Compensation Regulation in Banking: Executive Director Behavior and Bank Performance after the EU Bonus Cap*

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Abstract

We investigate the (unintended) effects of bank executive compensation regulation. We find no evidence that capping the share of variable compensation spurred a substantial outflow of executive directors from the EU banking industry. The response of banks to regulation to raise fixed compensation apparently sufficed to retain them. However, risk-adjusted bank performance deteriorated, consistent with reduced incentives to exert effort and insurance effects associated with fixed compensation components. We also find that banks with executives that are more affected by the bonus cap exhibit more systemic as well as systematic risk. This result casts doubts on the effectiveness of the policy to enhance financial stability.

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1 Introduction

In April 2013, the European Parliament voted to cap the compensation share of bonus payments to banks' executive directors—executives for short—in the European Union (EU). Many observers interpreted this decision as the dawn of a regime shift that should alter the risk-taking attitudes of bank executives after the Great Recession of 2007-2008 (The Economist, 2013). Yet, theoretical predictions about the effects of bonus caps are mixed. Some studies show that they can contain excessive risk-taking when banking regulation is weak (Hakenes and Schnabel, 2014) or if the bank is systemically relevant (Freixas and Rochet, 2013). Others caution that less incentive pay reduces bank executives' effort and serves as an undesirable insurance mechanism that may even increase systemic risk (Carlson and Lazrak, 2010; Albuquerque, Cabral, and Guedes, 2019).

Given this theoretical ambiguity, we assemble a novel sample of all executive directors of 45 major EU banks to provide comprehensive empirical evidence on the implications of this policy shock in two dimensions. First, we isolate first-order effects in labor markets to learn if this stark regulatory policy intrusion inflicted undesirable collateral damage by driving the most talented human capital out of the banking industry. Second, we test if the policy shock successfully tamed excessive risk-taking by banks or whether changed incentives of top executives possibly jeopardized banking system resilience.

After all, the high levels of pay in the finance industry, which disgruntled the public in the aftermath of the Great Recession, were necessary to attract and retain the most skilled human capital (Philippon and Reshef, 2012; Murphy, 2013a,b). An erosion of the talent pool may destabilize this inherently complex sector. High fixed compensation insures risk-averse bankers (Carlson and Lazrak, 2010) and causes higher operating leverage (Efing, Hau, Kampkötter, and Rochet, 2018), possibly increasing systemic risk. However, large variable and incentive-based compensation components in the United States (US) banking industry invited risk-shifting behavior after deregulation in 1999 (DeYoung, Peng, and Yan, 2013). Pre-crisis compensation practices also contributed to excessive risk-taking in non-US banking markets (Efing, Hau, Kampkötter, and Steinbrecher, 2015). This mixed evidence highlights that corporate governance in banking is special and conditional on country-specific regulatory conditions (Laeven and Levine, 2009; Anginer, Demirguc-Kunt, Huizinga, and Ma, 2018).

With our novel and granular executive data collected for 14 different EU countries at hand, we demonstrate empirically that the policy did not generate unintended collateral

damage to banks' human capital. The concerns voiced by industry representatives that the most talented managers would leave did not materialize. Banks simply indemnified their CEO and non-CEO executives sufficiently when adjusting compensation packages to comply with the new regulation. But bonus caps also failed to reduce risk-taking and to enhance financial system resilience. The risk-adjusted performance of the average EU bank suffered from the regulation and risk profiles deteriorated for any of the main stakeholders of banks: shareholders, creditors, and the general public. In particular, the result that banks affected by the bonus cap exhibit a hike of systemic risk relative to banks that were not affected raises concerns about the effectiveness of the EU bonus cap to foster financial stability.

This paper contributes to a firmer comprehension of the consequences of limiting incentive pay in banking in three distinct ways. First, we test for the adverse attrition of human capital from the banking industry due to the regulatory shock to compensation. The isolation of first-order effects in bank executive labor markets helps to reveal potentially unintended consequences of regulating incentive pay. Contrary to most studies, we do not limit our focus to CEOs in one country (see, e.g., Kleymenova and Tuna, 2018). Instead, we collect data on CEOs and all non-CEO executives of 45 EU banks that reside in 14 countries between 2010 and 2016. The EU bonus cap establishes that the maximum variable-to-fixed compensation ratio shall not exceed 100%. Subject to shareholder approval, banks can increase this threshold up to 200%. Our data allow us to precisely identify executives with higher maximum variable-to-fixed compensation ratios who were therefore not compliant with the EU cap as of 2013. These executives constitute our treatment group whereas those with compliant contracts as of 2013 serve as the control group. By differentiating between plausibly forced and voluntary executive turnover in a difference-in-differences framework, we provide evidence of the absence of (excessive) collateral damage. Turnover is not significantly more likely for executives with higher treatment intensity when controlling for management shake-ups. Likewise, better skilled and more experienced executives are not more likely to depart after the regulatory shock, which suggests that executives' dismissals rather than top talents abandoning sinking ships drive executive turnover. This interpretation is consistent with the result that especially treated executives at under-performing banks leave the industry and are replaced by younger and less experienced successors. Overall, we find no empirical indications of a dramatic impairment of EU banks' ability to retain their best executives.

Second, we test whether and how banks implemented the regulation. Beyond confirming that banks abide with new rules, we are the first to collect information on fixed

compensation and *maximum achievable* rather than *granted* or *realized* variable compensation. This metric for the maximum variable-to-fixed compensation ratio is a truly forward-looking measure of incentives in the contracts of both CEO and non-CEO executives in EU banks. Therefore, it allows us to show that the absence of human capital attrition is attributable to the practice of a timely adjustment of treated directors' compensation structure to comply with the cap. Banks do so through a combination of increased fixed compensation and a decreased maximum variable compensation. We show that expected compensation did not change significantly from the perspective of a risk-neutral treated executive around the EU cap. Thus, banks appear to indemnify their executives and buffer the regulatory shock to their labor income. Banks only changed the face value of variable compensation. They did not alter key performance indicators (KPIs) or pay-for-performance sensitivities of bonus plans though. This practice raises the question of whether the regulation succeeded at all to change risk attitudes and materialized risks.

The third contribution is therefore to test if these indemnification responses to the bonus cap did temper banks' tendency toward excessive risk-taking. We assess if EU bank performance in terms of risk-return achievements changed after the regulatory shock. Contrary to the common narrative about performance compensation, often perceived to be akin to risk-taking incentives, treated banks exhibit a significant increase in risk-taking following the cap. This hike is accompanied by a decrease in risk-adjusted performance. Increased risk-taking manifests itself through different risk dimensions that are of direct relevance to shareholders (stock return volatility and beta), creditors (credit spreads), and the public and policy-makers (systemic risk). This pattern is consistent with the theoretical prediction of Carlson and Lazrak (2010) that risk-averse managers become more tolerant to risk because of the insurance effect provided by higher fixed compensation.

A fundamental problem in the literature on executive compensation is the endogenous nature of pay (Edmans, Gabaix, and Jenter, 2017). Although the EU bonus cap constitutes a shock to the contracting environment in which banks and their executives operate, its exogenous nature is unclear. In our sample, treated executives exhibit indeed different levels of observable traits compared to untreated executives. But importantly, we demonstrate that the parallel trends assumption is not violated, indicating that differences across the two groups of executives are arguably time invariant. To this end, we saturate our difference-in-differences specifications with fixed effects to account for these level differences. We also ensure that our results are not driven by one of the many confounding events and factors, such as the contemporaneous EU implementation

of Basel III, banks' exposure to the European debt crisis, bailouts, and macroeconomic or regulatory shocks that are subsumed by country-by-year fixed effects. Our results also obtain when using an alternative control sample based on top executives at large US banks, who are by definition not affected by the EU bonus cap. The mostly large, internationally active treated EU banks arguably share more hard-to-observe features—such as risk exposures, business models, and below-executive-level compensation practices—with this alternative control group of US peers compared to untreated EU banks. Yet, we cannot exclude the possibility that treated directors self-select into treatment. Overall, we therefore interpret the empirical results as suggestive evidence rather than clear-cut causal effects of a shock to compensation structure. Despite this limitation, these relationships measure relevant observational differences associated with a change in regulatory compensation introduced in the wake of the Great Recession.

The first strand of literature to which we relate studies the relationship between bank executive compensation and the consequences for risk-taking and financial stability. Against the backdrop of the Great Recession, several theoretical frameworks emerged that link executive compensation, regulation of compensation, and risk-taking in banks (e.g., Thanassoulis, 2012; Bénabou and Tirole, 2016; Bolton, Meran, and Shapiro, 2015). On the empirical side, Fahlenbrach and Stulz (2011) investigate the role of bank CEOs' incentives before the crisis and show that banks with CEOs whose incentives were more tightly linked to shareholder wealth performed worse during the crisis. Those CEOs did not decrease their equity holdings and subsequently experienced large losses due to poor performance. Boyallian and Ruiz-Verdú (2017) complement this line of research by looking at how pre-crisis incentives and leverage interacted, showing that equity incentives were especially conducive to default risk in highly levered banks. Kolasinski and Yang (2018) illustrate that financial institutions whose CEOs had a higher fraction of short-term incentives before the crisis exhibited higher exposure to subprime mortgages and higher distress. Bhagat and Bolton (2014) find that managerial incentives led to excessive risk-taking and that poor bank performance was not the result of unforeseen risk. Efing et al. (2015) exploit payroll data from selected European countries to document that incentives in banks before the crisis were too high to be the result of an optimal trade-off between risk and return.[1] DeYoung et al. (2013) show that in the US, more risk-taking incentives were provided to CEOs after regulatory constraints on growth opportunities of banks were lifted in the wake of the Financial Services Modernization Act deregulation in

[1] A growing literature analyzes the labor market for bankers even below the executive level (see references in Mukharlyamov, 2016).

and around the year 1999. They report that as a result, both bank risk-taking and average (variable) pay of CEOs increased. Fahlenbrach, Prilmeier, and Stulz (2012) conclude that a bank's performance in the crisis of 1998 had strong predictive power on its performance in the recent crisis, which solidified the rise to persistence of that bank's risk culture. Using data from 2006–2014, Bennett, Gopalan, and Thakor (2016) report that banks link their compensation more to short-term metrics and do not appropriately adjust for leverage, providing a potential explanation for the observation that banks took greater risks before the Great Recession. We add to these studies by testing whether attempts in the EU banking sector to tame risk-taking due to incentive pay were successful.

A second strand of empirical and experimental literature relates more directly to our exercise and focuses on the consequences of regulation of bankers' compensation on both risk and executive labor markets. In a cross-country setting, Cerasi, Oliviero et al. (2015) show that banks whose CEOs receive more stock and option grants perform worse and take more risk in the presence of explicit deposit insurance schemes. Cerasi, Deininger, Gambacorta, and Oliviero (2017) provide cross-country evidence on how bank CEOs' pay packages and turnover rates changed around the introduction of the Financial Stability Board (FSB) guidelines on compensation. Kleymenova and Tuna (2018) investigate UK banks' reactions in terms of CEO compensation, turnover, and risk-taking to a regulation that mandated the deferral of compensation and subjected it to performance-based vesting. They report that it contributed to a reduction of systemic risk, but possibly impaired banks' ability to retain their CEOs. These results are important evidence on unintended effects of the EU-wide mandatory deferral of bonuses as part of the Capital Regulation Directive (CRD) III of 2010 on CEOs employed in one important financial system, the UK. We complement this insight with an assessment of the approach adopted by regulators as part of the CRD IV in 2013: bonus share instead of clawback rules under CRD III. Empirical evidence on the effect of bonus caps is surprisingly scarce and we are only aware of laboratory-based experimental evidence by Harris, Mercieca, Soane, and Tanaka (2018).[2] They show that this type of cap is highly effective at limiting risk-taking if and only if the bonus is not conditional on achieving a performance target. Since this condition is rarely met in the banking industry, we study the effects of capping bonus shares of CEOs and non-CEO executives at 45 major banks from 14 EU countries and provide empirical ad-hoc tests showing that bonus caps in fact exacerbate rather than

[2] Abudy, Amiram, Rozenbaum, and Shust (2017) investigate the consequences of a cap on *total* compensation in the Israeli finance industry, finding evidence that this regulation helped reduce rent extraction.

mitigate risk-taking through differential effects on the stakeholders of the banking sector: owners, creditors, and tax payers with a public interest in system resilience.

In sum, we conduct a comprehensive empirical assessment of the (un)intended consequences of a bonus cap on the compensation and career choices of CEO and non-CEO executives in multiple jurisdictions within the EU, before isolating the association of such a regulatory shock with bank performance and risk-taking.

2 Institutional background on main changes of compensation regulation

Short termism—especially in the form of excessive risk-taking—induced by high-powered compensation packages in the financial industry is often blamed for the Great Recession (DeYoung et al., 2013; Efing et al., 2015). This view also explains why, for example, bailouts of stressed US banks under the Troubled Asset Relief Program were conditioned on executive compensation constraints (Bayazitova and Shivdasani, 2012). The longer-term implications were regulatory reforms that aimed to curb excessive risk-taking incentives in bankers' compensation packages for good.

In 2009, the FSB published the Principles for Sound Compensation Practices, which comprise three clusters. The overarching goal is to raise awareness that compensation systems are closely related to risk management and governance. The first cluster guides the governance of compensation and the internal monitoring of compensation systems. The second provides principles aligning compensation to prudent risk-taking goals. Payouts should be risk-adjusted, penalize bad performance on various levels of the institution, and reflect the time horizon of risks in appropriate deferral schemes. The employee's role, position, and responsibility should be reflected by the mix of payouts in equity, equity-linked, and cash components. The third cluster of principles defines standards on the supervision and disclosure of compensation practices. Supervisors should review compensation systems continuously as part of their risk assessment and take supervisory actions when deficiencies are identified. Information on compensation systems should also be made accessible to stakeholders to allow them to evaluate the compensation policies.

The European CRD III reflects the FSB principles.[3] It prescribes minimum levels of deferral and equity grants for identified staff at significant institutions to better link bankers' incentives to long-term bank performance and favor prudent risk-taking. At least 40% of variable compensation must be deferred for at least three years. Not less than half of variable compensation should be granted in a way that incentives are

[3]Directive 2010/76/EU.

aligned with long-term interests of the credit institution (e.g., by granting share-linked compensation). The most well-known transposition into national law of CRD III is the UK Remuneration Code, which came into effect in 2010. Other transpositions (e.g., the German *Institutsvergütungsverordnung*) were enacted in the same year.

The CRD IV was introduced in 2013 and its rules on compensation became binding as of January 2014. The main goal was to limit excessive bank risk-taking.[4] This regulation complements the original rules of the CRD III with the so-called banker bonus cap. It limits the ratio of variable-to-fixed compensation at 100%, or 200% if shareholders agree.[5] Studying this regulatory shock complements the existing evidence on vesting periods and clawbacks with a comprehensive cross-country study of a compensation component that is most directly linked to short-termism: variable bonuses.

According to the European Banking Authority (EBA), compensation items can only be classified as fixed if they are "permanent, i.e., maintained over a period tied to the specific role and organisational responsibilities for which they are granted; pre-determined, in terms of conditions and amount; non-discretionary, non-revocable and transparent to staff".[6] The cap applies to senior managers, so-called material risk takers (e.g., traders), and internal supervisors. It is binding for legal entities of EU banking groups, i.e., also for non-EU subsidiaries. Regulating the variable-to-fixed compensation ratio leaves compensation levels as such untouched, but the costs to incentivize employees increase. For example, under a cap of 100%, for each euro a bank offers as a potential variable earning to an executive director, the bank must pay at least one euro as fixed pay, irrespective of performance. Therefore, the bonus cap leads banks to internalize to a larger extent the potential costs of incentivization.

3 Compensation regulation in banking: Theoretical priors

First, we provide theoretical guidance on how the particular governance of the banking firm interacts with regulation, which gives rise to different implications for the nexus between compensation and risk-taking. Second, we discuss theoretical implications of

[4]Directive 2013/36/EU (preamble no. 65). National regulators had to ensure compliance with it by the end of 2014: see https://www.eba.europa.eu/-/eba-discloses-probe-into-eu-bankers-allowances.

[5] The cap can be further increased by discounting up to 25% of the variable compensation that is deferred for at least five years. The discount rate is a function of macroeconomic conditions and the specific features of the compensation plan of the director (see the respective EBA Guidelines, EBA/GL/2014/01, p. 3). Robustness tests using a ratio of variable-to-fixed compensation of 250% as the threshold (in line with commentators like Reuters UK, 2013) leaves our main results unaffected.

[6]See https://www.eba.europa.eu/-/eba-discloses-probe-into-eu-bankers-allowances.

compensation regulation regarding the first-order effects in managerial labor markets.

3.1 Governance, regulation, and risk in the banking industry

The governance mechanism of banks differs from the well-known one pertaining to non-financial firms described by Shleifer and Vishny (1997) for two main reasons: pervasive regulatory oversight and the presence of explicit (e.g., deposit insurance schemes) and implicit government safety nets (e.g., bailouts of *too-big-to-fail* banks), as illustrated by Adams and Mehran (2003) and John, Mehran, and Qian (2010). Both aspects reflect the systemic relevance of bank stress, which can generate negative externalities for non-stressed banks as well as for non-financial firms and households (Acharya, 2009; Brunnermeier, 2009).

Given these two features in the banking industry, the traditional agency problem between shareholders, creditors, and management is nested in the broader one between shareholders and the public. This public interest in a stable banking system explains why most observers assess bank governance arrangements in terms of how well they do (not) contain excessive risk-taking (The Economist, 2010; Freixas and Rochet, 2013).

Two main views prevail as to why bank governance arrangements failed to prevent the Great Recession. According to the first view, critically weak governance practices prior to 2007 take center stage to explain individual and systemic failure. Interests between shareholders and management have not been aligned sufficiently well, such that excessive risks accumulated in the banking system that triggered, in turn, subsequent regulatory initiatives aiming to strengthen governance, such as the introduction of proxy access and say-on-pay rules (e.g., in the Dodd-Frank Act of 2010). The second view posits that excessive risk-taking can occur even if strengthened shareholder-oriented governance, for example via independent boards of directors, ensured aligned shareholder and management interests. Privately optimal arrangements between shareholders and management in the presence of a government safety net and limited liability can still entail negative externalities in the form of a socially suboptimal level of risk-taking from the general public's perspective. (see, e.g., Chaigneau, 2013; Eufinger and Gill, 2016; Anginer et al., 2018). Hence, standard governance practices are insufficient for banks according to this view, calling for additional governance through regulation.

Consistent with this second perspective, the scope of bank regulation was extended continuously since the Great Recession. Conventional microprudential capital requirements have been revised and complemented with liquidity and leverage requirements.

Macroprudential regulatory instruments, such as countercyclical and systemic capital charges or lending restrictions in the form of loan-to-value caps, account more explicitly for the systemic dimension of risk-taking.

Besides the regulation of financial quantities, ensuring sound management processes and corporate governance received substantial attention too (Bank for International Settlements, 2011). Among the various aspects of governance influencing bankers' risk-taking incentives, significant attention has been devoted to bankers' pay packages. Indeed, theoretical studies indicate that compensation regulation fulfills a distinct disciplining role compared to more direct approaches to regulating risk-taking. John, Saunders, and Senbet (2000) show that capital regulation cannot fully curb risk-shifting behavior due to banks' high leverage. Likewise, asset restrictions may lead to substantial inefficiencies in investment policy. They propose to link deposit insurance premia to bankers' compensation structure to induce shareholders to design Pareto optimal managerial contracts. Similarly, Eufinger and Gill (2016) illustrate that capital requirements contingent on bank management incentive schemes—under which banks can lever up more, the more decoupled managerial pay is from shareholders' interests—could achieve the socially optimal level of risk-taking. Kolm, Laux, and Lóránth (2017) show that the optimal approach to prevent excessive risk-taking comprises both capital and compensation regulation if shareholders are active. Capital regulation limits underinvestment in risk-reducing projects. But only when combined with compensation regulation, it is effectively preventing active risk-shifting in the form of conducting excessively risky investments. In sum, theoretical studies point towards an intricate interaction between prudential regulation and existing governance arrangements (see also Laeven and Levine, 2009), which raises the question if alternative policy tools to regulate compensation also have different effects on executive labor markets and risk-taking.

Executive compensation structure encompasses many different dimensions of managerial pay, and accordingly multiple possible angles for compensation regulation. It may relate to the level of pay, the fraction of debt vis-a-vis equity incentives, the maturity of pay components, or the like. As discussed in Section 2, most compensation regulation aims to reduce short-term incentives by constraining the structure of bank executives' payment packages. Accordingly, the focus on vesting periods under the 2010 regulation of CRD III, was supplemented with a more explicit cap of bonuses in the CRD IV of 2013. Therefore, we focus on one particular facet of compensation structure, the ratio of incentive pay relative to fixed pay, but study all board members in the entire EU banking industry, not only CEOs in selected countries.

