.D. and Columns (1) and (3) control for the average share of female executives per year. Macroeconomic control variables include the interest rate spread between 10-year and 1-year government bonds, GDP growth and population (log) of the state where the headquarter of the bank is registered. t-statistics in parentheses. Constant terms included but not reported. ***,*,* indicate significance at the 1%, 5%, and 10% level, respectively.

Figure I: Evolution of board characteristics over time



We present how board age, female share of executives, and the share of executives with Ph.D. have evolved over time. Average age refers to the average board age in a given year. Share of females denotes the average proportion of female board members. Share of PhDs denotes the average share of board members holding Ph.D.s. Averages are calculated per year.