It is important to provide comprehensive empirical evidence, because it is theoretically unclear if and via which economic mechanisms bonus caps mitigate risk-shifting. Risk-shifting concerns are more severe than effort problems if bank bailout probabilities are high. Against the backdrop of a so far untested Single Resolution Mechanism (SRM) paired with the absence of European Deposit Insurance Scheme, many argue that the European Banking Union is incomplete. Thus, doubts about bank resolution continue to prevail among market participants (Beck, Da-Rocha-Lopes, and Silva, 2019; Carmassi, Dobkowitz, Evrard, Parisi, Silva, and Wedow, 2019). In such as setting, Hakenes and Schnabel (2014) show that capping bonuses is an effective tool to restore the socially optimal level of risk-taking. Relatedly, Kolm et al. (2017) point out that a bonus cap can contain the bank's maximum default probability. However, it does not mitigate underinvestment in risk-reducing strategies, which prevents attainment of the first-best level of risk-taking. Thanassoulis and Tanaka (2018) study the case of a *too-big-to-fail* bank, focusing on clawback rules as the main tool to curb excessive risk-taking. Accounting for bank shareholders' endogenous reaction, they predict that these rules are effective only if coupled with restrictions on pay-for-performance sensitivity, such as bonus caps. Yet, they caution that shareholders can circumvent a cap structured like the EU one by granting highly convex pay schemes within a concentrated incentive region, thereby undoing the risk-reducing effect of the regulation (a similar result is obtained by Jokivuolle, Keppo, and Yuan, 2015). As such, their model suggests that bonus caps effectively reduce risk-taking only under fairly specific conditions. An outright unintended implication of bonus caps is put forth by Albuquerque et al. (2019). They show how a bonus cap can reduce managerial effort and may increase systemic risk if executive performance is evaluated relative to peers, a common practice among large EU financial institutions.[7] As a result, bankers may invest in correlated projects and thereby increase systemic risk (Acharya and Yorulmazer, 2007; Farhi and Tirole, 2012).

[7]Appendix Figure A.1 provides concrete examples of pre-EU cap performance-based compensation plans. Variable compensation at EU banks takes most commonly the form of bonuses and performance-based incentive plans. The payoff on variable compensation is linked to different KPIs. KPIs generally include accounting- and market-based measure of equity or asset performance, but may also comprise "soft" metrics, such as employee satisfaction. In the case of Deutsche Bank, for instance, bonuses are linked to return on equity (ROE) and the performance-based incentive plan is instead linked to the so-called Relative Total Shareholder Return, which is a measure of stock return adjusted for the performance of selected peer banks (source: Deutsche Bank AG, Annual Report 2012, pp. 208-211). In the case of Barclays, besides traditional KPIs such as return on assets and loan loss rate, "sustanaibility metrics"—defined in the bank's "Citizenship Agenda"—are also taken into account (source: Barclays PLC, Annual Report 2011, p. 60). Due to the difficulty of measuring soft KPIs, our analysis of performance sensitivity of compensation in Section 6.2 focuses on equity performance.

Overall, numerous countervailing forces emerge from theories that analyze how bonus caps influence risk-taking. Fewer short-term incentives may reduce managerial risk appetite. But compensation packages skewed toward the fixed component of pay may induce managers to exert less effort and invest in riskier projects. Since existing theories relies on inherently unobservable quantities, a tight empirical test of each economic mechanisms modeled there is outside the scope of any reduced-form setting. We therefore limit ourselves to provide evidence on the equally important empirical question that is realistic to answer: what was the net change in bank riskiness around the introduction of the EU cap? Before doing so, we articulate our expectations about the first-order effects of capping incentive pay for highly skilled human capital in the labor market for executives.

3.2 Implications for managerial labor markets

Compensation structure is especially likely to co-determine executives' career trajectories in the financial industry. Skills can be better scaled in the financial industry compared to other sectors, which results in higher returns to human capital, in particular during times of deregulation (Philippon and Reshef, 2012; Célérier and Vallée, 2018). Skilled workers in the financial industry also tend to be highly mobile, possibly leading to tax competition across jurisdictions within a banking union to retain them (Gietl and Haufler, 2018). Van Boxtel (2017) discusses anecdotal evidence and provides a model that endogenizes compensation structure and risk-taking. In the presence of highly mobile workers, banks attract skilled workers in this model if they offer high-powered incentives. According to Oyer (2004), variable compensation can be more efficient than fixed pay to ensure that workers' participation constraint is met, even if the former partly rewards "luck". The financial industry provides a setting where variable compensation may indeed primarily serve the function of retaining talent rather inducing optimal effort. Murphy (2013b) cautions that constraining bonus payments may have severe consequences on banks' abilities to retain managers. Since the most talented executives would suffer the most from a more performance-insensitive compensation structure, they might be the first to leave. Thus, before turning to an assessment of the bank performance implications of the bonus cap, we formulate testable hypotheses about such first-order effects.

To understand the potential impact of the EU bonus cap for the managerial labor market, consider a stylized performance-based compensation plan resembling those in place at most EU banks. Variable compensation opportunities for executive directors are usually capped at a maximum level (Murphy, 2001; Bettis, Bizjak, Coles, and Kalpathy,

2018), which was also the case for major EU banks already before the introduction of the bonus cap. Figure 1 visualizes the terminal payoff M_T of one such plan as a function of a given measure of performance A_T at time T. Within the incentive zone ($X \leq A_T \leq Z$), directors participate in the bank's performance $\Pi = A_T - X$ at the participation rate p. The maximum variable compensation achievable by the executive V_{max} can be expressed as a fraction of fixed compensation ρF, where ρ represents the level of the cap ratio. At the end of a period, the compensation contract has the value:

$$M_T = F + \underbrace{(\rho F)/(Z - X)}_{p} \left[\max\{\underbrace{A_T - X}_{\Pi}, 0\} - \max\{A_T - Z, 0\} \right]. \tag{1}$$

The EU cap limits the value of the parameter ρ to 100%, which can be raised up to 200% upon shareholder approval. To assess the consequences of the regulatory shock for the managerial labor market, we investigate *how* banks complied with it. Consider again a compensation plan with payoff (1). Figure 2 relates an executive director's preferences to the possible adjustments in the associated compensation structure in terms of fixed compensation vs. expected variable compensation $E_t\,[Var.\ comp.]$ as of time t around the EU cap. The risk-averse case (the solid red line) and the risk-neutral case (dotted black 45° line) are depicted. Suppose that the maximum variable-to-fixed compensation ratio ρ in place before the EU cap does not comply with the new regulation (point O). If banks abide by the new regulation, three ways to reduce the ratio to ρ' are:

1. Decrease expected variable compensation while keeping fixed compensation unchanged (point A);
2. Increase fixed compensation while keeping expected variable compensation unchanged (point B); or
3. Rebalance both along the red line such that, for instance, the risk-averse executive director remains indifferent (point C).

These corner cases highlight empirically testable effects of the EU cap on managerial mobility. If banks comply with the cap as in case 1 (2), we should observe a surge (decrease) in voluntary turnover rates of executive directors. If banks *indemnify* their executives as in case 3, we expect no significant change in voluntary turnover rates.

Several additional factors are likely to matter. For example, highly skilled managers, who benefit more from performance-based compensation, may be more likely to leave than less skilled ones. A manager with general skills may also be more prone to leave

for another bank or sector if his/her human capital is portable, thus reducing personal switching cost (Weinberg, 2001). In addition to executive directors' characteristics, bank traits may also play an important role. Banks may purposely decide not to indemnify certain managers either because they want them to leave or they do not have the resources to retain them. This scenario has become increasingly relevant for the banking sector, which experienced a substantial loss in attractiveness as employer after the Great Recession. Therefore, we control below for unobservable and observable bank-level traits.

In sum, we test empirically if bank executives leave their positions around the introduction of the EU cap after controlling for director- and bank-specific traits. In particular, we test if departures occur more often under circumstances that are consistent with voluntary or forced attrition as far as these inherently opaque motives can be approximated. After establishing these first-order effects in executive labor markets, we proceed to examine the adjustment in executive compensation structure and the implications for bank performance and risk-taking.

4 Empirical approach

The January 2014 introduction of the EU bank bonus cap is our laboratory to examine how executive compensation structure affects banks' ability to retain their executives and their risk-adjusted performance. We focus on the executive directors serving on the board, to whom the shareholders delegate the management of the bank.

The bonus cap was imposed on banks across all EU countries at the same time. Therefore, no obvious counterfactual sample of unaffected banks exists relative to which the consequences of the regulatory shock can be isolated trivially. We thus define bank executives with compensation packages that did not comply with the cap as of 2013 as *treated* in a difference-in-differences approach. Bank executives with compliant compensation packages as of 2013 constitute instead the control group. Table A.1 illustrates that treated and untreated executives are employed across a diverse set of banks. The absence of any glaringly obvious clustering of treated executives in banks of a certain type, for example in terms of business model, distress, nationality, or ownership, bodes well for the empirical approach. To define the treated group in our baseline tests, we use the 200% threshold, which applies if shareholders agree. We choose the higher threshold because it allows us to minimize the number of false positives in the treatment group and because many of the large banks in our sample sought approval for a threshold above 100%.[8]

[8]Only 3% of banks received approval for a threshold higher than 100%, but they account for more

4.1 Turnover rate

We start by studying the first-order consequences of the EU bonus cap for executives' mobility in managerial labor markets. Given the concerns voiced on the potentially adverse impact of the cap on EU banks' ability to retain their managers (Murphy, 2013b), we are especially interested in executives who voluntarily left their banks either to take positions at other institutions or to retire early. Intuitively, by revealed preferences, if directors after the cap are worse (better) off, the number of voluntary turnovers should increase (decrease). In a second step, we document how compensation packages changed around the introduction of the cap so as to comply with the new regulation. Thereby, we shed light on how attractive an executive's current position is relative to possibly available outside options.

We adopt a difference-in-differences design and estimate a linear probability model along the lines of Guo and Masulis (2015) for executive director turnover:

$$y_{ijt} = \beta_0 + \beta_1 Treatment\ intensity_i \times Post_t + \boldsymbol{\gamma x_{it}} + \boldsymbol{\theta z_{jt}} + \mathbf{1}\boldsymbol{\alpha_{jt}} + \epsilon_{ijt}. \qquad (2)$$

The unit of observation is executive director i at bank j in year t. The dependent variable y_{ijt} is an indicator equal to 1 if a given executive i leaves bank j in year t. Executive are classified as treated if their maximum variable-to-fixed compensation ratio exceeds the 200% threshold in 2013. Rather than using a binary treatment indicator, we exploit variation in compensation structure across treated executives. More specifically, the $Treatment\ intensity_i$ variable equals 0 for the control group, but it is equal to the distance between ρ and 200% as of 2013 for treated executives. Whereas untreated executives have a treatment intensity of 0, an executive with, for example, a maximum variable-to-fixed compensation ρ of 240% as of 2013 has a treatment intensity of 0.4. This approach improves the precision of empirical estimates. Note that $Treatment\ intensity_i$ is defined at the level of the executive rather than at the bank-level, which allows us to focus on within-bank variation. In robustness tests, we also use a standard binary treatment indicator as well as a different treatment threshold. $Post_t$ is an indicator variable equal to 1 from 2014 onward.

$\boldsymbol{x_{it}}$ is an array of director-level control variables such as age, a CEO indicator, professional experience, a retirement age indicator (1 if the director is older than 65 years), a

than 50% of aggregate banking sector assets (see Figure 1 of European Banking Authority, 2015). The individual remuneration reports that we collected confirm these aggregate data: large banks raised the cap to 200%.

female indicator, and tenure. $\boldsymbol{z_{jt}}$ comprises bank-level control variables such as size (natural logarithm of total assets), risk-adjusted performance as proxied by the lagged Sharpe ratio, the number of executive directors serving on the board, and an indicator for CEO turnover. In contrast to most self-explanatory control variables, professional experience deserves further explanation. We measure it like Custódio, Ferreira, and Matos (2013) by conducting a principal component analysis of information about the employment history of executives. This variable is crucial to control—at least indirectly—for an executive's outside option. Appendix Table A.2 provides more details about the computation.

We estimate increasingly saturated specifications by including year and bank fixed effects, which we denote by $\boldsymbol{\alpha_{jt}}$. Thereby, we control for changes in aggregate conditions and unobservable, time-invariant bank traits. Equation (2) depicts the most saturated specification. For ease of notation, we do not report direct terms of $Treatment\ intensity_i$, and $Post_t$ is absorbed by year fixed effects. We cluster standard errors at the bank level.

The baseline estimations comprise all turnover events. Since we sample CEOs and non-CEOs, identifying forced and voluntary turnovers through news searches à la Jenter and Kanaan (2015) is infeasible due to the sparse media coverage of the latter group. Observed changes in the overall turnover rate are informative regarding voluntary departures only as long as no differential changes occurred across the treatment and the control group in terms of the forced turnover rate and job-switching costs or preferences. Both conditions are unlikely to hold around the introduction of the EU bonus cap. We partially relax these strong assumptions by following the intuition of Jenter and Lewellen (2017). Rather than applying their estimation methodology, we analyze the turnover rate at different levels of performance. An executive turnover taking place after a year of good performance is arguably unlikely to be a dismissal. In this way, we refine our estimates of the consequences of the EU bonus cap for banks' ability to retain their executives.

4.2 Compensation structure

In a second step, we analyze how banks adjust their executives' compensation packages to comply with the new regulation. The adjustment of compensation structure is key to understand how attractive an executive's outside option becomes after the introduction of the EU cap and, thus, the strength of his/her incentives to leave the bank. Put differently, we study whether banks indemnify directors for the loss in variable pay opportunities to gain insights into the observed patterns of executive turnover around the cap.

The difference-in-differences design is the same as in equation (2). Dependent vari-

ables y_{ijt} include different measures of compensation: the level of fixed and (maximum) variable pay, the ratio of maximum variable compensation to fixed compensation, and expected pay. As before, executive-level controls comprise age, tenure, a female indicator, professional experience, and a CEO indicator. Bank-level controls comprise size, performance as proxied by ROE, and number of executive directors serving on the board. The most saturated compensation regression specification also includes director fixed effects.

4.3 Bank performance and risk-taking

Compensation structure is also of key importance in an executive's incentives to exert effort and to take risk. Such incentives affect also the interests of other bank stakeholders, such as shareholders, creditors, and the general public. In the last step of our analysis, we explore the evolution of performance and risk-taking (idiosyncratic, systematic, and systemic) around the introduction of the EU cap. Again, we follow a difference-in-differences approach similar to equation (2). The outcome variables y_{jt} comprise the Sharpe ratio, credit default swap (CDS) spreads, and measures of systemic and systematic risk taking. Most notably, we conduct our analysis at the bank level, because we do not observe individual executives' performance and risk-taking. The bank-level variable $Treatment\ intensity_j$ is the average across executives serving on a bank's board as of the enforcement of the EU cap. In this way, treatment intensity refers to the same executives that are in the post-treatment sample in executive-level regressions.

4.4 Identification challenges

The empirical analysis faces three key challenges. The first is selection bias. Highly skilled executives are more likely to receive high-powered incentives and are thus more likely treated. Therefore, we specify covariates to gauge managers' skills and risk appetite as well as banks' abilities to retain human capital and perform standard diagnostic tests. Still, we cannot rule out that treatment assignment is to some extent non-random in the difference-in-differences design. Especially managerial skill is intrinsically elusive.

To address the lack of a clear counterfactual in the context of the EU-wide introduction of a bankers' bonus cap, we scrutinize our results regarding alternative treatment and control group definitions mainly in three ways. First, we build an alternative control group of top executives from the largest US banks to complement the baseline choice of untreated EU bankers, which enriches our analysis for two main reasons. To begin with, US banks' executives are not directly affected by the cap. Furthermore, this alternative

control group allows us to compare the EU banks where treated executives are employed to similar US institutions in terms of size and business model. Compensation packages of treated EU executives may simply be more similar to top executives' pay at large US banks rather than resembling pay at untreated EU banks. Indeed, the difference in CEO pay between US and non-US CEOs is moderate when comparing CEO compensation of firms with similar characteristics across countries (Fernandes, Ferreira, Matos, and Murphy, 2013). The US control group also alleviates concerns about executives' self-selection into treatment. Despite these apparent advantages, the US control group suffers from the crucial limitation that executives' payoff schedules cannot be measured in a fully comparable way to the EU case. Therefore, we prefer untreated EU directors as the baseline control group. Second, we use a standard binary treatment indicator $Treated_i$, equal to 1 for treated directors, and 0 otherwise. Third, to compute $Treatment\ intensity_i$, we replace the 200% threshold for the maximum variable-to-fixed compensation ratio with the standard 100% threshold. Although this method suffers from having more false positives, it has the benefit of a larger treatment group that is more akin to the control group.

The second empirical challenge are confounding events. Obvious suspects in this respect are the many other post-Great Recession regulatory events discussed in Section 2, such as the CRD III. Importantly, many of these regulatory changes after the Great Recession were introduced before the EU bonus cap. Whereas this alleviates some confounding concerns, the adjustments to these reforms might have clearly taken place over an extended period of time, thus overlapping and interacting with the EU bonus cap. In addition to such observable differences, unobservable country effects may be at work, for example in terms of non-synchronous business cycles, banking system distress, or diverging government bailout practices across EU-countries after 2014. To account for possible unobserved confounding factors, we therefore specify country-year fixed effects as a first line of defense. However, country-by-year fixed effects may not suffice to rule out that we capture spurious effects due to other provisions, specifically those contained in the 2013 Capital Requirements Regulation (CRR).[9] Together with the CRD IV, which contains the EU cap, it implemented Basel III in the EU. Spurious effects may arise if banks' exposure to the cap correlated with changes in capital and liquidity requirements required at the same time. As a second line of defense, we therefore test if our main results hold up when controlling for changes in the level and the composition of regulatory capital and in liquidity. As a third approach to tackle confounding concerns, we conduct

[9]Regulation (EU) No. 575/2013 was enacted in 2013, but applies from 2014 onward, like the EU bonus cap. The CRR mainly addresses disclosure requirements on remuneration policy (see Art. 450).

falsification tests for selected events. One such event is the European debt crisis that hit banks to different degrees, depending on their exposures to sovereign debt. To rule out that sovereign debt exposures drive our bank-level results, we replace *Treatment intensity* with bank-level exposure to sovereign debt of peripheral countries. Further falsification tests include the exclusion of bailed out banks as well as the exclusion of UK banks.

A third challenge is to isolate the economic mechanism underlying the effects estimated with equation (2). Given the mixed theoretical predictions paired with the inherent limitations of any reduced-form empirical exercise discussed in Section 3, we conduct various ad hoc tests for executive- and bank-level regressions. Regarding the former, we study differential changes in the turnover rate across directors based on the approximated attractiveness of their outside options. In the bank-level analyses, we analyze the dynamics of plausible drivers of bank risk around the cap, such as insurance effects implied by larger shares of fixed compensation, operating leverage, and the intensity of monitoring over the bank portfolio of assets.

5 Data

5.1 Sources of bank and executive variables

We use a panel of EU banks with available information on executive directors' compensation over the 2010–2016 period. We obtain information on boards of directors and directors' characteristics from BoardEx. We sample only executive directors who are directly involved in the management of the bank, and exclude supervisory directors. Accounting data are from Bureau van Dijk's Bankscope for 2010–2015 and Orbis Bank Focus for 2016. Stock market and CDS spread data are from Thomson Reuters Datastream. Systemic risk measures are obtained from the V-Lab at New York University's Volatility Institute. Sovereign debt exposure data are from the EBA Transparency Exercise of 2011. To construct an alternative control group based on top executives from the largest 25 US banks, we then obtain compensation data from Standard and Poor's Execucomp, and accounting and stock price data from CRSP-Compustat merged (CCM).

We manually collect information on post-evaluation grants and on the structure of compensation at EU banks from publicly available remuneration reports. Collecting these data by hand allows us to precisely measure the *maximum* variable-to-fixed compensation ratio, which is the quantity regulated by the EU bonus cap. We track the evolution of this ratio in the years around the introduction of the EU bonus cap. This feature of our dataset allows more precise investigation than commercial databases allow, considering

that they only report *granted* or *realized* variable compensation.[10] Appendix Table A.1 provides the list of EU banks available in BoardEx for which we found compensation data. We distinguish between banks with at least one treated executive director (treated banks) and other banks (untreated banks). For each of them, we provide information on the number of treated and untreated directors serving on the board to illustrate the degree of within-bank variation in compensation schemes. The list of 25 US banks used as an alternative control group is also provided.

The final sample contains 995 bank-executive-year observations from 45 banks. Table 1 reports summary statistics for the main executive- and bank-level variables, which are winsorized at the 1st and 99th percentiles and defined in detail in Appendix Table A.3. In reporting summary statistics for these variables, we distinguish between executives belonging to the treatment group (Panel A) and the control group (Panel B) as well as between the period before (2010–2013) and after (2014–2016) the introduction of the EU bonus cap. According to the baseline treatment definition (200% threshold), there are 24 treated executives from nine distinct banks in our sample. Treated executives, as one would expect, are characterized by overall higher levels of compensation, receive more performance-based pay, and are employed at larger banks. Yet, Panel C shows that changes in executive- and bank-level variables between 2010 and 2013 across the treatment and the control group are not significantly different, in line with no divergence in trends between the two groups before the treatment.

Panel D of Table 1 tests the difference between average changes of the main variables in the treatment and the control group around the introduction of the EU bonus cap. Put differently, column (3) shows univariate difference-in-differences tests. The estimates demonstrate that treated executives exhibit a significant increase in their turnover rate. At the same time, the fixed compensation of treated executives significantly increases while the variable component contracts around the introduction of the EU cap. The combined pattern of compensation structure changes thus indicates that banks indemnify their executives for the EU bonus cap. Bank performance indicators, in turn, do not exhibit unconditionally significant difference-in-differences. Below, we revisit this prima facie evidence extensively in a regression framework where we can adequately account for both observable and unobservable factors that may also explain the differences in turnover rates as well as the absence of unconditional bank performance differentials.

[10]The data comprises only top management but not middle management to whom the cap might also apply if they qualify as material risk-takers, such as traders (European Banking Authority, 2013), but whose compensation has not to be reported publicly.

5.2 Post-turnover career trajectories of bank executive directors

Before proceeding with the analysis, it is worth exploring where bank executives go after leaving their positions. To this end, we manually collect data on career trajectories after a turnover from news stories and professional networking websites. Focusing on banks for which treatment status is defined, we identify 90 turnover events (47 at listed banks).

Table 2 groups executives by post-turnover employment category. We retrieve these information for 70.3% of departing executives (63.2% at listed banks),[11] of which 26.7% (28.1% at listed banks) continue as executives at another bank or a non-bank company. Another 19.8% (14% at listed banks) become senior managers, partners, self-employed, or work as advisors. Among this subset, 5.9% (3.5% at listed banks) advise the bank which they left as executives. 8.9% (5.3% at listed banks) stay active as supervisory board members or as non-executive directors.

Overall, considering that executive director positions constitute the most prestigious job category, it seems fair to say that most departing executives face inferior employment conditions after turnover. As such, these data suggest that executives in this sample do not voluntarily leave banks to look for better employment opportunities.

6 Main results

First, we investigate the first-order effects around the introduction of the EU bonus cap in terms of executive directors' turnover. Second, we analyze the changes in executive compensation structure around this regulatory shock. Third, we test how bank performance and risk-taking changed and provide ad-hoc tests on the respective channels.

6.1 Turnover rate

We examine the executive turnover rate around the introduction of the EU bonus cap. The literature has mostly focused on the turnover of CEOs (e.g., Jenter and Kanaan, 2015). We focus on the entire board of executive directors with managerial duties that are more comparable to a CEO than supervisory directors or non-executive managers.

Table 3 shows the headline turnover results from difference-in-differences tests around the introduction of the EU bonus cap. Columns 1, 2, and 5 include all executives. The remaining columns exclude CEOs and control for CEO turnover to account for management shake-ups, which often coincide with CEO turnovers (Pan, Wang, and Weisbach,

[11] We find no explicit information on career endings, e.g., for age reasons, for the other executives.

2016). In columns 1 to 4, the dependent variable is an indicator variable equal to 1 for any turnover. The turnover rate of treated executives increases in a statistically significant manner in the post-EU bonus cap period, but turns insignificant once we account for management shake-ups (columns 3 and 4). Since the latter are unlikely to reflect executive-specific career prospects, this non-result suggests that banks were able to retain their executives around the regulatory shock.[12]

These headline results raise the question if increased turnovers after the regulatory shock are more likely to reflect that the most talented managers "abandon ship" and leave the industry or whether altered bank governance practices also implied more forced attrition of bad managers if bank performance is poor. Whereas the true nature of turnover is ultimately inherently opaque, which precludes to rigorously distinguish turnovers due to executives' versus employers' choices, columns 5 and 6 are the first approach to tackle this question. Specifically, we focus on turnover events in the presence of below-median bank performance, as measured by the bank's ROE relative to the other banks in a given year.[13] Turnover at well-performing banks is arguably more likely to originate from executives' choices and therefore represent a plausible approximation of voluntary turnovers. Conversely, turnover at poorly performing banks is consistent with executives being forced to leave (see also Jenter and Lewellen, 2017). The frequency of turnover events at below-median performing banks increases significantly for treated executives, especially non-CEO ones. This result suggests that the bonus cap led to more stringent governance, but not necessarily to an exodus of the best bankers from the industry.[14]

We examine the relationship between turnover and risk-adjusted bank performance for treated and untreated executives more explicitly in Figure 3. Instead of re-classifying the dependent variable for poorly performing banks as in columns 5 and 6 of Table 3, we predict here turnover rates from a linear probability model specification of equation (2)

[12] Note that we account for further well-known determinants of executive turnover. Turnovers are more likely at smaller banks, at banks that perform worse, and if the executive is of retirement age and has more professional experience, which arguably correlates positively with executives' outside options. Coefficients confirm economic intuition, but point estimates are unavoidably imprecise in this manually collected executive sample. Note that the lagged Sharpe ratio is only available for listed banks. Therefore, this sample is smaller than for compensation regressions (e.g., Table 5). Overall, executive turnovers among EU banks exhibit similar patterns diagnosed in previous studies for US firms.

[13] Executives are often also evaluated based on relative performance vis-á-vis peers at other banks and KPIs are often closely linked to short-term metrics such as ROE (Bennett et al., 2016). ROE crucially depends on leverage and may be a misleading metric to gauge performance (Engel, Hayes, and Wang, 2003). We therefore perform the same tests using ROA to define poor performance bank-years. The results are not sensitive to this choice and available upon request.

[14] Unreported tests over a CEO-only sample confirm that turnover hikes are driven by CEOs at times of poor performance.

conditional on terciles of the Sharpe ratio. The left panel compares predicted turnover by tercile for treated executives before and after the introduction of the bonus cap. The right panel does the same for untreated executives. This comparison shows that turnover rates hike in the treated group only in bank-years characterized by poor performance.

But the increase in the turnover rate during bad treated bank-years does not suffice to conclude that most attrition is forced. Instead, some underperforming banks may have been unable to retain their best executives (especially CEOs) following the introduction of the cap. In fact, if it is the most talented executives that are called for the toughest restructuring cases, this most talented human capital pool has more degrees of freedom to decide to leave in case of unsatisfactory turnaround missions. We therefore augment our empirical strategy with explicit proxies for the quality of executives in Table 4 to tease out differential change in turnovers that reflect forced versus voluntary departures conditional on observable executive traits. Specifically, we interact proxies for executive directors' skill that should gauge the attractiveness of their outside option and, thus, the ease of leaving their current position. In Panel A, we add a triple interaction with the indicator variable *High experience*, which equals 1 if the professional experience measure à la Custódio et al. (2013) is above its median. In Panel B, we assume that the best executives are also the highest paid in the bank and measure executive skills accordingly by compensation in the pre–EU bonus cap period. The indicator variable *Top total pay* in columns 1 and 2 equals 1 if the executive is the best paid (or the second best paid) on the board in terms of total compensation (for boards with at least five executives). The indicator variable in columns 3 and 4 is computed identically using variable compensation (*Top var. pay*). No statistically significant pattern across different degrees of professional experience or compensation levels emerges, reinforcing the idea that executives' voluntary turnovers are not more likely after the introduction of the EU bonus cap.

Three additional explorations lend further support to this interpretation. First, for those executives where we could identify career transitions in more detail, we replace the dependent variable in Appendix Table A.4 with an indicator equal to 1 if a turnover event implied that the executives secured another executive position. The differential effect of the bonus cap introduction is insignificant, which is consistent with the absence of a change in the voluntary turnover rate following the EU cap

Second, provided that the bonus cap produces a shift towards a safer compensation structure, executives' total compensation may become less exposed to poor performance. Thus, banks may use forced turnovers as a substitute to discipline executives for weak performance. Such a change in governance practice would lead to the observed higher

turnover rate at treated banks with poor performance. If so, we would expect a positive differential effect on the performance sensitivity of turnover events in the presence of below-median bank performance. Appendix Table A.5 reports triple difference-in-difference regressions that analyze the role of risk-adjusted performance for such turnover events. We find qualitative evidence that turnover sensitivity to risk-adjusted performance increases, but the change is not statistically significant at conventional levels.

Third, we conduct a non-parametric comparison of leaving executives' characteristics with those of newly appointed ones in the post-cap period in Appendix Table A.6. Whereas incoming executives are younger and slightly less experienced than those who leave, no stark differences emerge between treated and untreated institutions.

Overall, we find no consistent evidence that banks fail to retain their executives following the EU bonus cap, in particular at well-performing banks. By contrast, we observe a surge in the turnover rate by treated executives at under-performing banks. This result may either reflect that skilled executives leave poorly performing banks or stronger shareholder discipline through forced turnovers. The absence of a higher attrition rate for highly skilled managers coupled with some evidence of increased turnover-performance sensitivity point towards the latter channel.

6.2 Compensation structure

The results in the preceding section suggest that executive directors are not worse off under the bonus cap, as reflected by the absence of a surge in turnovers, at least at well-performing banks. Next, we investigate whether the dynamics of compensation structure adjustment around the cap are consistent with such a pattern in turnover.

A visual inspection of compensation structure around the introduction of the EU bonus cap confirms that EU banks complied with the new regulation in a timely manner. Figure 4 depicts the maximum variable-to-fixed compensation ratio for the treated and the control groups. For both, we plot the ratio before the EU cap against the ratio after the EU cap. By definition, the treated group's ratio exceeds 200% in the pre-EU cap period and ranges from just above the threshold up to approximately 700%. After the introduction of the cap, the maximum variable-to-fixed compensation ratio declines to below 200% for virtually all treated executives.[15] Consistently, the regression line in the upper-left quadrant (treated executives) is steeper than the 45° line. By contrast, the regression line in the lower-left quadrant (control group) essentially coincides with the

[15]Some banks applied for higher thresholds according to the rules detailed in footnote 5, which explains why a few executives exhibit a maximum variable-to-fixed compensation ratio above 200% after 2013.

45° line, corroborating the idea that the control group's compensation structure does not change systematically around the EU cap.

Given this prima facie evidence, we conduct a formal regression analysis. We estimate equation (2), using maximum variable-to-fixed compensation ratio, realized post-evaluation variable compensation, fixed compensation, and maximum variable compensation as dependent variables. For each dependent variable, we consider three progressively more saturated specifications: (1) controlling for bank and executive characteristics and year fixed effects, (2) including bank fixed effects, and (3) including executive fixed effects. Table 5 reports the estimation results. Panel A focuses on the maximum variable-to-fixed compensation ratio (columns 1 – 3), i.e., the quantity directly regulated by the EU bonus cap, and post-evaluation variable compensation (columns 4 – 6). For both measures, in each specification we observe a large and statistically significant decrease for the treated group. The parameter estimates of roughly –1 for maximum variable-to-fixed pay implies that compensation was on average adjusted without overshooting. This is accomplished by a significant and economically substantial reduction of executives' variable compensation grant levels after the reform. The point estimates in columns 4–6 imply that the average executive received 0.5 million euro less in variable compensation after the introduction of the cap compared to executives that complied already as of 2013.

Many point estimates of control variables are statistically insignificant once we specify fixed effects for all unobservable factors in the time, bank, and executive dimension in columns 3 and 6. They provide some qualitative indications though that are consistent with economic intuition. Larger banks offer more variable compensation. Interestingly, seniority as such is not rewarded. Age exhibits instead a weakly significant negative effect on the achievable variable compensation. In contrast, professional experience and longer tenure with the bank are rewarded in terms of higher variable compensation levels and incentives, at least in parsimonious specifications. Not too surprisingly, the estimates suggest further that in particular the compensation packages of CEOs contain larger bonus elements compared to non-CEO executives.

Panel B analyzes fixed compensation (columns 1 – 3) and maximum variable compensation (columns 4 – 6). Treated executives received substantially higher fixed compensation following the EU bonus cap. By contrast, maximum variable compensation exhibits a large and statistically significant decrease. This decomposition of the results in Table A already suggests that banks responded to the regulatory shock by indemnifying their executives, thus resembling case 3 from Section 3.2. Point estimates for control variables are again often insignificant after saturating the model with fixed effects. One upshot of

these results is that CEOs receive in general higher levels of pay, both in fixed as well as in variable terms. In addition, better bank performance as measured by ROE increases also both fixed and variable levels of executive compensation, as can be expected given ample evidence of pay-performance sensitivity in prior studies.

To corroborate the validity of our difference-in-differences tests, Figure 5 plots different measures of compensation (fixed and variable compensation, maximum variable-to-fixed compensation ratio, and equity rate) around the introduction of the cap for treated and control groups. The evolution of these measures—with the exception of realized variable compensation—supports the parallel trend assumption, with the divergence between treated and untreated executives taking place only starting in 2014. With regard to realized variable compensation, however, the bottom left-hand graph of Figure 5 does not condition on bank performance, which may blur the interpretation. Also note that the adjustment to the new regulation takes largely place in the first year. Variables for treated and untreated executives do not converge afterwards.

So far, the empirical results highlight two implications. The first is the timely compliance by banks with the EU bonus cap. The second is an adjustment to the regulation through an increase in fixed compensation and a decrease in maximum variable compensation, resembling a scheme consistent with unchanged executives' utility (point C in Figure 2).

To test the conjecture that banks design post–EU bonus cap contracts that leave executives' utility unchanged around the introduction of the cap more rigorously, we investigate if expected utility changes around the introduction of the cap. To this end, we take the perspective of a risk-neutral executive and approximate the probability to earn variable compensation by the ratio of variable grants over maximum variable grants. We call this measure the goal achievement rate. Expected pay is computed as the sum of fixed compensation and maximum variable times the goal achievement rate.

Table 6 shows the results from estimating equation (2) with expected pay specified as the dependent variable. In columns 1 – 4, the goal achievement rate is computed over the pre-EU bonus cap period. Columns 1 and 2 rely on a measure of expected compensation based on the executive-level goal achievement rate, whereas columns 3 and 4 are based on the board-level achievement rate. To account for possible changes in managerial effort induced by the cap, columns 5 – 8 replicate the same tests, but for a goal achievement rate computed over the post-EU bonus cap period. Treated executives do not exhibit any statistically significant change in expected pay at conventional levels. Thus, at least from the perspective of a risk-neutral manager, banks seem to indeed

offer contract adjustments that do not make managers worse off around the introduction of the EU bonus cap. One possible interpretation of this result is that banks adjust contracts in such a way that their ex ante costs of compensation stay at the same level. However, sufficiently risk-averse and undiversified executives may even be better off under the regulation-compliant contracts.[16]

We also analyze the sensitivity of compensation to bank performance around the introduction of the EU bonus cap by means of triple difference-in-differences specifications. Appendix Table A.7 focuses on the sensitivity of executives' goal achievement rate to stock return (columns 1 – 3) and the Sharpe ratio (columns 4 – 6).[17] By focusing on the goal achievement rate, we investigate whether it is harder for an executive to achieve a percentage of his/her bonus plan, rather than a euro amount. Changes in performance sensitivity and risk-adjusted performance sensitivity of treated executives' compensation are statistically insignificant.

In addition to this formal test on pay-for-performance sensitivity, we study changes in KPIs of bonus plans at treated banks by looking at their compensation reports around the introduction of the EU bonus cap. Both the weights and the range of KPIs in these plans remain largely unchanged. This feature suggests that banks complied with the cap by reducing the face value of variable compensation instead of altering KPIs or their weighting underlying compensation plans.

Finally, in Table A.8 we estimate difference-in-differences specifications for the fraction of compensation deferred by executives (columns 1 – 3) and the equity rate (columns 4 – 6). We generally observe an increase in both the deferred compensation rate and the equity rate around the introduction of the cap, pointing to an increase in the riskiness of variable pay. Higher deferrals and equity compensation stem from (1) fixed allowances that are used to increase fixed compensation and (2) stronger reliance on long-term compensation plans. Both link executive compensation to bank performance in the medium- to long-run. Taking the perspective of the average treated executive (*Treatment intensity*$= 4.3 - 2 = 2.3$, based on Panel A of Table 1) and looking at columns 3 and 6, the

[16] Our measure offers an upper bound of expected utility but a lower bound for the differential change in expected utility linked to a decrease of variable compensation, given that most executives are arguably risk averse. Unreported results obtained under the assumption of risk-averse executives underpin this argument. To compute the expected utility of risk averse managers, we follow Hall and Murphy (2002), who investigate the difference between the cost of compensation to firms and the safety equivalent of compensation plans to risk averse managers and find large differences for plausible parametrizations.

[17] This approach provides ex post pay-for-performance sensitivities. Given data limitations and peculiarities of incentive design in EU banks, a reliable computation of ex ante wealth-performance sensitivities in the spirit of Core and Guay (2002) is unfortunately infeasible.

differential increase around the cap is of 3.6% × 2.3 = 8.28% for the deferral rate and 4.6% × 2.3 = 10.58% for the equity rate. Stronger reliance on long-term compensation plans could also indicate that banks want to exploit the 25% discount rule for variable compensation, which, in turn, allows them to exceed to some extent the 200% threshold (see footnote 5). Whereas the change in the deferral and equity rate is sizable, it is unlikely to have a major impact on the implementation of the regulation.

6.3 Bank performance and risk-taking

Banks are highly interconnected institutions, in which the inherently different objectives of multiple interest groups interact and possibly conflict. The EU bonus cap, by changing the executives' compensation structure, alters the agency relationship between bank management and these interest groups. The first important interest groups traditionally distinguished are shareholders and creditors. Both have direct claims on the asset value of the bank, but have different payoff functions. Shareholders are residual claimants who are more keen on risk-taking relative to creditors who hold senior claims. The seniority differences of claims can generate agency conflicts between owners and creditors especially if the bank is approaching distress. We thus examine the performance of equity and debt claims around the introduction of the EU cap.

In addition to this conventional agency conflict, explicit and implicit public guarantees on banks' debt are a capstone element of agency conflicts that are specific to the banking firm. In particular, the presence of deposit insurance or too-big-to-fail guarantees may reduce creditors' incentives to monitor and curb risk-taking by executives. Hence, the stewards of public interest, usually regulatory and supervisory bodies, are a major stakeholder in banks, too. If a bank encounters financial problems, such central planners may serve as a backstop to depositors through insurance schemes and to other creditors by means of bailouts. In the absence of a credible and tested SRM in the EU, the deadweight costs of distress have traditionally been born by the public and are particularly high in the case of a systemic banking crisis. Hence, it is of public interest to evaluate not only the bank-specific risk implications of the EU cap, but also potential implications for the resilience of the entire banking sector.

Whereas the Great Recession clearly demonstrated the first-order importance of financial stability for the welfare of modern economies, it remains an illusive concept ever since (European Central Bank, 2009; Allen and Carletti, 2013). Yet, most scholars agree on a range of mutually non-exclusive drivers of systemic crises, which are common ex-

posures of banks (Acharya, 2009; Wagner, 2011) to overvalued assets that are subject to sudden corrections (Brunnermeier, Rother, and Schnabel, 2019), subsequent liquidity freezes, and fire sales that cause financial market breakdowns (Tirole, 2011). Gridlock in financial markets fuels the contagion of insolvency risk via observable and unobservable financial networks (Glasserman and Young, 2016; Bosma, Koetter, and Wedow, 2019) among banks, of which some are considered too big, too connected, too many, or otherwise too important to fail (Acharya and Yorulmazer, 2007; Brown and Dinc, 2009; Farhi and Tirole, 2012; Freixas and Rochet, 2013), triggering government intervention. Given the ongoing debate about the sources of systemic financial crises, we remain agnostic as to the mechanisms explaining systemic risk. Instead, we take advantage of various systemic risk measures being recently suggested that approximate the vulnerability of individual institutions towards financial crises.

In Table 7, we conduct a difference-in-differences analysis around the introduction of the EU bonus cap for different bank-level variables capturing the motives of the various stakeholders involved. We define bank-level *Treatment intensity* as the average treatment intensity of executives within a bank's board when the cap became effective. In Panel A, the focus is on shareholders' and creditors' perspectives. Shareholders' objectives are measured by the Sharpe ratio, which accounts for changes in both risk and return. The results in column 1 point to a decrease in these risk-adjusted returns for treated banks. Hence, the reform did apparently not strengthen shareholders' position in the bank. Columns 2 and 3 show that the decrease of risk-adjusted stock returns is driven simultaneously by an increase in return volatility as well as decreasing returns.

Five-year CDS spreads approximate default risk and thus creditors' stakes. In column 4, banks' excess CDS spreads vis-á-vis their corresponding sovereign CDS spread are specified as the dependent variable.[18] The evidence suggests that treated banks' idiosyncratic credit risk increased after the regulatory shocks compared to untreated peers. This increase in risk-taking is at odds with the original intention of the EU bonus cap, providing important evidence of unintended consequences, possibly due to imposing inferior incentives for managers to exert (risk-management) effort or by providing insurance to risk-averse managers as in Carlson and Lazrak (2010).

Given the potential of banks to generate negative externalities beyond the individual institution, it is at least as important to investigate whether systemic and systematic risk exhibit patterns similar to idiosyncratic risk and performance. The former risk dimension

[18]This measure provides the most conservative estimate of the increase in credit risk. Results for absolute CDS spreads that are not adjusted for the respective sovereign debt spreads are even stronger.

is presumably even more important to the general public as it likely bears most of the costs associated with rescuing banks during financial crises.

Panel B of Table 7 shows the estimation results when specifying measures of systemic risk and systematic risk as the dependent variable. The systemic risk measures gauge the bank's expected capital shortfall conditional on a large drop in equity markets. We use both the raw long-run marginal expected shortfall (LRMES) as well as the expected shortfall adjusted for the size and the leverage of banks (SRISK) as suggested by Acharya, Pedersen, Philippon, and Richardson (2016) and Brownlees and Engle (2017). Specifically, SRISK% (column 1) measures the bank's fraction of the capital shortfall conditional on a large drop of European financial market value adjusted for the size and leverage of the bank. LRMES (column 2) represents the expected equity loss faced by the bank in such a severely adverse market scenario.[19] We approximate systematic risk using the bank's market beta and correlation (columns 3 and 4).

Treated banks experience a statistically significant increase in all these risk measures. These results, together with those on managerial turnover, paint a mixed picture of the EU bonus cap. Whereas it did not lead to any obvious outflow of managerial labor force from the EU banking industry, it also appears to be associated with a deterioration in banks' risk profile, i.e., the dimension the regulator aimed to contain with the cap.

6.4 Economic channels

Given that the EU bonus cap's primary goal was to curb risk-taking, this result is all the more remarkable. Therefore, Table 8 seeks to unveil possible drivers of the increase in risk. In Panel A, we consider three specific bank policies that may be conducive to a surge in bank (systemic) risk. First, in column 1 we analyze *Deposits*, which capture to what extent banks rely on retail as opposed to wholesale funding. Higher reliance on wholesale short-term funding is associated with higher systemic risk (Huang and Ratnovski, 2011). We find consistently that treated banks turn more to this source of funding following the

[19] For further details on the computation of these measures, see: https://vlab.stern.nyu.edu/help/risk_summary_en.html.php?gmes. We also used ΔCoVaR data provided to us for European banks by the Systemic Risk Lab at the Center for Sustainable Architecture of Finance in Europe. ΔCoVaR (Adrian and Brunnermeier, 2016) gauges a bank's contribution to systemic risk. However, we are mainly interested in examining if the bonus cap induced executives to expose their banks more to financial system instability, say by exerting less monitoring effort or through more lenient screening. Moreover, ΔCoVaR relies on a fairly data-intensive quantile regression approach, which is rather sensitive to the choice of the considered time period to specify state-dependent controls (see also Adams, Gropp, and Füss, 2014). Given the relatively short and low-frequency data underlying our analysis, we therefore find no significant relationships for this measure of systemic risk contributions as reflected by ΔCoVaR.

cap, although the result is not statistically significant at conventional levels. Second, in column 3 we specify *Interbank assets* as the dependent variable to gauge whether treated banks aim to increase their systemic importance in a "too-many-to-fail" sense (see, e.g., Brown and Dinc, 2009). The (insignificant) decline in this admittedly crude measure of connectivity suggests, however, that the increase in systemic risk was not channeled via higher exposure to other players on the interbank market. Finally, we analyze a more general measure of risk-taking, namely the exposure to *Corporate loans* (columns 5 and 6) as opposed to safer assets, such liquid government securities. Consistent with treated banks becoming riskier after the cap, the ratio of corporate loans over total asset increases, but the result is again insignificant at conventional levels.

The absence of statistically significant correlations in these tests suggests that the increase in bank riskiness following the EU cap is not the result of some single, radical shift in banks' business models. Rather than shifting, for example, the entire funding strategy of the bank out of one source like deposits into another one like wholesale funding, more nuanced responses within the more aggregate asset and liability categories visible to us appear to be at work. Hence, future research with access to a more granular dimension of risk-taking using, for example, confidential supervisory data would be warranted.

Whereas structural tests of the specific theories about the effects of bonus caps discussed in Section 3 are beyond the scope of any reduced-form empirical analysis, it is still important to disentangle the mechanics of changes in bank riskiness around the introduction of the cap. To this end, it is instructive to look more generally at how risk-taking incentives depend on compensation structure in the absence of any regulation restricting it. Recall that the standard argument for a risk-neutral manager is that incentive pay may favor risk-shifting by aligning managers to equity holders (see, e.g., John and John, 1993). Yet, the direction of the effect is ambiguous when other forces are taken into account. Ross (2004) shows that the net impact on risk-taking is only positive under certain assumptions. In the presence of bankers whose task is to manage a bank portfolio, lower incentives may be associated with lower effort exertion and, consequently, lower risk-adjusted returns (Martinez-Miera and Repullo, 2017). At the same time, Carlson and Lazrak (2010) argue that a risk-averse manager may take more risk as the ratio of fixed-to-variable pay increases. An increase in fixed-to-variable pay may also augment bank riskiness by increasing operating leverage (Efing et al., 2018).

In Panel B, we thus turn attention to three theory-founded mechanisms possibly underlying the rise in bank risk. In column 1, we examine *Nonperforming loans*, as lower performance pay may induce weakened monitoring effort by bankers and, in turn,

higher delinquencies (Martinez-Miera and Repullo, 2017). Increased risk-taking following the introduction of the bonus cap is also consistent with a story about higher fixed labor costs augmenting operating leverage (Murphy, 2013b; Efing et al., 2018). Remember that the cap extends to so-called material risk-takers, who can be well below the executive level. In column 2, we therefore look at *Operating leverage*. Furthermore, Carlson and Lazrak (2010) hypothesize that an increase in safe compensation—i.e., what happened following the cap—might serve as an insurance to risk-averse executives, allowing them to take more risks. To capture this, in column 3 we consider a bank-level measure of *Executive pay safety*. The results in the table support only this last conjecture.

7 Robustness and further results

7.1 Confounding events

It is important to acknowledge that the bank-level results are less direct than those at the executive-level, also because the cap affects not only executives, but all the material risk-takers as well. Therefore, we scrutinize next the sensitivity of these results towards a host of confounding events.

To deal comprehensively with this problem, we augment the baseline bank-level specifications with country-by-year fixed effects in Table 9. Thereby, we absorb any variation in the business cycle or in the regulatory environment across countries, such as country-level heterogeneity of deposit insurance schemes or bank bailout practices. A comforting result is that default risk, systemic risk, and systematic risk continue to exhibit a significant increase also in this setting. The results on performance and stock return volatility also continue to exhibit the same signs as in the baseline analysis, but become statistically insignificant at conventional levels.

In addition to the "brute-force" approach of including country-by-year fixed effects, we also conduct selected direct tests on four plausible confounders: the EU implementation of Basel III, the European debt crisis, bank bailouts, and the passage of the FSB guidelines on compensation.[20]

First, the EU bonus cap is contained in the CRD IV, which, together with the CRR, implements Basel III in the EU.[21] Both the bonus cap and the CRR became effective in the

[20] In unreported tests, we show that our results are not driven by the introduction of the Single Supervisory Mechanism in 2013-14 or by differences (not absorbed by bank fixed effects) between large—classified as global systematically important by FSB—and small banks.

[21] Note that the CRD IV introduced also systemic risk buffers, which could affect bank riskiness, but have not been activated in those EU economies (Germany, France, UK, Italy, Spain) that host most

entire EU as of 2014. Specifically, the CRR reformed capital and liquidity requirements, whose impact could confound our estimates of the effects of the bonus cap on bank performance and risk. Yet, while effective from 2014, the CRR's capital and liquidity requirements were subject to a phase-in period that ended only in 2019. Concerning capital requirements, for instance, up to 2016 the phase-in focused on increasing the quality of regulatory capital (e.g., higher fraction of Tier I capital), while only after 2016 it increased its level, mainly through the new so-called conservation buffer.[22] In contrast, the EU bonus was fully implemented already in 2014 without a phase-in process.

Because of these discrepancies in the schedule of implementation, it is unlikely that our bank-level results are blurred by the EU implementation of the new Basel III requirements. Nonetheless, in Appendix Table A.9 we formally control for changes in Tier I capital levels, in the composition of regulatory capital, and in liquid assets, which were possibly induced by the CRR.[23] Even after accounting for these changes, our main findings remain qualitatively unchanged.

Second, we assess the sensitivity of the bank-level results to banks' exposure to the European debt crisis. We devise a falsification test in which we replace *Treatment intensity* with *Peripheral exposure*, a measure of bank exposure to the sovereign debt of EU peripheral sovereigns (Greece, Ireland, Italy, Portugal, and Spain). To this end, we use data on bank sovereign debt holdings from the EBA Transparency Exercise of 2011, which was the first time this information was disclosed to the public. If in the baseline analysis we are indeed just capturing the lingering effects of the European debt crisis, we will observe the same patterns in bank performance and risk-taking also in this case.

Appendix Table A.10 reports estimates of the falsification test. In Panel A, neither equity return and risk measures (columns 1 – 3) nor CDS spreads (column 4) exhibit a significant change around the cap introduction for banks highly exposed to peripheral sovereigns. Panel B illustrates that banks exposed to the European debt crisis do not experience any significant change in systemic and systematic risk after 2013. All in all, no clear pattern emerges from these results, which corroborates the interpretation of the baseline findings in the light of the introduction of the cap.

Third, governments of EU member states provided support to several institutions in the sample (e.g., Banca MPS, Dexia, etc.). It is possible that these interventions bias our

banks in our sample. See https://www.esrb.europa.eu/national_policy/systemic/html/index.en.html.

[22]Minimum total regulatory capital relative to risk-weighted assets stays at 8% as under Basel II up to 2016. See https://www.bis.org/bcbs/basel3/basel3_phase_in_arrangements.pdf.

[23]The CRR regulates liquidity with the so-called liquidity coverage, which is barely reported in Bankscope before 2014. Thus, we use the ratio of liquid assets to short-term funding.

analysis of the EU bonus cap, especially because they were extended conditional on tight restrictions on bank managers' compensation. In Appendix Table A.11, we therefore repeat the same analysis as in Table 7 excluding all banks that were bailed out starting from the Great Recession.[24] Our findings are robust to this adjustment.

In sum, the bank-level results obtain also under an encompassing specification using country-by-year fixed effects as well as when accounting explicitly for major confounding events.

7.2 US executives as an alternative control group

So far, we have compared treated to untreated executives at EU banks around the introduction of the cap. Whereas we define *Treatment intensity* at the executive level, it is still possible—and Table 1 shows it is indeed the case—that most treated executives are from large EU banks, while smaller EU institutions in our sample seldom award executives compensation packages with a maximum variable-to-fixed ratio above 200% in the pre-cap period. As a consequence, although the executive-level results appear unlikely to be driven by anything else than the bonus cap, it is still possible that de facto we are comparing large to small institutions and capturing a shock that affected these two groups of institutions differentially.

To address this concern, we form an alternative control group based on top executives from large US banks. More specifically, we identify banks in Execucomp following Boyallian and Ruiz-Verdú (2017) and rank them by asset size as of 2013. We focus on the largest 25 banks. Execucomp generally reports the five most paid executives for each firm. We include all of them in our control sample and obtain data on their turnover events and compensation packages, as well as on bank-level variables.

The US banks in the alternative control sample closely resemble the EU ones from which treated executives are drawn in terms of size and business model, thus being arguably exposed to similar risks. Whereas large US banks are affected by the same international regulations, such as the FSB's guidelines on compensation, they are not directly affected by the EU cap, rendering them a suitable control group. An important limitation of this alternative control group is, however, that Execucomp provides realized variable compensation, but does not report the maximum variable compensation. Therefore, we prefer to use EU banks' untreated executives in the baseline analysis.

[24] We collect information on bank-level bailouts from Table B.I of Carbó-Valverde, Cuadros-Solas, and Rodríguez-Fernández (2018), Table A.3 of Bosma et al. (2019), and the state aid case-search engine of the European Commission (see http://ec.europa.eu/competition/elojade/isef/).

Table 10 shows estimates from difference-in-differences specifications using data from large US banks to form the control sample. In Panel A, we analyze executive turnover rates around the introduction of the cap. As in the baseline analysis, we observe a general increase in the turnover rate of treated executives in the post-EU bonus cap period, driven by turnover events taking place in periods of poor bank performance, which reinforces our finding that the cap did not lead to a surge in voluntary turnovers.

In Panel B, we estimate compensation structure regressions. In line with the results above, we find a positive and significant increase in measures of fixed compensation (columns 1 and 2), coupled with a significant decline in measures of variable compensation (columns 3 – 5). In other words, EU treated executives appear to have been indemnified relative to their peers at US banks around the introduction of the cap.

In Panel C and Panel D we re-estimate difference-in-differences specifications on bank performance and risk-taking, using the same dependent variables as before. Most of the results described in Section 6.3 are confirmed. Changes pertain only to a loss of statistical significance rather than qualitatively different inference with the exception of an insignificant, but negative point estimate for one measure of systematic risk.

7.3 Additional tests

Whereas the baseline treatment group composition comprises banks from many EU countries, UK banks are by some margin the largest group (see Appendix Table A.1). Therefore, bank-level tests—which do not allow for executive-level treatment definition—may capture spurious effects, for instance, a more investment banking-oriented business model or the more prevalent bonus culture at UK banks. In Table 11, we therefore exclude UK banks both from the treatment and the control group. All the results remain robust.

Next, we broaden the treatment definition and include all executives with a maximum variable-to-fixed compensation ratio above 100% as of 2013. This treatment definition is more likely to return false positives because banks have the opportunity to increase the threshold to 200% provided they obtain shareholders' approval (see footnote 5).[25] On the other hand, our treatment definition based on the 200% will miss several treated executives at banks that decided not to raise the threshold relative to 100% or raise it to a level below 200%. The broader treatment group comprises 17 banks (vs. 9 in the baseline). As a result, by using the 100% threshold, we also improve the covariate balance between the treated and the control sample. In this case, we rely again on the treatment

[25] Unreported tests confirm the main findings also when using thresholds above 200%.

intensity variable. Table 12 shows regression estimates using this treatment definition. Our results generally continue to hold.

In Appendix Table A.12, we specify a binary treatment indicator using the 200% threshold instead of the treatment intensity variable. Our findings stay generally robust.

8 Conclusion

Bankers' compensation has been subject to significant regulatory activity following the Great Recession, ultimately aiming to reduce excessive risk-taking. But the banking sector is characterized by, first, higher returns to skill than other industries and, second, a highly mobile workforce. Hence, any regulation of pay practices in banking may have important unintended consequences on this specific managerial labor market. Specifically, it can adversely affect banks' abilities to retain their most skilled managers. Concurrently, the consequences of compensation regulation for managerial risk-taking behavior are far from obvious and depend on a host of factors, such as managers' risk preferences, their time horizon, and the complex interactions among different pay components.

We examine the interplay between executive compensation structure, managerial career trajectories, and risk-taking in the banking sector by using the introduction of the EU bonus cap in 2013 as a laboratory. The EU cap limits the maximum variable-to-fixed compensation ratio of executives in EU banks. We use a difference-in-differences approach to compare executives whose compensation structure as of 2013 did not comply with the cap to a control group of executives with compensation packages compliant with the cap as of 2013. The evidence does not support the notion that banks lose their ability to retain their most skilled managers after introducing the cap. The empirical results consistently indicate that banks comply with the regulation by offering their executives higher fixed compensation and lower maximum variable compensation. This result suggests that banks indemnify their executives for the introduction of the cap.

Bank-level evidence suggests that treated banks exhibit lower risk-adjusted returns and higher risk-taking propensities. This is in line with a theory predicting that an increase in the ratio of fixed-to-variable compensation induces risk-averse managers to tolerate more risks. Importantly, the deterioration of risk profiles is not confined to indicators of total and diversifiable risk, but also extends to banks' systemic risk exposures.

In sum, whereas it is important to note that our testing framework does not allow for clear causal statements, the results suggest that concerns about the potential adverse impact of the cap on EU banks' ability to attract skilled managers may have been over-

stated. At the same time, the EU cap's effectiveness to curb excessive risk-taking in the banking sector appears to be questionable at best.

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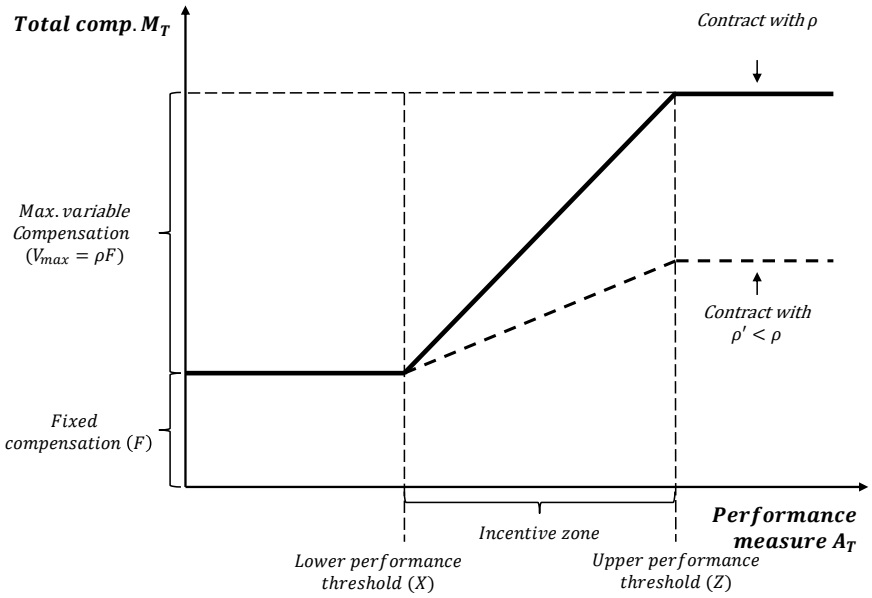


Figure 1: A stylized performance-based compensation plan
This figure shows the terminal payoff M_T of a stylized performance-based compensation plan as a function of a given measure of performance A_T at time T. The executive participates in the bank's performance $\Pi = A_T - X$ at the participation rate p within the incentive zone ($X \leq A_T \leq Z$). ρ is the ratio of the maximum variable compensation achievable by the executive V_{max} and fixed compensation F. Such a ratio is the quantity regulated by the EU bonus cap.

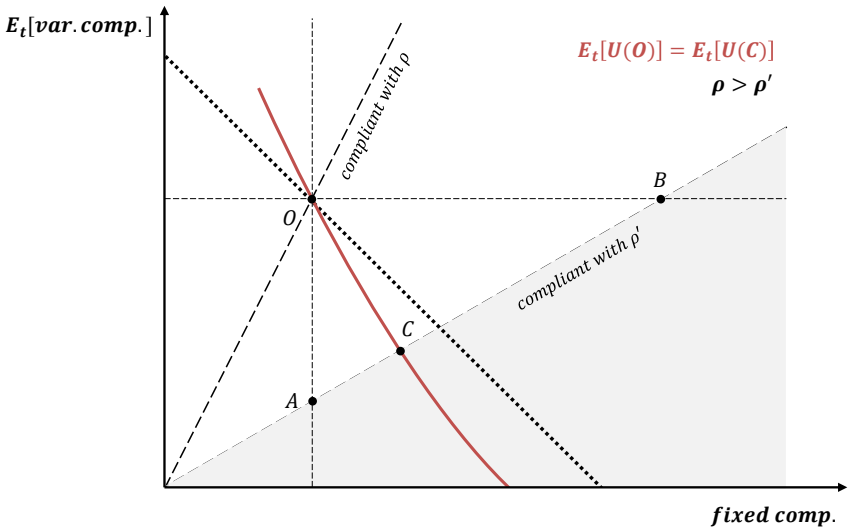


Figure 2: Adjustment schemes of executive compensation structure in reaction to the EU bonus cap
This figure visualizes how the bank can adjust executives' compensation packages to comply with the EU bonus cap. Consider an executive with an initial maximum variable-to-fixed compensation ratio ρ (point O), which is higher than the limit imposed by the EU bonus cap (i.e., ρ'). The solid red (dotted black 45°) line represents the indifference curve of a risk-averse (risk-neutral) executive. The bank can adjust the executive's compensation structure and comply with the regulation by implementing one of the following schemes: (1) decreasing expected variable compensation while keeping fixed compensation unchanged (point A); (2) increasing fixed compensation while keeping expected variable compensation unchanged (point B); or (3) rebalancing both along the indifference curve (red line) such that a risk-averse executive is indifferent between the old and the new contract, i.e. $E_t\,[U(O)] = E_t\,[U(C)]$ (point C).

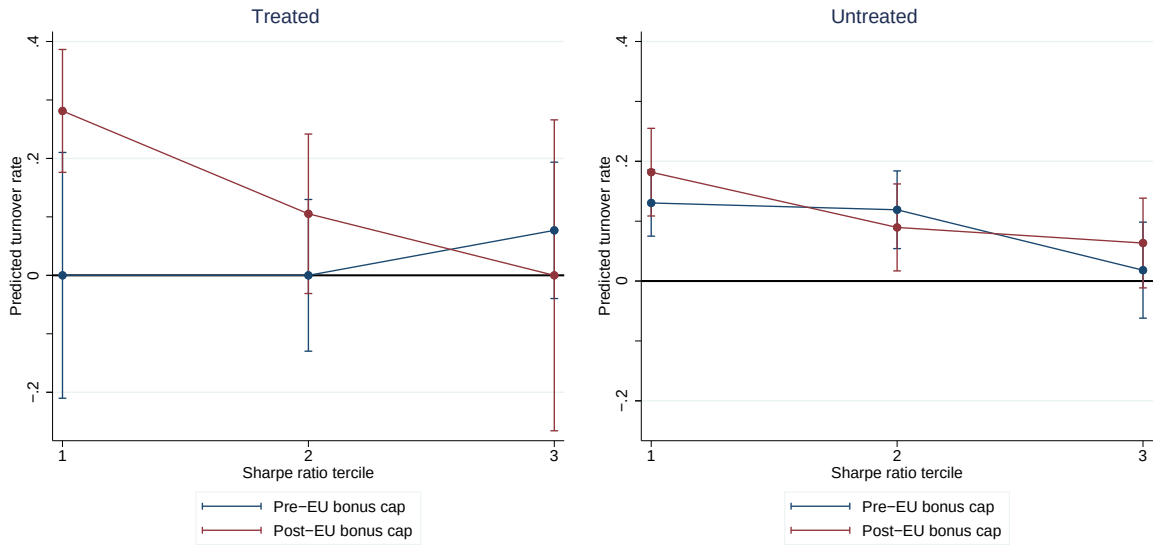


Figure 3: Prediction of turnover rate
This figure shows the predicted turnover rate at different terciles of the Sharpe ratio from linear probability models. The left plot refers to treated executives (those whose compensation structure is non-compliant with the EU bonus cap as of 2013: maximum variable-to-fixed compensation ratio>200%). The right plot refers to untreated executives. Blue lines indicate predicted turnover rates before the introduction of the EU bonus cap (2010-2013), whereas red lines indicate predicted turnover rates after the introduction of the EU bonus cap (2014-2016). Vertical bars indicate 95% confidence intervals.

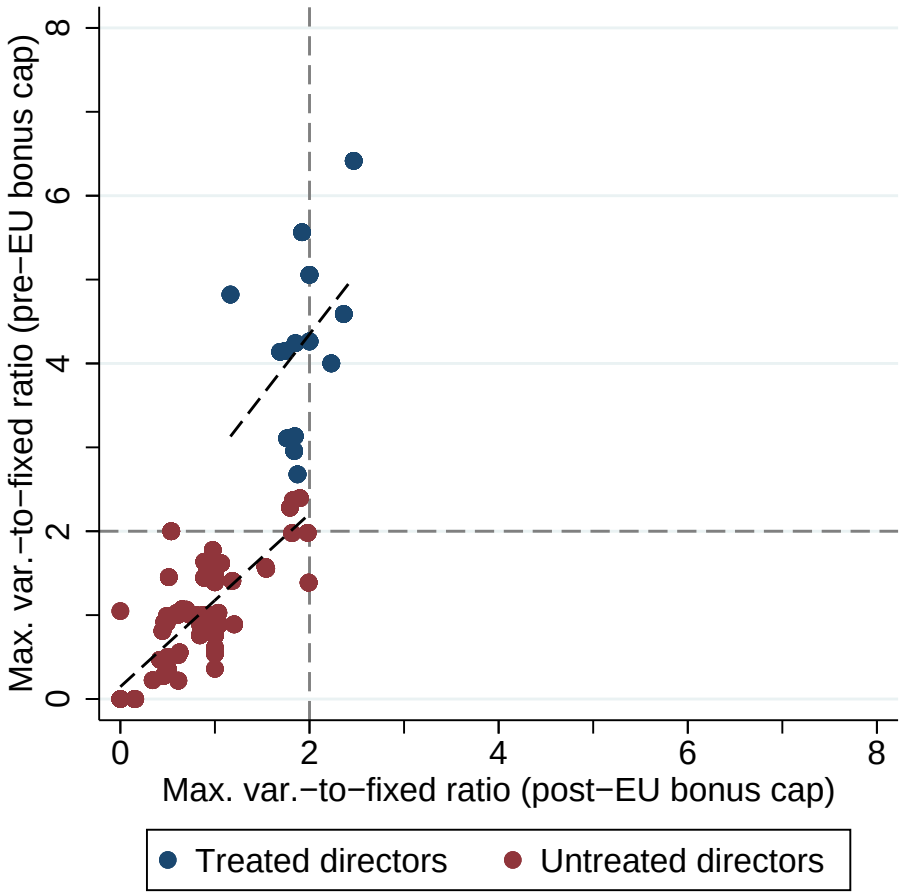


Figure 4: Adjustment of compensation structures to the EU bonus cap
This figure shows the maximum variable-to-fixed compensation ratio for treated and untreated executives at EU banks before (median over 2010–2013) and after (median over 2014–2016) the introduction of the EU bonus cap. Blue dots represent treated executives (i.e., those whose compensation structure was noncompliant with the EU bonus cap as of 2013; maximum variable-to-fixed compensation ratio>200%). Red dots represent untreated executives (i.e., those whose compensation structure is compliant with the EU bonus cap as of 2013). The bold dashed lines are regression lines for treated and untreated executives. The vertical and horizontal dashed lines represent the 200% limit on the maximum variable-to-fixed compensation ratio imposed by the EU bonus cap.

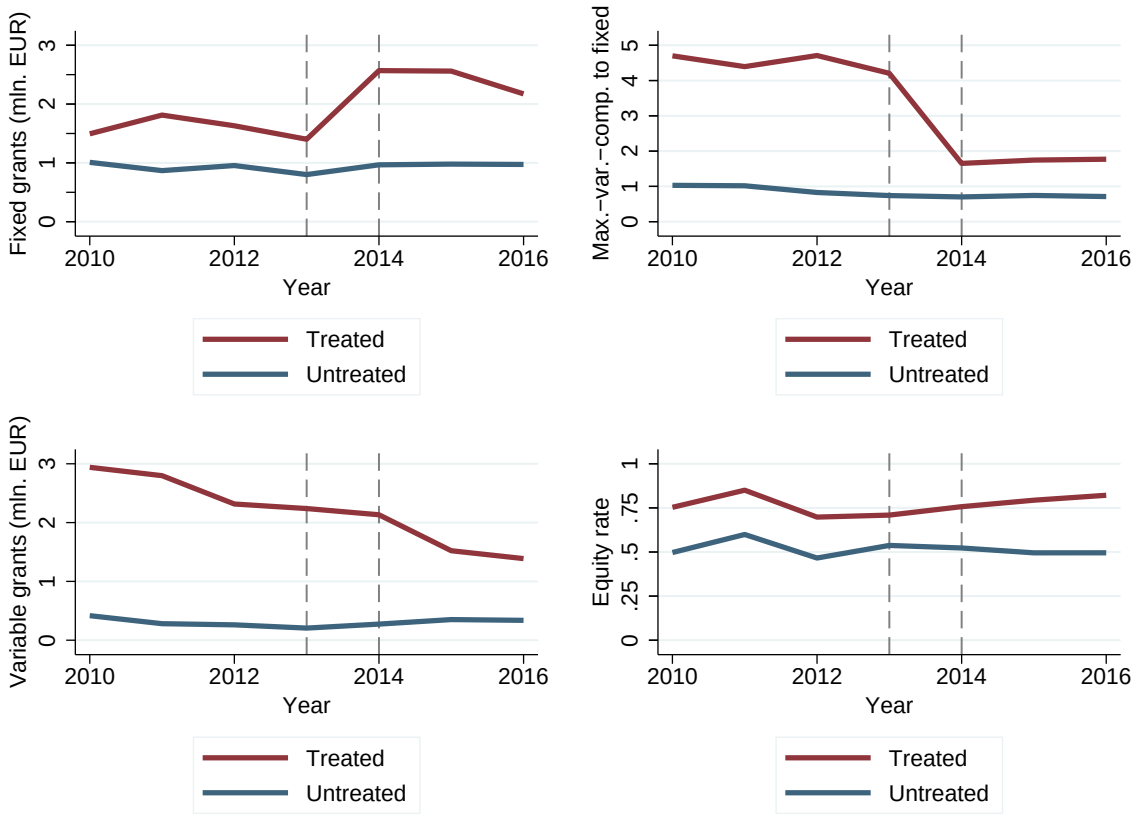


Figure 5: Evolution of compensation structure around the introduction of the EU bonus cap
This figure shows the evolution of executives' fixed compensation, maximum variable compensation-to-fixed compensation ratio, variable compensation, and equity rate around the introduction of the EU bonus cap for a sample of EU banks. The red line represents treated executives (those whose compensation structure is non-compliant with the EU bonus cap as of 2013: maximum variable-to-fixed compensation ratio>200%). The blue line represents untreated executives. The dashed vertical lines denote the points in time at which the EU bonus cap was introduced (2013) and at which it became binding (2014).

Table 1: Summary statistics
This table shows summary statistics for a sample of EU banks over 2010–2016. Panel A reports summary statistics for treated executive directors (i.e., those with a maximum variable-to-fixed compensation ratio exceeding 200% as of 2013). Panel B reports summary statistics for untreated executive directors. Panel C reports differences over the pre-treatment period, i.e., between 2013 and 2010, for treated (column 1) and untreated executive directors/banks (column 2), as well as the difference between the two in the third column ((1) − (2)). Panel D reports average differences between 2014–2016 and 2010–2013 for treated (column 1) and untreated executive directors/banks (column 2), as well as the difference between the two in the third column ((1) − (2)). The p-values (in parentheses) are computed from t-tests with standard errors clustered by bank. Refer to Appendix Table A.3 for variable definitions.

Panel A: Treated executive directors

	2010–2013				2014–2016			
	N	Average	S.E.	Median	*N*	Average	S.E.	Median
Executive characteristics:								
Turnover	67	0.030	0.171	0.000	57	0.193	0.398	0.000
Prof. experience	67	0.618	1.564	0.216	57	0.628	1.706	0.177
Age	67	52.910	5.570	51.000	57	55.368	5.951	54.000
Compensation structure:								
Fixed comp. (thd. EUR)	67	1,559.811	626.448	1,603.252	57	2,439.960	939.986	2,248.520
Var. comp. (thd. EUR)	67	2,493.708	1,798.012	2,003.701	57	1,703.418	1,678.042	1,206.645
Max. var. comp. (thd. EUR)	62	6,765.360	2,846.159	6,816.691	57	4,382.624	2,446.419	4,000.000
Bank-level information:								
Total assets (bln. EUR)	35	1,143.245	682.276	1118.198	27	1,085.196	613.232	954.415
ROA	35	0.181	0.529	0.230	27	0.134	0.456	0.180
ROE	35	2.982	8.340	5.530	27	1.797	7.623	3.360
Stock return	35	0.615	38.863	6.725	27	-8.056	19.995	-8.091
Stock return volatility	35	34.012	10.718	35.507	27	29.301	13.644	23.373
Sharpe ratio	35	0.081	1.117	0.232	27	-0.256	0.701	-0.278
Log 5-year excess CDS spread	27	1.113	0.601	1.241	21	1.373	0.654	1.273
Peripheral exposure	27	0.347	0.298	0.224	21	0.336	0.300	0.224
SRISK%	35	21.959	18.417	20.240	27	22.750	19.427	15.010
LRMES	35	54.821	8.132	56.400	27	49.188	8.017	48.800
Beta	35	1.585	0.341	1.630	27	1.351	0.345	1.310
Corr.	35	0.541	0.077	0.540	27	0.475	0.078	0.460
CEO-turnover	35	0.086	0.284	0.000	27	0.111	0.320	0.000

Panel B: Untreated executive directors

	2010–2013				2014–2016			
	N	Average	S.E.	Median	*N*	Average	S.E.	Median
Executive characteristics:								
Turnover	519	0.077	0.267	0.000	352	0.111	0.314	0.000
Professional experience	519	-0.035	1.438	-0.340	352	0.010	1.666	-0.462
Age	519	54.620	8.441	53.000	352	56.648	7.999	55.000
Compensation structure:								
Fixed comp. (thd. EUR)	519	890.312	619.718	734.714	352	972.998	666.709	904.571
Var. comp. (thd. EUR)	519	269.369	634.373	0.000	352	317.445	578.629	125.760
Max. var. comp. (thd. EUR)	402	851.435	1,329.753	500.000	352	758.828	1,001.971	425.322
Bank-level information:								
Total assets (bln. EUR)	125	529.226	549.994	280.719	96	466.014	528.571	233.653
ROA	125	-0.090	1.075	0.180	96	0.192	0.602	0.320
ROE	125	-3.672	31.003	4.730	96	2.978	12.530	5.630
Stock return	76	-8.417	53.472	6.464	61	-9.563	42.953	3.307
Stock return volatility	76	43.994	19.744	39.422	61	33.288	19.114	25.375
Sharpe ratio	76	0.054	1.124	0.172	61	0.038	0.927	0.101
Log 5-year excess CDS spread	70	1.220	0.760	1.325	53	1.367	0.856	1.568
Peripheral exposure	93	0.303	0.353	0.162	67	0.354	0.377	0.184
SRISK%	90	30.467	25.971	21.805	66	22.740	24.440	16.585
LRMES	90	53.545	12.027	54.860	66	46.211	9.400	47.265
Beta	90	1.563	0.496	1.555	66	1.243	0.338	1.250
Corr.	90	0.478	0.124	0.480	66	0.407	0.114	0.415
CEO turnover	125	0.096	0.296	0.000	96	0.063	0.243	0.000

Panel C: Pre-treatment changes (2010 vs. 2013)

	Δ Treated	Δ Untreated	Diff.
	(1)	(2)	(1) - (2)
Executive characteristics:			
Turnover	0.0833	0.2179	-0.1345
	(0.2902)	(0.0000)	(0.2902)
Professional experience	-0.3543	0.0431	-0.3974
	(1.3298)	(0.8362)	(0.4935)
Age	0.6667	5.6964	-5.0297
	(0.1012)	(0.0000)	(0.1012)
Compensation structure:			
Fixed comp. (thd. EUR)	-92.0765	-207.6847	115.6082
	(0.6292)	(0.0128)	(0.6164)
Var. comp. (thd. EUR)	-701.1673	-210.9905	-490.1768
	(0.2150)	(0.0765)	(0.1385)
Max. var. comp (thd. EUR)	-549.5368	-555.3960	5.8592
	(1.0478)	(0.0548)	(0.9929)
Bank-level information:			
Total assets (bln. EUR)	-249.6526	-155.4144	-94.2383
	(1.0583)	(0.2907)	(0.7676)
ROA	-0.4387	-0.4974	0.0587
	(0.9712)	(0.0550)	(0.9161)
ROE	-7.7552	-10.5343	2.7790
	(0.8503)	(0.0449)	(0.8054)
Stock return	30.4951	23.8124	6.6828
	(0.8415)	(0.0699)	(0.7716)
Stock return volatility	-5.3732	4.7373	-10.1104
	(0.8062)	(0.4453)	(0.3610)
Sharpe ratio	0.9700	0.8930	0.0770
	(0.8889)	(0.0041)	(0.8848)
Log 5-year excess CDS spread	0.7098	0.5228	0.1869
	(0.7557)	(0.0551)	(0.7006)
Peripheral exposure	-0.0505	0.0679	-0.1184
	(1.0953)	(0.5099)	(0.5854)
SRISK	-7.9771	0.8355	-8.8126
	(1.4843)	(0.9170)	(0.5673)
LRMES	-3.0778	-5.2389	2.1612
	(0.8516)	(0.1176)	(0.7340)
Beta	-0.1337	-0.2493	0.1156
	(0.7160)	(0.0650)	(0.6511)
Corr.	-0.0413	-0.0743	0.0331
	(0.6263)	(0.0265)	(0.5998)
CEO turnover	0.1111	0.0899	0.0212
	(1.1345)	(0.2369)	(0.8976)

Panel D: Changes around treatment (2010–2013 vs. 2014–2016)

	Δ Treated	Δ Untreated	Diff.
	(1)	(2)	(1) - (2)
Executive characteristics:			
Turnover	0.1631	0.0337	0.1294
	(0.1109)	(0.0906)	(0.0202)
Professional experience	0.0093	0.0453	-0.0360
	(1.5754)	(0.6715)	(0.9039)
Age	2.4580	2.0273	0.4307
	(0.7805)	(0.0003)	(0.7803)
Compensation structure:			
Fixed comp. (thd. EUR)	880.1487	135.3953	744.7534
	(0.0149)	(0.0149)	(0.0000)
Var. comp. (thd. EUR)	-790.2908	60.3369	-850.6277
	(0.4100)	(0.4100)	(0.0000)
Max. var. comp (thd. EUR)	-2,382.7357	-56.9915	-2,325.7443
	(0.6699)	(0.6699)	(0.0000)
Bank-level information:			
Total assets (bln. EUR)	-191.2683	-34.7213	-156.5470
	(0.9982)	(0.6496)	(0.3486)
ROA	-0.0432	0.2819	-0.3252
	(0.1896)	(0.0111)	(0.1785)
ROE	-1.0083	6.6331	-7.6414
	(0.2601)	(0.0248)	(0.2352)
Stock return	-7.8869	-1.1687	-6.7182
	(1.5021)	(0.8752)	(0.6269)
Stock return volatility	-3.8037	-10.3535	6.5498
	(0.2352)	(0.0006)	(0.2347)
Sharpe ratio	-0.3087	-0.0121	-0.2966
	(1.2960)	(0.9438)	(0.3522)
Log 5-year excess CDS spread	0.2688	0.1518	0.1170
	(0.9093)	(0.2638)	(0.6455)
Peripheral exposure	-0.0112	0.0475	-0.0587
	(1.0041)	(0.3928)	(0.6113)
SRISK	-1.1707	-6.9544	5.7837
	(0.4730)	(0.0586)	(0.4144)
LRMES	-4.9797	-7.3190	2.3393
	(0.4600)	(0.0000)	(0.4600)
Beta	-0.2051	-0.3201	0.1150
	(0.3661)	(0.0000)	(0.3661)
Corr.	-0.0701	-0.0687	-0.0014
	(0.9649)	(0.0000)	(0.9648)
CEO turnover	0.0134	-0.0430	0.0564
	(0.7116)	(0.2355)	(0.4761)

Table 2: Career trajectories of bank executive directors after a turnover
This table shows information on the employment of bank executive directors after a turnover (up to one year after leaving the board). We collected data through searches of news stories and professional networking websites. Column 1 and 2 cover all executive director turnovers at banks for which treatment status is defined. Columns 3 and 4 focus on the subsample of listed banks. Odd (even) columns report the absolute (relative) number of directors by post-turnover employment category. If multiple positions are found, the position is classified according to this hierarchy: (1) executive position, (2) management position, (3) supervisory position, and (4) politics and regulation.

	All banks		Listed banks	
	#	%	#	%
Executive position	27	26.73%	16	28.07%
Exec. dir. at a bank	15	14.85%	7	12.28%
Exec. dir. at a non-bank	12	11.88%	9	15.79%
Management position	20	19.80%	8	14.04%
Self-employed	6	5.94%	3	5.26%
Advisor (to the same bank)	6	5.94%	2	3.51%
Advisor (elsewhere)	4	3.96%	2	3.51%
Senior management position	4	3.96%	1	1.75%
Supervisory director or non-exec. director	9	8.91%	3	5.26%
Politics and regulation	1	0.99%	1	1.75%
No information on further employment	30	29.70%	21	36.84%
No information on career path afterwards	23	22.77%	19	33.33%
Explicit information on retirement	7	6.93%	2	3.51%
Others	14	13.86%	8	14.04%
None of the above	13	12.87%	7	12.28%
Died in office	1	0.99%	1	1.75%

Table 3: Executive turnover

This table reports estimates from difference-in-differences regressions (linear probability models) for turnover of executive directors around the introduction of the EU bonus cap of 2013. The sample covers executive directors of EU banks between 2010 and 2016. In columns 1 to 4, the dependent variable is *Turnover*, an indicator variable equal to 1 if the director leaves the board of the bank in a given year. In columns 5 and 6, the dependent variable is *Turnover (poor perf.)*, an indicator variable equal to 1 if the director leaves the board of the bank and the bank's ROE is below the median in a given year. Treated executive directors are those whose maximum variable-to-fixed compensation ratio exceeds 200% as of 2013. *Treatment intensity* is (1) equal to 0 for directors in the control group and (2) equal to the distance between ρ (maximum variable-to-fixed compensation) and 200% as of 2013 for treated directors. *Post* is an indicator variable equal to 1 from 2014 onward. All specifications include bank and director control variables (bank size, lagged Sharpe ratio, number of executive directors serving on the board, age, a retirement age indicator, tenure, a female indicator, professional experience, and a CEO indicator) as well as year fixed effects. Except for columns 3 and 4 all specifications also include bank fixed effects. Data in odd columns include all executive directors. Data in even columns exclude CEOs and control for *CEO turnover*, an indicator variable equal to 1 if the bank's CEO is replaced in a given year, rather than for the CEO indicator. The t-statistics (in parentheses) are computed from standard errors clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.3 for variable definitions.

Dependent variable:	Turnover				Turnover (poor perf.)	
	(1)	(2)	(3)	(4)	(5)	(6)
Treat. int.	-0.006	-0.027	-0.006	-0.027	-0.012	0.013
	(-0.53)	(-0.99)	(-0.44)	(-0.85)	(-0.68)	(0.58)
Post × Treat. int.	0.044*	0.054**	0.032	0.034	0.063**	0.043
	(1.94)	(2.27)	(1.35)	(1.36)	(2.60)	(1.68)
Bank size	-0.012	-0.046	-0.014	0.125	-0.175	-0.072
	(-0.99)	(-0.34)	(-1.03)	(0.71)	(-1.38)	(-0.49)
Sharpe ratio (lag)	-0.036**	-0.020	-0.047***	-0.043	-0.023	-0.048*
	(-2.63)	(-0.96)	(-2.97)	(-1.48)	(-1.27)	(-2.03)
Number of exec. directors	-0.004	-0.066***	-0.002	-0.071***	-0.069***	-0.077***
	(-0.85)	(-3.89)	(-0.37)	(-4.38)	(-3.96)	(-4.37)
Age	0.000	-0.001	-0.000	-0.000	-0.002	-0.001
	(0.05)	(-0.39)	(-0.07)	(-0.11)	(-0.65)	(-0.29)
Retirement age	0.092	0.105*	0.086	0.055	0.085*	0.052
	(1.67)	(2.03)	(1.40)	(0.99)	(1.93)	(1.06)
Tenure	0.002	0.006	0.003	0.005	0.007**	0.008*
	(1.20)	(1.38)	(1.44)	(1.22)	(2.06)	(1.93)
Female	-0.100***	-0.081*	-0.126***	-0.092	-0.019	-0.021
	(-3.70)	(-1.72)	(-4.25)	(-1.70)	(-0.37)	(-0.34)
Professional experience	0.004	0.006	0.001	0.000	0.007	0.007
	(0.43)	(0.71)	(0.05)	(0.02)	(0.86)	(0.48)
CEO	-0.060***	-0.050**			-0.032	
	(-2.78)	(-2.19)			(-1.44)	
CEO turnover			0.021	-0.044		-0.031
			(0.20)	(-0.36)		(-0.27)
Year fixed effects	X	X	X	X	X	X
Bank fixed effects		X		X	X	X
Full sample	X	X			X	
Ex-CEO			X	X		X
Mean(y)	0.109	0.109	0.127	0.125	0.086	0.096
S.D.(y)	0.312	0.312	0.334	0.331	0.280	0.294
R^2	0.132	0.221	0.145	0.233	0.243	0.270
N	561	561	409	408	561	408

Table 4: Executive turnover (the role of managerial skills)
This table reports estimates from triple difference-in-differences regressions (linear probability models) for turnover of executive directors around the introduction of the EU bonus cap of 2013. The sample covers executive directors of EU banks between 2010 and 2016. The dependent variable is *Turnover*, an indicator variable equal to 1 if the director leaves the board of the bank in a given year. Treated executive directors are those whose maximum variable-to-fixed compensation ratio exceeds 200% as of 2013. *Treatment intensity* is (1) equal to 0 for directors in the control group and (2) equal to the distance between ρ (maximum variable-to-fixed compensation) and 200% as of 2013 for treated directors. *Post* is an indicator variable equal to 1 from 2014 onward. Specifications in Panel A include a triple interaction term with *High exp.*, an indicator variable equal to 1 if *Professional experience* is above its median for a given director. Specifications in Panel B include a triple interaction term with *Top total pay* (columns 1 and 2), an indicator variable equal to 1 if the director is the highest paid (or the second highest paid) within the board in terms of total compensation (for boards with at least five directors), and *Top var. pay* (columns 3 and 4), an indicator variable computed in the same way but based on variable compensation. All specifications include bank and director control variables (bank size, lagged Sharpe ratio, number of executive directors serving on the board, age, a retirement age indicator, tenure, a female indicator, professional experience, and a CEO indicator) and year fixed effects. Columns 1 and 2 of Panel A, and columns 1 and 3 of Panel B consider all executive directors. The other columns exclude CEOs and control for *CEO turnover*, an indicator variable equal to 1 if the bank's CEO is replaced in a given year, rather than for the CEO indicator. Columns 2 and 4 of Panel A and all columns of Panel B include bank fixed effects. The t-statistics (in parentheses) are computed from standard errors clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.3 for variable definitions.

Panel A: Measuring skills through professional experience

Dependent variable:	Turnover			
	(1)	(2)	(3)	(4)
Post × Treat. int. × High exp.	0.009	0.050	-0.008	0.050
	(0.15)	(0.86)	(-0.16)	(0.69)
Bank and director controls	X	X	X	X
Year fixed effects	X	X	X	X
Bank fixed effects		X		X
Full sample	X	X		
Ex-CEO			X	X
Mean(y)	0.109	0.109	0.127	0.125
S.D.(y)	0.312	0.312	0.334	0.331
R^2	0.139	0.231	0.156	0.246
N	561	561	409	408

Panel B: Measuring skills through compensation

Dependent variable:	Turnover			
	(1)	(2)	(3)	(4)
Post × Treat. int. × Top total pay	-0.050	-0.064		
	(-1.57)	(-1.29)		
Post × Treat. int. × Top var. pay			-0.035	-0.032
			(-1.04)	(-0.61)
Bank and director controls	X	X	X	X
Year fixed effects	X	X	X	X
Bank fixed effects	X	X	X	X
Full sample	X		X	
Ex-CEO		X		X
Mean(y)	0.117	0.136	0.117	0.136
S.D.(y)	0.322	0.343	0.322	0.343
R^2	0.233	0.250	0.229	0.242
N	521	375	521	375

Table 5: Executive compensation structure
This table reports estimates from difference-in-differences regressions for compensation structure of executive directors around the introduction of the EU bonus cap of 2013. The sample covers executive directors of EU banks over the years between 2010 and 2016. In Panel A, the dependent variables are *Maximum variable compensation to fixed* (columns 1 – 3) and *Variable compensation* (columns 4 – 6). In Panel B, the dependent variables are *Fixed compensation* (columns 1 – 3) and *Maximum variable compensation-to-fixed* (columns 4 – 6). The two panels follow the same structure. Treated executive directors are those whose maximum variable-to-fixed compensation ratio exceeds 200% as of 2013. *Treatment intensity* is (1) equal to 0 for directors in the control group and (2) equal to the distance between ρ (maximum variable-to-fixed compensation) and 200% as of 2013 for treated directors. *Post* is an indicator variable equal to 1 from 2014 onward. All specifications include bank and director control variables (bank size, ROE, number of executive directors serving on the board, age, tenure, professional experience, a CEO indicator, and a female indicator) as well as year and bank fixed effects. Columns 3 and 6 include director fixed effects. The t-statistics (in parentheses) are computed from standard errors clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.3 for variable definitions.

Panel A: Compliance with the bonus cap regulation

Dependent variable:	Max.-var.-comp. to fixed			Variable compensation		
	(1)	(2)	(3)	(4)	(5)	(6)
Treat. int.	1.223***	0.892***		794.270***	562.689***	
	(7.37)	(5.03)		(10.26)	(4.42)	
Post × Treat. int.	-0.935***	-0.952***	-0.896***	-523.160**	-542.217***	-527.269**
	(-6.93)	(-6.69)	(-6.78)	(-2.25)	(-2.80)	(-2.22)
Bank size	0.122	0.731**	0.700**	149.545*	-61.487	-115.650
	(1.47)	(2.43)	(2.22)	(2.01)	(-0.24)	(-0.36)
ROE	-0.003	0.000	-0.000	2.283	3.341	4.719*
	(-1.32)	(0.33)	(-0.06)	(1.38)	(1.54)	(1.71)
Number of exec. directors	-0.024	0.015	0.004	-30.685	6.340	25.007
	(-0.76)	(0.47)	(0.11)	(-1.31)	(0.23)	(0.79)
Age	-0.010*	-0.002	-0.102*	-6.062	-0.082	74.447
	(-1.93)	(-1.23)	(-1.75)	(-1.59)	(-0.03)	(1.37)
Tenure	0.032**	-0.006	-0.005	45.030**	-5.704	-141.572
	(2.35)	(-0.79)	(-0.30)	(2.16)	(-0.59)	(-1.17)
Professional experience	0.025	-0.002	0.294	55.033**	-1.213	-7.432
	(0.85)	(-0.12)	(1.52)	(2.10)	(-0.06)	(-0.06)
CEO	0.046	0.117**	-0.148	211.957*	358.687***	441.345
	(0.51)	(2.45)	(-0.54)	(2.01)	(2.96)	(1.66)
Female	-0.051	-0.016		141.204	34.947	
	(-0.44)	(-0.49)		(1.11)	(0.69)	
Year fixed effects	X	X	X	X	X	X
Bank fixed effects		X	X		X	X
Director fixed effects			X			X
Mean(y)	1.113	1.114	1.126	518.308	518.308	521.452
S.D.(y)	1.198	1.198	1.207	1,044.724	1,044.724	1,047.108
R^2	0.657	0.843	0.871	0.468	0.690	0.764
N	875	874	855	995	995	989

Panel B: Changes in compensation structure after the bonus cap

Dependent variable:	Fixed compensation			Max. variable compensation		
	(1)	(2)	(3)	(4)	(5)	(6)
Treat. int.	125.279***	-127.482		2247.767***	1636.665***	
	(3.25)	(-0.92)	(-0.00)		(6.71)	
Post × Treat. int.	331.962***	326.560***	343.651***	-947.836***	-986.087***	-858.713***
	(3.28)	(3.91)	(3.14)	(-5.90)	(-6.40)	(-4.06)
Bank size	142.285**	-220.098	-259.387	238.085	689.872*	354.250
	(2.24)	(-0.95)	(-0.84)	(1.61)	(1.88)	(0.68)
ROE	2.751*	2.229	3.191**	-0.824	3.043***	4.714***
	(1.84)	(1.66)	(2.21)	(-0.28)	(3.05)	(2.94)
Number of exec. directors	-30.623	-7.179	20.398	20.671	8.691	47.943
	(-1.51)	(-0.41)	(0.83)	(0.35)	(0.21)	(0.76)
Age	-17.163***	-7.325***	91.284	-18.933**	-0.837	33.089
	(-4.16)	(-2.82)	(1.33)	(-2.16)	(-0.09)	(0.39)
Tenure	44.537***	10.114	-115.269	95.021***	-11.270	-391.656
	(5.29)	(1.31)	(-1.20)	(2.92)	(-0.55)	(-1.29)
Professional experience	35.949	18.023	-37.130	115.541**	47.192	406.274*
	(1.41)	(0.90)	(-0.23)	(2.23)	(1.20)	(1.80)
CEO	359.573***	483.312***	493.584**	806.382***	1097.127***	1305.946*
	(4.34)	(5.88)	(2.66)	(2.95)	(3.53)	(1.92)
Female	-6.831	35.636		239.831	257.298	
	(-0.06)	(0.29)		(0.71)	(1.07)	
Year fixed effects	X	X	X	X	X	X
Bank fixed effects		X	X		X	X
Director fixed effects			X			X
Mean(y)	1,053.420	1,053.420	1,058.330	1,496.334	1,497.832	1,525.059
S.D.(y)	759.372	759.372	758.716	2,411.650	2,412.627	2,431.648
R^2	0.483	0.713	0.822	0.677	0.811	0.893
N	995	995	989	873	872	853

Table 6: Expected utility from executive compensation packages

This table reports estimates from difference-in-differences regressions for expected compensation of executive directors around the introduction of the EU bonus cap of 2013. The sample covers executive directors of EU banks between 2010 and 2016. The dependent variable is *Expected utility* for a risk-neutral executive director as measured by the sum of fixed compensation and maximum variable compensation times the goal achievement rate. In columns 1 – 4 (5 – 8), the goal achievement rate is computed as the ratio of pre(post)–EU bonus cap realized variable grants over pre(post)–EU bonus cap maximum variable grants. Columns 1, 2, 5, and 6 are based on the director-level goal achievement rate. Columns 3, 4, 7, and 8 are based on the board-level goal achievement rate. Treated executive directors are those whose maximum variable-to-fixed compensation ratio exceeds 200% as of 2013. *Treatment intensity* is (1) equal to 0 for directors in the control group and (2) equal to the distance between ρ (maximum variable-to-fixed compensation) and 200% as of 2013 for treated directors. *Post* is an indicator variable equal to 1 from 2014 onwards. All specifications include bank and director control variables (bank size, ROE, number of executive directors serving on the board, age, tenure, professional experience, a CEO indicator, and a female indicator) as well as year and bank fixed effects. Even columns include director fixed effects. The t-statistics (in parentheses) are computed from standard errors clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.3 for variable definitions.

Dependent variable:	Expected pay (pre-probabilities)				Expected pay (post-probabilities)			
	Director-level prob.		Board-level prob.		Director-level prob.		Board-level prob.	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treat. int.	616.772**		482.480**		600.582*		519.969**	
	(2.21)		(2.20)		(1.83)		(2.41)	
Post × Treat. int.	-25.054	-28.458	-31.667	-5.470	-382.441	-394.085	-303.657	-304.492
	(-0.13)	(-0.11)	(-0.20)	(-0.03)	(-1.15)	(-0.97)	(-1.20)	(-0.99)
Bank and director controls	X	X	X	X	X	X	X	X
Year fixed effects	X	X	X	X	X	X	X	X
Bank fixed effects	X	X	X	X	X	X	X	X
Director fixed effects		X		X		X		X
Mean(y)	1,710.522	1,735.223	1,694.311	1,718.688	1,743.693	1,770.892	1,705.812	1,729.927
S.D.(y)	1,783.815	1,791.914	1,726.315	1,733.656	1,741.809	1,749.050	1,684.772	1,691.123
R^2	0.808	0.906	0.816	0.898	0.782	0.868	0.789	0.874
N	730	715	737	722	736	720	752	737

Table 7: Bank performance and risk
This table reports estimates from difference-in-differences regressions for bank performance and risk-taking around the introduction of the EU bonus cap of 2013. The sample covers EU banks between 2010 and 2016. Panel A considers bank performance and measures of equity and credit risk: *Sharpe ratio* (column 1), *Stock return* (column 2), *Stock return volatility* (column 3), and *Log 5-year excess CDS spreads* (column 4). Panel B considers measures of systemic risk and systematic risk: *SRISK%* (column 1), *LRMES* (column 2), *Beta* (column 3), and *Correlation* (column 4). *Treatment intensity* is the average treatment intensity of directors within a bank as of 2014 (based on those directors for whom *Post* × *Treated* = 1, where *Treated* is the director-level binary treatment indicator). *Post* is an indicator variable equal to 1 from 2014 onward. All specifications include year and bank fixed effects. The t-statistics (in parentheses) are computed from standard errors clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.3 for variable definitions.

Panel A: Performance and risk

Dependent variable:	Sharpe ratio (in %)	Stock return (in %)	Stock return volatility (in %)	Log 5-year excess CDS spread
	(1)	(2)	(3)	(4)
Post × Treat. int.	-0.285***	-8.074**	5.858**	0.114*
	(-3.47)	(-2.36)	(2.55)	(1.75)
Year fixed effects	X	X	X	X
Bank fixed effects	X	X	X	X
Mean(y)	0.058	-6.291	36.142	1.103
S.D.(y)	1.051	44.862	18.828	0.765
R^2	0.608	0.573	0.678	0.909
N	216	216	216	132

Panel B: Systemic and systematic risk

	Systemic risk		Systematic risk	
Dependent variable:	SRISK%	LRMES	Beta	Corr.
	(1)	(2)	(3)	(4)
Post × Treat. int.	0.473**	4.106***	0.170***	0.014*
	(2.69)	(3.44)	(3.27)	(1.73)
Year fixed effects	X	X	X	X
Bank fixed effects	X	X	X	X
Mean(y)	2.209	51.038	1.443	0.468
S.D.(y)	2.416	10.410	0.429	0.113
R^2	0.959	0.694	0.638	0.855
N	216	216	216	216

Table 8: Economic channels behind bank-level results
This table reports estimates from difference-in-differences regressions for bank funding structure, loan policy, and possible drivers of asset riskiness around the introduction of the EU bonus cap of 2013. The sample covers EU banks between 2010 and 2016. The dependent variables of Panel A are *Deposits* in columns 1 and 2, *Interbank assets* in column 3 and 4, and *Corporate loans* in columns 5 and 6. The dependent variables of Panel B are *Nonperforming loans* in columns 1 and 2, *Operating leverage* in columns 3 and 4, and *Executive pay safety* in columns 5 and 6. *Treatment intensity* is the average treatment intensity of directors within a bank as of 2014 (based on those directors for whom $Post \times Treated = 1$, where *Treated* is the director-level binary treatment indicator). *Post* is an indicator variable equal to 1 from 2014 onward. All specifications include year and bank fixed effects. The t-statistics (in parentheses) are computed from standard errors clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.3 for variable definitions.

Panel A: Funding structure and loan policy

Dependent variable:	Deposits	Interbank assets	Corporate loans
	(1)	(2)	(3)
Post × Treat. int.	-0.019	-0.007	0.014
	(-1.30)	(-0.79)	(1.54)
Year fixed effects	X	X	X
Bank fixed effects	X	X	X
Mean(y)	0.416	0.084	0.138
S.D.(y)	0.156	0.055	0.092
R^2	0.939	0.839	0.834
N	216	216	121

Panel B: Risk drivers

Dependent variable:	Nonperf. loans	Operating leverage	Exec. pay safety
	(1)	(2)	(3)
Post × Treat. int.	-0.002	-0.000	0.573***
	(-0.64)	(-0.45)	(5.93)
Year fixed effects	X	X	X
Bank fixed effects	X	X	X
Mean(y)	0.043	0.007	0.529
S.D.(y)	0.047	0.003	0.628
R^2	0.859	0.943	0.734
N	216	216	216

Table 9: Bank performance and risk (including country-year fixed effects)
This table reports estimates from difference-in-differences regressions for bank performance and risk-taking around the introduction of the EU bonus cap of 2013. The sample covers EU banks between 2010 and 2016. Panel A considers bank performance and measures of equity and credit risk: *Sharpe ratio* (column 1), *Stock return* (column 2), *Stock return volatility* (column 3), and *Log 5-year excess CDS spreads* (column 4). Panel B considers measures of systemic risk and systematic risk: *SRISK%* (column 1), *LRMES* (column 2), *Beta* (column 3), and *Correlation* (column 4). *Treatment intensity* is the average treatment intensity of directors within a bank as of 2014 (based on those directors for whom *Post* × *Treated* = 1, where *Treated* is the director-level binary treatment indicator). *Post* is an indicator variable equal to 1 from 2014 onward. All specifications include year, bank, and country-year fixed effects. The *t*-statistics (in parentheses) are computed from standard errors clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.3 for variable definitions.

Panel A: Performance and risk

Dependent variable:	Sharpe ratio (in %)	Stock return (in %)	Stock return volatility (in %)	Log 5-year excess CDS spread
	(1)	(2)	(3)	(4)
Post × Treat. int.	-0.108	-3.359	5.279	0.310***
	(-0.82)	(-0.59)	(1.43)	(3.84)
Year fixed effects	X	X	X	X
Bank fixed effects	X	X	X	X
Country-year fixed effects	X	X	X	X
Mean(y)	0.025	-7.243	35.859	0.997
S.D.(y)	1.048	44.317	18.717	0.738
R^2	0.788	0.769	0.822	0.974
N	189	189	189	111

Panel B: Systemic and systematic risk

	Systemic risk		Systematic risk	
Dependent variable:	SRISK%	LRMES	Beta	Corr.
	(1)	(2)	(3)	(4)
Post × Treat. int.	0.689***	3.723**	0.142**	0.015
	(2.78)	(2.44)	(2.38)	(0.90)
Year fixed effects	X	X	X	X
Bank fixed effects	X	X	X	X
Country-year fixed effects	X	X	X	X
Mean(y)	2.321	50.854	1.433	0.472
S.D.(y)	2.505	10.201	0.413	0.114
R^2	0.977	0.851	0.835	0.891
N	189	189	189	189

Table 10: US executives/banks as the control group

This table reports estimates from difference-in-differences regressions around the introduction of the EU bonus cap of 2013. The sample period is 2010-2016. The dependent variables are executive turnover (Panel A), measures of executive compensation structure (Panel B), measures of bank-level performance and risk-taking (Panel C), and measures of systemic risk and systematic risk (Panel D). The treatment sample covers executive directors of EU banks fulfilling the conditions laid down below. The control sample covers the top executives from the largest 25 US banks as of 2013. Treated executive directors are those EU banks' directors whose maximum variable-to-fixed compensation ratio exceeds 200% as of 2013. In Panel A and Panel B, *Treatment intensity* is (1) equal to 0 for directors in the control group and (2) equal to the distance between ρ (maximum variable-to-fixed compensation) and 200% as of 2013 for treated directors. In Panel C and Panel D, *Treatment intensity* is the average treatment intensity of directors within a bank as of 2014 (based on those directors for whom $Post \times Treated = 1$, where *Treated* is the director-level binary treatment indicator). *Post* is an indicator variable equal to 1 from 2014 onward. All specifications correspond to the most saturated ones in Table 3, Table 5, and Table 7. Control variables in Panel A are bank size, lagged Sharpe ratio, age, a female indicator, and a CEO indicator. Control variables in Panel B are bank size, ROE, age, a female indicator, and a CEO indicator. The t-statistics (in parentheses) are computed from standard errors clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.3 for variable definitions.

Panel A: Turnover

Dependent variable:	Turnover				Turnover (poor perf.)	
	(1)	(2)	(3)	(4)	(5)	(6)
Treat. int.	-0.020	-0.055**	-0.020	-0.049*	-0.045***	-0.040***
	(-1.32)	(-2.07)	(-1.18)	(-1.76)	(-4.54)	(-4.08)
Post × Treat. int.	0.049**	0.049**	0.029	0.034	0.055***	0.040
	(2.07)	(2.32)	(1.04)	(1.35)	(2.95)	(1.61)
Bank and director controls	X	X	X	X	X	X
Year fixed effects	X	X	X	X	X	X
Bank fixed effects		X		X	X	X
Full sample	X	X			X	
Ex-CEO			X	X		X
Mean(y)	0.118	0.118	0.132	0.132	0.053	0.055
S.D.(y)	0.323	0.323	0.339	0.339	0.224	0.228
R^2	0.038	0.069	0.042	0.068	0.117	0.119
N	1,042	1,042	856	856	1,042	856

Panel B: Compensation

Dependent variable:	Measures of fixed comp.		Measures of var. comp.		
	(1)	(2)	(3)	(4)	(5)
Post × Treat. int.	220.760***	267.955**	-841.659***	-179.773***	-170.577***
	(2.87)	(2.73)	(-6.49)	(-3.43)	(-5.83)
Bank and director controls	X	X	X	X	X
Year fixed effects	X	X	X	X	X
Bank fixed effects	X	X	X	X	X
Director fixed effects	X	X	X	X	X
Mean(y)	1,226.256	767.483	3,525.117	672.055	678.486
S.D.(y)	907.352	504.268	3,327.529	1,273.429	1273.565
R^2	0.756	0.834	0.895	0.879	0.878
N	1,055	1,055	1,055	1,055	1,055

Panel C: Performance and risk

Dependent variable:	Sharpe ratio (in %)	Stock return (in %)	Stock return volatility (in %)	Log 5-year excess CDS spread
	(1)	(2)	(3)	(4)
Post × Treat. int.	-0.145***	-4.242***	1.313	0.229***
	(-2.82)	(-3.11)	(1.44)	(4.93)
Year fixed effects	X	X	X	X
Bank fixed effects	X	X	X	X
Mean(y)	0.668	13.611	25.460	2.977
S.D.(y)	1.228	35.437	10.815	1.538
R^2	0.579	0.439	0.705	0.953
N	232	232	232	124

Panel D: Systemic and systematic risk

Dependent variable:	Systemic risk		Systematic risk	
	SRISK%	LRMES	Beta	Corr.
	(1)	(2)	(3)	(4)
Post × Treat. int.	0.390***	-0.143	-0.009	-0.013***
	(4.37)	(-0.29)	(-0.43)	(-5.61)
Year fixed effects	X	X	X	X
Bank fixed effects	X	X	X	X
Mean(y)	2.517	44.028	1.165	0.583
S.D.(y)	4.081	9.379	0.351	0.105
R^2	0.935	0.815	0.795	0.838
N	232	232	232	232

Table 11: Bank performance and risk (excluding UK banks)
This table reports estimates from difference-in-differences regressions for bank performance and risk-taking around the introduction of the EU bonus cap of 2013. The sample covers EU banks between 2010 and 2016, excluding UK banks. Panel A considers bank performance and measures of equity and credit risk: *Sharpe ratio* (column 1), *Stock return* (column 2), *Stock return volatility* (column 3), and *Log 5-year excess CDS spreads* (column 4). Panel B considers measures of systemic risk and systematic risk: *SRISK%* (column 1), *LRMES* (column 2), *Beta* (column 3), and *Correlation* (column 4). *Treatment intensity* is the average treatment intensity of directors within a bank as of 2014 (based on those directors for whom *Post* × *Treated* = 1, where *Treated* is the director-level binary treatment indicator). *Post* is an indicator variable equal to 1 from 2014 onward. All specifications include year and bank fixed effects. The *t*-statistics (in parentheses) are computed from standard errors clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.3 for variable definitions.

Panel A: Performance and risk

Dependent variable:	Sharpe ratio (in %)	Stock return (in %)	Stock return volatility (in %)	Log 5-year excess CDS spread
	(1)	(2)	(3)	(4)
Post × Treat. int.	-0.328*	-8.968*	5.127**	0.276*
	(-1.72)	(-1.73)	(2.37)	(2.10)
Year fixed effects	X	X	X	X
Bank fixed effects	X	X	X	X
Mean(y)	0.078	-7.180	37.484	1.045
S.D.(y)	1.053	46.858	19.606	0.846
R^2	0.644	0.589	0.671	0.937
N	182	182	182	98

Panel B: Systemic and systematic risk

	Systemic risk		Systematic risk	
Dependent variable:	SRISK%	LRMES	Beta	Corr.
	(1)	(2)	(3)	(4)
Post × Treat. int.	0.297*	4.477***	0.194***	0.026**
	(1.89)	(3.45)	(3.86)	(2.64)
Year fixed effects	X	X	X	X
Bank fixed effects	X	X	X	X
Mean(y)	1.964	51.517	1.467	0.464
S.D.(y)	2.374	10.882	0.450	0.119
R^2	0.967	0.693	0.633	0.858
N	182	182	182	182

Table 12: Alternative treatment threshold

This table reports estimates from difference-in-differences regressions around the introduction of the EU bonus cap of 2013. The sample period is 2010-2016. The dependent variables are executive turnover (Panel A), measures of executive compensation structure (Panel B), measures of bank-level performance and risk-taking (Panel C), and measures of systemic risk and systematic risk (Panel D). Treated executive directors are those whose maximum variable-to-fixed compensation ratio exceeds 100% as of 2013. In Panel A and Panel B, *Treatment intensity (100%)* is (1) equal to 0 for directors in the control group and (2) equal to the distance between ρ (maximum variable-to-fixed compensation) and 100% as of 2013 for treated directors. In Panel C and Panel D, *Treatment intensity (100%)* is the average treatment intensity of directors within a bank as of 2014 (based on those directors for whom $Post \times Treated = 1$, where *Treated* is the director-level binary treatment indicator). *Post* is an indicator variable equal to 1 from 2014 onward. All specifications correspond to the most saturated ones in Table 3, Table 5, Table 6, and Table 7. The t-statistics (in parentheses) are computed from standard errors clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.3 for variable definitions.

Panel A: Turnover

Dependent variable:	Turnover		Turnover (poor perf.)	
	(1)	(2)	(3)	(4)
Post × Treat. int. (100%)	0.055**	0.046*	0.056***	0.044*
	(2.73)	(1.93)	(2.92)	(1.97)
Bank and director controls	X	X	X	X
Year fixed effects	X	X	X	X
Bank fixed effects	X	X	X	X
Full sample	X		X	
Ex-CEO		X		X
Mean(y)	0.109	0.125	0.086	0.096
S.D.(y)	0.312	0.331	0.280	0.294
R^2	0.226	0.238	0.247	0.273
N	561	408	561	408

Panel B: Compensation

Dependent variable:	Fixed comp.	Var. comp.	Max. var. comp.	Max. var. ratio	Exp. pay (board, pre)	Exp. pay (board, pre and post)
	(1)	(2)	(3)	(4)	(5)	(6)
Post × Treat. int. (100%)	283.384***	-357.964	-634.557***	-0.708***	95.354	-48.897
	(3.84)	(-1.65)	(-3.19)	(-11.31)	(0.68)	(-0.24)
Bank and director controls	X	X	X	X	X	X
Year fixed effects	X	X	X	X	X	X
Bank fixed effects	X	X	X	X	X	X
Director fixed effects	X	X	X	X	X	X
Mean(y)	1,058.330	521.452	1,525.059	1.122	1,541.542	1,552.359
S.D.(y)	758.716	1,047.108	2,431.648	1.201	1,454.112	1, 417.628
R^2	0.825	0.754	0.891	0.874	0.895	0.875
N	989	989	853	855	722	737

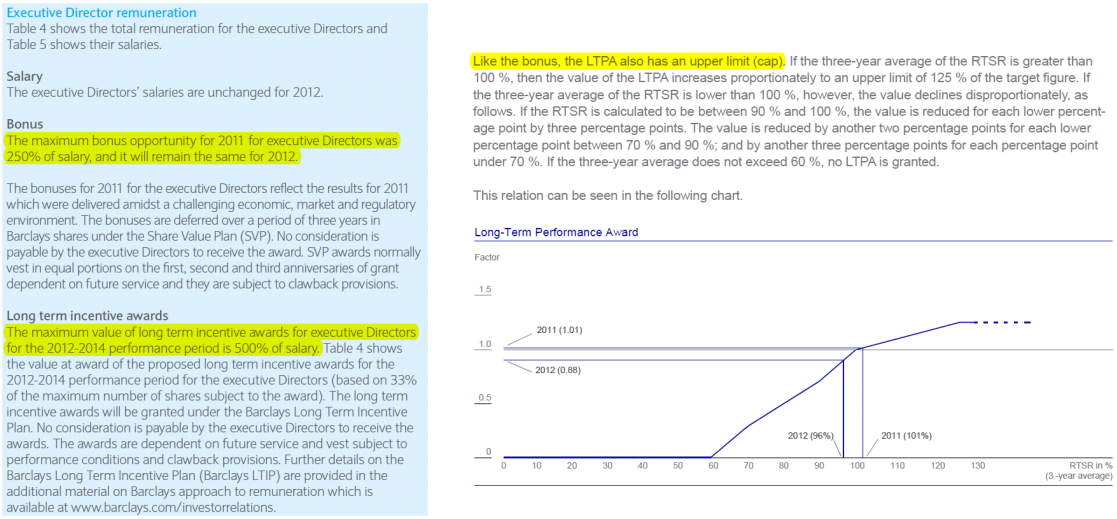
Panel C: Performance and risk

Dependent variable:	Sharpe ratio (in %)	Stock return (in %)	Stock return volatility (in %)	Log 5-year excess CDS spread
	(3)	(4)	(5)	(6)
Post × Treat. int. (100%)	-0.192**	-4.480	2.619	0.082
	(-2.54)	(-1.65)	(1.51)	(1.71)
Year fixed effects	X	X	X	X
Bank fixed effects	X	X	X	X
Mean(y)	0.058	-6.291	36.142	1.103
S.D.(y)	1.051	44.862	18.828	0.765
R^2	0.613	0.575	0.673	0.906
N	216	216	216	132

Panel D: Systemic and systematic risk

	Systemic risk		Systematic risk	
Dependent variable:	SRISK%	LRMES	Beta	Corr.
	(3)	(4)	(5)	(6)
Post × Treat. int. (100%)	0.145	2.252***	0.096**	0.005
	(0.83)	(2.76)	(2.67)	(1.13)
Year fixed effects	X	X	X	X
Bank fixed effects	X	X	X	X
Mean(y)	2.209	51.038	1.443	0.468
S.D.(y)	2.416	10.410	0.429	0.113
R^2	0.956	0.685	0.630	0.857
N	216	216	216	216

Appendix for "Compensation Regulation in Banking: Executive Director Behavior and Bank Performance after the EU Bonus Cap"



Executive Director remuneration
Table 4 shows the total remuneration for the executive Directors and Table 5 shows their salaries.

Salary
The executive Directors' salaries are unchanged for 2012.

Bonus
The maximum bonus opportunity for 2011 for executive Directors was 250% of salary, and it will remain the same for 2012.

The bonuses for 2011 for the executive Directors reflect the results for 2011 which were delivered amidst a challenging economic, market and regulatory environment. The bonuses are deferred over a period of three years in Barclays shares under the Share Value Plan (SVP). No consideration is payable by the executive Directors to receive the award. SVP awards normally vest in equal portions on the first, second and third anniversaries of grant dependent on future service and they are subject to clawback provisions.

Long term incentive awards
The maximum value of long term incentive awards for executive Directors for the 2012-2014 performance period is 500% of salary. Table 4 shows the value at award of the proposed long term incentive awards for the 2012-2014 performance period for the executive Directors (based on 33% of the maximum number of shares subject to the award). The long term incentive awards will be granted under the Barclays Long Term Incentive Plan. No consideration is payable by the executive Directors to receive the awards. The awards are dependent on future service and vest subject to performance conditions and clawback provisions. Further details on the Barclays Long Term Incentive Plan (Barclays LTIP) are provided in the additional material on Barclays approach to remuneration which is available at www.barclays.com/investorrelations.

Like the bonus, the LTPA also has an upper limit (cap). If the three-year average of the RTSR is greater than 100 %, then the value of the LTPA increases proportionately to an upper limit of 125 % of the target figure. If the three-year average of the RTSR is lower than 100 %, however, the value declines disproportionately, as follows. If the RTSR is calculated to be between 90 % and 100 %, the value is reduced for each lower percentage point by three percentage points. The value is reduced by another two percentage points for each lower percentage point between 70 % and 90 %; and by another three percentage points for each percentage point under 70 %. If the three-year average does not exceed 60 %, no LTPA is granted.

This relation can be seen in the following chart.

Figure A.1: Examples of performance-based compensation plans
This figure reports examples of performance-compensation plans in place at EU banks before the introduction of the EU bonus cap. The plan on the left was given by Barclays to its executives in 2011 (source: Barclays PLC, Annual Report 2011, p. 58). The plan on the right was given by Deutsche Bank to its executives in 2012 (source: Deutsche Bank AG, Annual Report 2012, p. 211). Yellow highlight is added in both cases.

Table A.1: List of banks
The number of director-year observations refers to the baseline estimation sample in column 4 of Panel A of Table 5.

	Banks with treated directors	Country	Treat. dir.-years	Untr. dir.-years
1.	AAREAL BANK AG	DE	4	20
2.	BARCLAYS PLC	GB	12	0
3.	BBVA - BANCO BILBAO VIZCAYA ARGENTARIA SA	ES	11	0
4.	DEUTSCHE BANK AG	DE	26	6
5.	HSBC HLDGS PLC	GB	14	7
6.	LLOYDS BANKING GROUP PLC	GB	15	0
7.	ROYAL BANK OF SCOTLAND GROUP PLC	GB	10	0
8.	STANDARD CHARTERED PLC	GB	18	0
9.	UNICREDIT SPA	IT	7	0
	Banks without treated directors	Country	Treat. dir.-years	Untr. dir.-years
1.	ABN AMRO GROUP NV	NL	0	43
2.	BANCA MPS	IT	0	13
3.	BANCA POPOLARE DELL'EMILIA ROMAGNA SCARL	IT	0	34
4.	BANCA POPOLARE DI MILANO SCARL	IT	0	20
5.	BANCO COMERCIAL PORTUGUES SA	PT	0	30
6.	BANCO SABADELL SA	ES	0	17
7.	BANCO SANTANDER SA	ES	0	29
8.	BANK OF CYPRUS GROUP	CY	0	12
9.	BANK OF IRELAND	IE	0	12
10.	BANKIA SA	ES	0	8
11.	BANKINTER SA	ES	0	15
12.	BNP PARIBAS	FR	0	9
13.	BAYERNLB AG	DE	0	36
14.	CAIXABANK SA	ES	0	2
15.	COMMERZBANK AG	DE	0	54
16.	CREDIT AGRICOLE SA	FR	0	6
17.	COOPERATIEVE RABOBANK UA	NL	0	37
18.	DANSKE BANK AS	DK	0	2
19.	DEUTSCHE POSTBANK AG	DE	0	28
20.	DEXIA SA	BE	0	4
21.	DZ BANK AG	DE	0	47
22.	ERSTE GROUP BANK AG	AT	0	31
23.	GRUPPO BANCA CARIGE SPA	IT	0	21
24.	GROUPE BPCE SA	FR	0	22
25.	HELABA LANDESBANK HESSEN THUERINGEN	DE	0	31
26.	ING GROEP NV	NL	0	20
27.	INTESA SANPAOLO SPA	IT	0	51
28.	KBC GROUP NV	BE	0	18
29.	KFW GROUP	DE	0	27
30.	LANDESBANK BERLIN AG	DE	0	30
31.	LANDESBANK BADEN WUERTTEMBERG AG	DE	0	31
32.	MEDIOBANCA SPA	IT	0	24
33.	SKANDINAVISKA ENSKILDA BANKEN AB	SE	0	7
34.	SOCIETE GENERALE SA	FR	0	7
35.	SVENSKA HANDELSBANKEN AB	SE	0	6
36.	UNIONE DI BANCHE ITALIANE SCPA	IT	0	61
	US banks in the alternative control group	Country	Treat. dir.-years	Untr. dir.-years
1.	AMERICAN EXPRESS CO	US	0	37
2.	AMERIPRISE FINANCIAL INC	US	0	34
3.	BANK OF AMERICA CORP	US	0	37
4.	BANK OF NEW YORK MELLON CORP	US	0	38
5.	CAPITAL ONE FINANCIAL CORP	US	0	34
6.	CITIGROUP INC	US	0	36
7.	COMERICA INC	US	0	37
8.	E TRADE FINANCIAL CORP	US	0	39
9.	FIFTH THIRD BANCORP	US	0	42

10.	FIRST NIAGARA FINANCIAL GRP	US	0	32
11.	FIRST REPUBLIC BANK	US	0	29
12.	GOLDMAN SACHS GROUP INC	US	0	36
13.	HUDSON CITY BANCORP INC	US	0	28
14.	HUNTINGTON BANCSHARES	US	0	42
15.	JP MORGAN CHASE & CO	US	0	37
16.	KEYCORP	US	0	35
17.	MORGAN STANLEY	US	0	34
18.	NEW YORK COMMUNITY BANCORP INC	US	0	35
19.	NORTHERN TRUST CORP	US	0	38
20.	PNC FINANCIAL SERVICES GROUP INC	US	0	39
21.	SCHWAB (CHARLES) CORP	US	0	38
22.	STATE STREET CORP	US	0	34
23.	SUNTRUST BANKS INC	US	0	35
24.	US BANCORP	US	0	36
25.	WELLS FARGO & CO	US	0	43

Table A.2: Principal component analysis of executive directors' employment history
We apply a principal component analysis to proxy for directors' professional experience. We choose five indicators generated from the BoardEx employment history as listed in Panel A. Panel B reports the explanatory ability of the different principal components. Our approach builds on Custódio et al. (2013), who use a principal component analysis to proxy for general managerial skills. We depart from Custódio et al. (2013) by applying principal component analysis for each year separately. The results listed in the table correspond to 2015.

Panel A: Principal components of professional experience

	Component 1	Component 2	Component 3	Component 4	Component 5
Numb. exec. dir.	0.4266	0.263	-0.6282	0.5893	-0.0831
Numb. of industries	0.3129	0.6454	0.6681	0.1979	0.0021
Numb. of firms	0.4923	0.2466	-0.2643	-0.6946	0.3802
Numb. of positions	0.5306	-0.3317	0.1332	-0.1988	-0.7424
Numb. of superv. dir.	0.4429	-0.586	0.2673	0.3027	0.5453

Panel B: Eigenvalues and proportion explained (by principal components)

	Eigenvalue	Difference	Proportion expl.	Cumulative
Component 1	2.7775	1.8491	0.5555	0.5555
Component 2	0.9284	0.1996	0.1857	0.7412
Component 3	0.7288	0.3212	0.1458	0.8870
Component 4	0.4076	0.2500	0.0815	0.9685
Component 5	0.1576	-	0.0315	1.0000

Table A.3: Definition of variables
For variables used in tests relying on the US control group (see Table 10), additional information on the database and the variable definition is given [in brackets].

Variable	Databases	Definition
Director characteristics:		
Turnover	BoardEx [Execucomp]	Dummy variable that is one if a director leaves the board and zero otherwise. Note that we collected data on 2016 turnovers manually by checking banks' websites and news reports. [Executive turnover is set to one in the year after an executive has last been reported in Execucomp, and zero otherwise.]
Turnover (poor performance)	BoardEx, Bankscope and Orbis Bankfocus [Execucomp and CCM]	Dummy variable equal to *Turnover* if ROE of the respective bank is below the 50th percentile in a year in our sample of banks and zero otherwise.
CEO	Manually collected [Execucomp]	Dummy variable indicating if a director is the CEO of the bank (1) or not (0). We collected this information manually because BoardEx does not supply a variable indicating the CEO in a board. [Execucomp provides a CEO indicator.]
Professional experience	BoardEx	Variable derived from BoardEx data on executive directors' employment history by means of a principle component analysis similar to the one by Custódio et al. (2013). Relevant information includes number of executive directorships, number of industries, number of firms, number of positions, and number of supervisory directorships.
Age	BoardEx [Execucomp]	Age of the director.
Retirement age	BoardEx [Execucomp]	Dummy variable that is one if a director is older than 65 years.
Tenure	BoardEx [Execucomp]	Number of years a director has served as executive for the bank.
Female	BoardEx [Execucomp]	Dummy variable that is one if a director is female.
Turnover to other executive position	Manually collected	Dummy variable equal to *Turnover* if the director leaves the board of the bank in a given year and moves to another executive director position afterwards and zero otherwise.
Compensation structure:		
Fixed compensation	Manually collected [Execucomp]	Sum of fixed compensation grants in a year (i.e., salary, pensions, other fixed compensation and fixed allowances). If banks do not report these subcategories, we take the aggregate value of fixed compensation. [For tests using the US control group, two different measures of fixed compensation are defined. Measure 1 is defined as (i) the one described above for EU executives, (ii) the sum of salary (`salary`), other components (`othcomp`), and pension contributions (`pension_chg`) for US executives. Measure 2 is defined as (i) the one described above minus pensions and other components for EU executives, (ii) salary for US executives.]
Variable compensation	Manually collected [Execucomp]	Sum of variable (postevaluation) grants in a year (i.e., grants that relate to bank performance of up to the reporting year). [For tests using the US control group, three different measures of variable compensation are defined. Measure 1 is defined as (i) the one described above for EU executives, (ii) the sum of bonus (`bonus`), option grants (`option_awards_fv`), and stock grants (`stock_awards_fv`) for US executives. Measure 2 is defined as (i) variable compensation granted in cash (both deferred and non-deferred) for EU executives, (ii) bonus for US executives. Measure 3 is defined as (i) variable compensation without long-term deferral (i.e., less than a year until realization of a grant) for EU executives, (ii) bonus for US executives.]
Maximum variable compensation	Manually collected	Maximum value of variable compensation that can be achieved within the reporting year.
Maximum variable compensation to fixed	Manually collected	Ratio of maximum variable compensation to fixed compensation. It is the ratio to which the bonus cap applies.
Deferral rate	Manually collected	Sum of deferred variable grants and deferred parts of fixed allowances over the sum of total variable compensation and total fixed allowances.

(Continued)

Table A.3: – *Continued*

Equity rate	Manually collected	Sum of equity grants or grants that are equity-linked over the sum of total variable compensation and total fixed allowances.
Treatment intensity	Manually collected	This is equal to 0 for directors in the control group and equal to the distance between ρ (maximum variable-to-fixed compensation) and 200% as of 2013 for treated directors. Treated executive directors are those whose maximum variable-to-fixed compensation ratio exceeds 200% as of 2013.
Treated	Manually collected	Dummy equal to 1 if an executive director has a maximum variable-to-fixed compensation ratio exceeding 200% as of 2013.
Bank-level information:		
Bank size	Bankscope and Orbis Bank Focus [CCM]	Natural logarithm of total assets.
ROA	Bankscope and Orbis Bank Focus [CCM]	Return on average assets.
ROE	Bankscope and Orbis Bank Focus [CCM]	Return on average equity.
Stock return	Datastream [CCM]	Annual return on stock (total investment return).
Stock return volatility	Datastream [CCM]	Standard deviation of monthly returns over the previous 12 months.
Sharpe ratio	Datastream [CCM]	Ratio of stock return over stock volatility.
Log 5-year excess CDS spread	Datastream	Log of 5-year CDS excess spread. The excess spread is the difference of the CDS spread of the bank and the CDS spread of the corresponding sovereign CDS spread (average over the last quarter of the year).
SRISK%	NYU V-Lab	Fraction of the whole financial sector's capital shortfall the bank would incur in the event of a crisis.
LRMES	NYU V-Lab	Expected fractional equity loss the bank would incur in the event of a crisis.
Beta	NYU V-Lab	Market beta of the bank based on the MSCI World Index.
Correlation	NYU V-Lab	Correlation of the bank's stock returns with the returns on the MSCI World Index.
Number of executive directors	BoardEx	Number of executive directors serving on the board. We take the gross number of observations per year on a board and subtract the sum of the turnovers of the respective year.
CEO turnover	BoardEx [Execucomp]	Dummy variable that indicates if the CEO leaves the board (1) or stays on the board (0). Note that we collected data on 2016 turnovers manually by checking banks' websites and news reports. We also manually collected who the CEO is because BoardEx does not supply a variable indicating the CEO in a board. [Execucomp provides a CEO indicator.]
Deposits	Bankscope and Orbis Bank Focus	Deposits over total assets.
Interbank assets	Bankscope and Orbis Bank Focus	Interbank assets over total assets.
Corporate loans	Bankscope and Orbis Bank Focus	Corporate loans over total assets.
Nonperforming loans	Bankscope and Orbis Bank Focus	Doubtful loans over total assets.
Operating leverage	Bankscope and Orbis Bank Focus	Payroll over total assets.
Executive pay safety	Manually collected	Within-bank-year median of variable compensation over fixed compensation times minus one. Note that we use the negative ratio of variable over fixed compensation instead of using fixed over variable compensation to omit having zeros at the denominator.
Tier I	Bankscope and Orbis Bank Focus	Tier 1 capital over risk-weighted assets.

(Continued)

Table A.3: – *Continued*

Regulatory capital mix	Bankscope and Orbis Bank Focus	Tier 1 capital over total regulatory capital.
Liquidity	Bankscope and Orbis Bank Focus	Liquid assets over short-term funding.
Peripheral exposure	EBA	Ratio of the sum of a bank's sovereign debt exposure to peripheral countries (Portugal, Ireland, Italy, Portugal, and Spain) over a bank's total sovereign debt exposure. Data are from the 2011 EBA Transparency Exercise.
Treatment intensity	Manually collected	This is equal to 0 for banks in the control group and equal to the average director-level treatment intensity of directors within a bank as of 2014. We use 2014 as reference year to ensure that only directors' treatment intensities who serve as executives in the post-period are captured by our measure.
Treated	Manually collected	Dummy equal to 1 if at least one executive in the bank has a maximum variable-to-fixed compensation ratio exceeding 200% as of 2013.

Table A.4: Executive turnover and post-turnover career outcomes
This table reports estimates from difference-in-differences regressions (linear probability models) for turnover of executive directors around the introduction of the EU bonus cap of 2013 conditional on post-turnover outcomes. The sample covers executive directors of EU banks between 2010 and 2016. The dependent variable is *Turnover to other executive position*, an indicator variable equal to 1 if the director leaves the board of the bank in a given year and moves to another executive director position afterwards. Treated executive directors are those whose maximum variable-to-fixed compensation ratio exceeds 200% as of 2013. *Treatment intensity* is (1) equal to 0 for directors in the control group and (2) equal to the distance between ρ (maximum variable-to-fixed compensation) and 200% as of 2013 for treated directors. *Post* is an indicator variable equal to 1 from 2014 onward. All specifications include bank and director control variables (bank size, lagged Sharpe ratio, number of executive directors serving on the board, age, a retirement age indicator, tenure, a female indicator, professional experience, and a CEO indicator) as well as year fixed effects. Even columns include bank fixed effects. Data in odd columns include all executive directors. Columns 3 and 4 exclude CEOs and control for *CEO turnover*, an indicator variable equal to 1 if the bank's CEO is replaced in a given year, rather than for the CEO indicator. The t-statistics (in parentheses) are computed from standard errors clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.3 for variable definitions.

Dependent variable:	Turnover to other executive position			
	(1)	(2)	(3)	(4)
Treat. int.	-0.002	0.003	-0.000	-0.006
	(-0.27)	(0.36)	(-0.02)	(-0.69)
Post × Treat. int.	0.005	0.014	-0.002	0.006
	(0.38)	(1.20)	(-0.18)	(0.54)
Bank and director controls	X	X	X	X
Year fixed effects	X	X	X	X
Bank fixed effects		X		X
Full sample	X	X		
Ex-CEO			X	X
Mean(y)	0.030	0.030	0.027	0.027
S.D.(y)	0.172	0.172	0.162	0.162
R^2	0.039	0.135	0.060	0.127
N	561	561	409	408

Table A.5: Sensitivity of executive turnover to performance
This table reports estimates from triple difference-in-differences regressions (linear probability models) for turnover of executive directors around the introduction of the EU bonus cap of 2013. The sample covers executive directors of EU banks between 2010 and 2016. The dependent variable is *Turnover (poor perf.)*, an indicator variable equal to 1 if the director leaves the board of the bank and the bank's ROE is below the median in a given year. Treated executive directors are those whose maximum variable-to-fixed compensation ratio exceeds 200% as of 2013. *Treatment intensity* is (1) equal to 0 for directors in the control group and (2) equal to the distance between ρ (maximum variable-to-fixed compensation) and 200% as of 2013 for treated directors. *Post* is an indicator variable equal to 1 from 2014 onward. *Treatment intensity* and *Post* are interacted with bank risk-adjusted performance as measured by lagged *Sharpe ratio*. All specifications include bank and director control variables (bank size, lagged Sharpe ratio, number of executive directors serving on the board, age, a retirement age indicator, tenure, a female indicator, professional experience, and a CEO indicator) and year fixed effects. Columns 2 and 4 also include bank fixed effects. Data in columns 1 and 2 include all executive directors. Data in columns 3 and 4 exclude CEOs and control for *CEO turnover*, an indicator variable equal to 1 if the bank's CEO is replaced in a given year, rather than for the CEO indicator. The t-statistics (in parentheses) are computed from standard errors clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.3 for variable definitions.

Dependent variable:	Turnover (poor perf.)			
	(1)	(2)	(3)	(4)
Post × Treat. int. × Sharpe ratio (lag)	-0.048	-0.043	-0.058	-0.045
	(-1.69)	(-0.95)	(-1.67)	(-0.84)
Bank and director controls	X	X	X	X
Time fixed effects	X	X	X	X
Bank fixed effects		X		X
Whole sample	X	X		
Ex-CEO			X	X
Mean(y)	0.086	0.086	0.098	0.096
S.D.(y)	0.280	0.280	0.297	0.294
R^2	0.144	0.248	0.170	0.274
N	561	561	409	408

Table A.6: Characteristics of leaving directors and new directors over the post-EU bonus cap period
This table shows summary statistics for directors leaving their bank (columns 1 to 4) and directors that are newly employed (columns 1 to 4) in the post period, i.e. in the years 2014–2016. Panel A reports summary statistics for directors at treated banks (i.e., those where at least one director has a maximum variable-to-fixed compensation ratio exceeding 200% as of 2013). Panel B reports summary statistics for directors at untreated banks. Refer to Appendix Table A.3 for variable definitions.

Panel A: Directors at treated banks

	Leaving directors				New directors			
	N	Mean	S.E.	Median	*N*	Average	S.E.	Median
Age	13	55.154	5.080	53.000	12	50.333	3.892	50.500
Professional experience	13	0.082	1.206	0.025	12	-0.061	1.717	-0.54
Female	13	0.000	0.000	0.000	12	0.083	0.289	0.000
Number of executive directorships held	13	2.846	1.994	3.000	12	2.333	1.303	2.000
Number of supervisory directorships held	13	3.385	3.404	3.000	12	0.833	1.528	0.000
Number of previous sectors	13	1.385	0.506	1.000	12	1.333	0.651	1.000
Number of previous firms	13	4.615	1.805	4.000	12	6.250	5.396	4.000

Panel B: Directors at untreated banks

	Leaving directors				New directors			
	N	Average	S.E.	Median	*N*	Average	S.E.	Median
Age	48	62.208	10.213	60.500	25	54.640	9.367	52.000
Professional experience	48	0.276	1.841	-0.081	25	0.287	2.111	-0.311
Female	48	0.000	0.000	0.000	25	0.080	0.277	0.000
Number of executive directorships held	48	2.438	1.785	2.000	25	2.480	2.044	1.000
Number of supervisory directorships held	48	5.313	4.406	4.000	25	3.240	4.456	1.000
Number of previous sectors	48	1.208	0.504	1.000	25	1.280	0.542	1.000
Number of previous firms	48	5.125	3.071	5.000	25	5.920	3.451	6.000

Table A.7: Sensitivity of compensation to performance
This table reports estimates from triple difference-in-differences regressions for goal achievement of executive directors around the introduction of the EU bonus cap of 2013. The sample covers executive directors of EU banks between 2010 and 2016. The dependent variable is the realized *Variable compensation-to-maximum variable compensation* ratio. Treated executive directors are those whose maximum variable-to-fixed compensation ratio exceeds 200% as of 2013. *Treatment intensity* is (1) equal to 0 for directors in the control group and (2) equal to the distance between ρ (maximum variable-to-fixed compensation) and 200% as of 2013 for treated directors. *Post* is an indicator variable equal to 1 from 2014 onward. The estimated specifications include a triple interaction term with *Stock return* (columns 1 – 3) and with *Sharpe ratio* (columns 4 – 6). All specifications include bank and director control variables (bank size, ROE, number of executive directors serving on the board, age, tenure, professional experience, a CEO indicator, and a female indicator) and year fixed effects. Columns 2 and 5 include bank fixed effects. Columns 3 and 6 include director fixed effects. The t-statistics (in parentheses) are computed from standard errors clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.3 for variable definitions.

Dependent variable:	Var. comp.-to-max. var. comp.					
	(1)	(2)	(3)	(4)	(5)	(6)
Post × Treat. int. × Stock return	0.001	0.001	0.001			
	(1.05)	(1.06)	(0.80)			
Post × Treat. int. × Sharpe ratio				0.019	-0.001	-0.003
				(0.65)	(-0.02)	(-0.09)
Bank and director controls	X	X	X	X	X	X
Time fixed effects	X	X	X	X	X	X
Bank fixed effects		X	X		X	X
Director fixed effects			X			X
Mean(y)	0.338	0.338	0.350	0.338	0.338	0.350
S.D.(y)	0.314	0.314	0.314	0.314	0.314	0.314
R^2	0.213	0.536	0.590	0.219	0.528	0.583
N	472	471	450	472	471	450

Table A.8: Deferred and equity executive compensation
This table reports estimates from difference-in-differences regressions for compensation structure of executive directors around the introduction of the EU bonus cap of 2013. The sample covers executive directors of EU banks between 2010 and 2016. The dependent variables are *Deferral rate* (columns 1 – 3) and *Equity rate* (columns 4 – 6). Treated executive directors are those whose maximum variable-to-fixed compensation ratio exceeds 200% as of 2013. *Treatment intensity* is (1) equal to 0 for directors in the control group and (2) equal to the distance between ρ (maximum variable-to-fixed compensation) and 200% as of 2013 for treated directors. *Post* is an indicator variable equal to 1 from 2014 onwards. All specifications include bank and director control variables (bank size, ROE, number of executive directors serving on the board, age, tenure, professional experience, a CEO indicator, and a female indicator) and year fixed effects. Column 2 and 5 include bank fixed effects. Columns 3 and 6 include director fixed effects. The t-statistics (in parentheses) are computed from standard errors clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.3 for variable definitions.

Dependent variable:	Deferral rate			Equity rate		
	(1)	(2)	(3)	(4)	(5)	(6)
Treat. int.	0.009	0.009		0.059*	-0.009	
	(0.40)	(1.41)		(1.80)	(-1.04)	
Post × Treat. int.	0.039**	0.027	0.036	0.040**	0.037***	0.046**
	(2.39)	(1.64)	(1.51)	(2.14)	(2.94)	(2.28)
Bank and director controls	X	X	X	X	X	X
Year fixed effects	X	X	X	X	X	X
Bank fixed effects		X	X		X	X
Director fixed effects			X			X
Mean(y)	0.685	0.686	0.686	0.565	0.565	0.565
S.D.(y)	0.222	0.222	0.222	0.305	0.305	0.307
R^2	0.101	0.656	0.692	0.160	0.882	0.892
N	451	449	435	451	449	435

Table A.9: Bank performance, risk, capital requirements and liquidity regulation
This table reports estimates from difference-in-differences regressions for bank performance and risk-taking around the introduction of the EU bonus cap of 2013. The sample covers EU banks between 2010 and 2016. Panel A considers bank performance and measures of equity and credit risk: *Sharpe ratio* (column 1), *Stock return* (column 2), *Stock return volatility* (column 3), and *Log 5-year excess CDS spreads* (column 4). Panel B considers measures of systemic risk and systematic risk: *SRISK%* (column 1), *LRMES* (column 2), *Beta* (column 3), and *Correlation* (column 4). *Treatment intensity* is the average treatment intensity of directors within a bank as of 2014 (based on those directors for whom *Post* × *Treated* = 1, where *Treated* is the director-level binary treatment indicator). *Post* is an indicator variable equal to 1 from 2014 onward. Δ *Tier I* is the change in the bank's Tier I capital over total risk-weighted assets. Δ *Regulatory capital mix* is the change in the bank's Tier I capital over total regulatory capital. Δ *Liquidity* is the change in the bank's ratio of liquid assets over deposits and short-term funding. All specifications include year and bank fixed effects. The *t*-statistics (in parentheses) are computed from standard errors clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.3 for variable definitions.

Panel A: Performance and risk

Dependent variable:	Sharpe ratio (in %)	Stock return (in %)	Stock return volatility (in %)	Log 5-year excess CDS spread
	(1)	(2)	(3)	(4)
Post × Treat. int.	-0.337***	-9.549***	6.569**	0.111*
	(-3.79)	(-2.77)	(2.71)	(1.75)
Δ Tier I	-0.008	0.692	-0.882	-0.021
	(-0.21)	(0.42)	(-1.58)	(-1.53)
Δ Regulatory capital mix	-0.011	-1.095	0.624**	0.013***
	(-1.24)	(-1.57)	(2.62)	(3.76)
Δ Liquidity	0.004	0.007	0.018	-0.004
	(0.67)	(0.03)	(0.22)	(-1.08)
Year fixed effects	X	X	X	X
Bank fixed effects	X	X	X	X
Mean(y)	0.049	-6.335	36.097	1.109
S.D.(y)	1.043	44.501	18.638	0.778
R^2	0.624	0.634	0.718	0.926
N	198	198	198	123

Panel B: Systemic and systematic risk

	Systemic risk		Systematic risk	
Dependent variable:	SRISK%	LRMES	Beta	Corr.
	(1)	(2)	(3)	(4)
Post × Treat. int.	0.405**	3.944***	0.161***	0.009
	(2.27)	(3.25)	(3.07)	(1.20)
Δ Tier I	0.013	0.198	0.007	0.001
	(0.79)	(0.52)	(0.33)	(0.42)
Δ Regulatory capital mix	-0.008	-0.084	-0.002	-0.001
	(-1.08)	(-1.08)	(-0.37)	(-1.02)
Δ Liquidity	0.001	-0.019	-0.001	0.000
	(0.10)	(-0.42)	(-0.50)	(0.69)
Year fixed effects	X	X	X	X
Bank fixed effects	X	X	X	X
Mean(y)	2.267	51.125	1.447	0.468
S.D.(y)	2.458	10.400	0.428	0.107
R^2	0.964	0.707	0.657	0.843
N	198	198	198	198

Table A.10: Bank performance and risk (falsification test)
This table reports estimates from difference-in-differences regressions for bank performance and risk-taking around the introduction of the EU bonus cap of 2013, replacing the bank's *Treatment intensity* used in Table 7 with *Peripheral exposure*, i.e., the bank's exposure to the sovereign debt of peripheral countries (Greece, Ireland, Italy, Portugal, and Spain) relative to its total sovereign debt holdings. The sample covers EU banks between 2010 and 2016. Panel A considers bank performance and measures of equity and credit risk: *Sharpe ratio* (column 1), *Stock return* (column 2), *Stock return volatility* (column 3), and *Log 5-year excess CDS spreads* (column 4). Panel B considers measures of systemic risk and systematic risk: *SRISK%* (column 1), *LRMES* (column 2), *Beta* (column 3), and *Correlation* (column 4). The dependent variables are *SRISK%*, *LRMES*, *Beta*, and *Correlation*. *Post* is an indicator variable equal to 1 from 2014 onward. All specifications include year and bank fixed effects. The t-statistics (in parentheses) are computed from standard errors clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.3 for variable definitions.

Panel A: Performance and risk

Dependent variable:	Sharpe ratio (in %)	Stock return (in %)	Stock return volatility (in %)	Log 5-year excess CDS spread
	(1)	(2)	(3)	(4)
Post × Periph. exposure	0.071	-2.910	3.463	-0.001
	(0.25)	(-0.24)	(0.44)	(-0.01)
Year fixed effects	X	X	X	X
Bank fixed effects	X	X	X	X
Mean(y)	0.048	-4.244	35.647	1.142
S.D.(y)	1.026	41.053	16.467	0.782
R^2	0.631	0.675	0.696	0.919
N	140	140	140	101

Panel B: Systemic and systematic risk

	Systemic risk		Systematic risk	
Dependent variable:	SRISK%	LRMES	Beta	Corr.
	(1)	(2)	(3)	(4)
Post × Periph. exposure	0.367	1.698	0.069	0.023
	(0.94)	(0.45)	(0.41)	(1.50)
Year fixed effects	X	X	X	X
Bank fixed effects	X	X	X	X
Mean(y)	3.109	53.232	1.527	0.497
S.D.(y)	2.545	9.252	0.400	0.094
R^2	0.947	0.683	0.636	0.883
N	140	140	140	140

Table A.11: Bank performance and risk (excluding bailed-out banks)
This table reports estimates from difference-in-differences regressions for bank performance and risk-taking around the introduction of the EU bonus cap of 2013. The sample covers EU banks between 2010 and 2016, excluding banks that received government support. Panel A considers bank performance and measures of equity and credit risk: *Sharpe ratio* (column 1), *Stock return* (column 2), *Stock return volatility* (column 3), and *Log 5-year excess CDS spreads* (column 4). Panel B considers measures of systemic risk and systematic risk: *SRISK%* (column 1), *LRMES* (column 2), *Beta* (column 3), and *Correlation* (column 4). *Treatment intensity* is the average treatment intensity of directors within a bank as of 2014 (based on those directors for whom *Post* × *Treated* = 1, where *Treated* is the director-level binary treatment indicator). *Post* is an indicator variable equal to 1 from 2014 onward. All specifications include year and bank fixed effects. The *t*-statistics (in parentheses) are computed from standard errors clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.3 for variable definitions.

Panel A: Performance and risk

Dependent variable:	Sharpe ratio (in %)	Stock return (in %)	Stock return volatility (in %)	Log 5-year excess CDS spread
	(1)	(2)	(3)	(4)
Post × Treat. int.	-0.273**	-2.703	5.116**	0.148*
	(-2.69)	(-0.92)	(2.23)	(2.07)
Year fixed effects	X	X	X	X
Bank fixed effects	X	X	X	X
Mean(y)	0.146	-1.986	32.413	0.881
S.D.(y)	1.014	35.902	15.083	0.766
R^2	0.566	0.562	0.691	0.907
N	125	125	125	84

Panel B: Systemic and systematic risk

	Systemic risk		Systematic risk	
Dependent variable:	SRISK%	LRMES	Beta	Corr.
	(1)	(2)	(3)	(4)
Post × Treat. int.	0.541***	2.898**	0.100*	0.009
	(3.70)	(2.37)	(2.09)	(0.85)
Year fixed effects	X	X	X	X
Bank fixed effects	X	X	X	X
Mean(y)	1.723	49.533	1.376	0.478
S.D.(y)	2.296	10.076	0.381	0.106
R^2	0.976	0.750	0.723	0.876
N	125	125	125	125

Table A.12: Binary treatment indicator

This table reports estimates from difference-in-differences regressions around the introduction of the EU bonus cap of 2013. The sample covers executive directors of EU banks between 2010 and 2016. The dependent variables are executive turnover (Panel A), measures of executive compensation structure (Panel B), measures of bank-level performance and risk-taking (Panel C), and measures of systemic risk and systematic risk (Panel D). Treated executive directors are those whose maximum variable-to-fixed compensation ratio exceeds 200% as of 2013. In Panel A and Panel B, *Treated* is an indicator variable equal to 1 if an executive director has a maximum variable-to-fixed compensation ratio exceeding 200% as of 2013. In Panel C and Panel D, *Treated* is computed at the bank-level and is equal to one if at least one treated director served on the board as of 2014. *Post* is an indicator variable equal to 1 from 2014 onward. All specifications correspond to the most saturated ones in Table 3, Table 5, Table 6, and Table 7. The *t*-statistics (in parentheses) are computed from standard errors clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.3 for variable definitions.

Panel A: Turnover

Dependent variable:	Turnover		Turnover (poor perf.)	
	(1)	(2)	(3)	(4)
Post × Treated	0.166**	0.158*	0.198***	0.192**
	(2.35)	(1.82)	(3.25)	(2.44)
Bank and director controls	X	X	X	X
Year fixed effects	X	X	X	X
Bank fixed effects	X	X	X	X
Full sample	X		X	
Ex-CEO		X		X
Mean(y)	0.109	0.125	0.086	0.096
S.D.(y)	0.312	0.331	0.280	0.294
R^2	0.224	0.237	0.249	0.275
N	561	408	561	408

Panel B: Compensation

Dependent variable:	Fixed comp.	Var. comp.	Max. var. comp.	Max. var. ratio	Exp. pay (board, pre)	Exp. pay (board, pre and post)
	(1)	(2)	(3)	(4)	(5)	(6)
Post × Treated	999.347***	-714.977	-1,727.356**	-2.425***	595.349	226.337
	(5.66)	(-0.91)	(-2.14)	(-8.11)	(1.67)	(0.34)
Bank and director controls	X	X	X	X	X	X
Year fixed effects	X	X	X	X	X	X
Bank fixed effects	X	X	X	X	X	X
Director fixed effects	X	X	X	X	X	X
Mean(y)	1,058.330	521.452	1,525.059	1.126	1,541.542	1,552.359
S.D.(y)	758.716	1047.108	2,431.648	1.207	1,454.112	1,417.628
R^2	0.828	0.735	0.883	0.872	0.898	0.875
N	989	989	853	855	722	737

Panel C: Performance and risk

Dependent variable:	Sharpe ratio (in %)	Stock return (in %)	Stock return volatility (in %)	Log 5-year excess CDS spread
	(3)	(4)	(5)	(6)
Post × Treated	-0.565***	-15.359**	6.654*	0.074
	(-4.11)	(-2.66)	(1.80)	(0.50)
Year fixed effects	X	X	X	X
Bank fixed effects	X	X	X	X
Mean(y)	0.058	-6.291	36.142	1.103
S.D.(y)	1.051	44.862	18.828	0.765
R^2	0.613	0.575	0.673	0.906
N	216	216	216	132

Panel D: Systemic and systematic risk

	Systemic risk		Systematic risk	
Dependent variable:	SRISK%	LRMES	Beta	Corr.
	(3)	(4)	(5)	(6)
Post × Treated	0.429	4.707**	0.196**	0.028**
	(1.23)	(2.16)	(2.07)	(2.23)
Year fixed effects	X	X	X	X
Bank fixed effects	X	X	X	X
Mean(y)	2.209	51.038	1.443	0.468
S.D.(y)	2.416	10.410	0.429	0.113
R^2	0.956	0.685	0.630	0.857
N	216	216	216	216