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Preface

Human beings do not act in isolation. This particularly holds for economic systems in which workers are employed at firms. In one of the seminal papers in economics, Coase (1937) identifies transaction costs to be the prime economic reason why firms are formed to organize production, and, consequently, transaction costs also explain why workers are employed at firms. At first glance, this appears to be a subtle detail on the organization of economic activity. It has, however, a huge impact on individuals, as this subtle detail also is the reason why the provision of their workforce in the economy is performed through employment at firms.

In a free and capitalist society, markets constitute the ecosystem of firms. Firms obtain their resources in factor markets and financial markets, while produced goods are sold via product markets. In the four papers of this thesis, I—together with my co-authors—study the interrelation of these ecosystems with particular focus on labor markets from a corporate finance angle. Each of the papers highlights different aspects in the employment of labor by firms. In Paper 1 I study labor rigidities and their impact on firm financial performance, in Paper 2 we evaluate behavioral effects due to changes in compensation structure, in Paper 3 we investigate pay differences along task-related differences in marginal returns to talent, and in Paper 4 we study cross-sector mobility of former bankers that moved to banking supervision. These aspects do not only matter for financial decision making but also come with implications for the economy as a whole.

The economic literature on labor is traditionally interested in labor markets, namely in how prices and quantities in labor markets come about and how these translate into wages, employment and, more recently, income distribution. Financial economics is traditionally interested in financial markets, i.e., how firms attain funding, and financial performance, i.e., how firms' economic activity can ensure to provide goods and services in an economically sustainable manner. Recently, financial economists also focus on the interrelation of labor and finance within and across firms. One reason for this is that labor is different from other factors of production in various aspects. These differences have important implications on firm financing, but can also retroactively affect the greater economy. Another reason is that well-established figures on labor markets recently observed new trends. Three prominent examples are the decrease in labor shares (e.g. Karabarbounis and Neiman, 2014; Dao, Das, Koczan, and Lian, 2017), job-market polarization in developed economies (e.g. Autor, Katz, and Kearney, 2006; Goos and Manning, 2007), and the stark increase in top-level pay (e.g. Rosen, 1981; Gabaix and Landier, 2008). For a sound understanding of these phenomena, the firm-centric perspective of financial economists is of great value. Not only can corporate structures be sources of such patterns, they will also be affected by them in a plethora of ways. All papers in this thesis have in common that they relate to meaningful trends in labor markets. To enlighten the discussion on these, the papers trace stylized facts or common narratives on labor markets back to their origin at the firm level (Paper 1 and Paper 3) or even at the level of individual employment contracts (Paper 2 and Paper 4).

When investigated separately, both the combination of production factors and financing activities of firms can be well described by means of traditional tools that economists use, such as production functions and firm financial analyses. Not surprisingly, these tools are regularly applied in the fields of labor economics and financial economics, respectively, to investigate the ecosystems of interest. However, to study interaction effects between labor and finance empirically, conventional means do not suffice most of the time. For instance, while survey data offers great insight into individual decision making, labor income, and information on many covariates, it is regularly hard—if not impossible—to link such data to firm financials. At the same time, the best data on firm financials is useless if it offers no insights into the specific characteristics of the labor force employed in firms. The papers of this thesis therefore do not only rely on firm financials and financial market data, but rather combine those data with granular information on labor markets and employment. As such, the papers of this thesis can contribute to the evaluation of the impact of labor on various levels.

As economists can seldom execute controlled field experiments to test their conjectures, it is of utmost importance to understand the context from which the empirical results are sourced. Henceforth, while the availability of data is key to establish certain empirical facts, it is econometric analyses that allow one to uncover meaningful regularities of economic ecosystems well below the surface of a pure statistical description. In some cases, an empirical setting might be suitable to argue that variation in explanatory variables is sufficiently exogenous to interpret estimated coefficients in a causal way (I do so in Paper 1). It is very important to understand, however, that it is not the mechanical application of a model, but rather the investigation of the specific features of a settings, that allows such inference. In the real world, the researcher will find herself in less optimal situations most of the time (Paper 2, Paper 3, and Paper 4). However, econometric anaylses may still be informative in the absence of "clean" identification. For instance, in Paper 2 we argue that while the regulatory shock that we investigate clearly is a shock to compensation structure, its exogenous nature is unclear and, subsequently, needs to be studied in depth. Therefore, the econometric analyses in Paper 2 do not solely rely on a mechanical application of the difference-in-differences approach, but rather on the profound description of the institutional setting, in tests that falsify confounding events, and in controlling for alternative explanations.

There is a clear trend towards more reliance on empirical research rather than pure theoretical, i.e., model-based, research. Note, however, that the two approaches are highly related. The motivation to work empirically is largely motivated by theoretical work and vice versa. In many cases, empirical studies inspired theorists to rethink their way of modeling the behavior of economic agents (e.g. Kahneman and Tversky, 1979). In other cases, it took empiricists a long time to ultimately be able to provide evidence that backed well-established theoretical work. One prominent example is the provision of empirical evidence by Aggarwal and Samwick (1999) on the principal-agent model of executive compensation. Also, it can often be a first step to provide empirical evidence in line with a plausible theory on a subject (Paper 3), rather than rejecting research ideas that do not offer fully fledged causal identification strategies. Clearly, such evidence cannot be regarded as the ultimate empirical proof. It can, however, inform ongoing debates on important issues by revealing patterns and by putting them into perspective by directly relating it to theory.

Labor market-related topics are usually dealt with in a highly emotional way in the public, as most people are directly affected by labor-market outcomes. Therefore, it is of first order importance to support policy makers with scientific evidence to support their decision making. With two of my papers I shed light on topics that are particularly sensitive—financial costs of fixed wages and incentive pay of bankers. First, in Paper 1 I demonstrate that while safe contracts might be favorable to workers in the short run, they might come at some cost in the long run. I show that the decrease in financial performance that firms experience in times of competitive pressure is mostly related to labor leverage due to rigid labor costs. If both the inflexibility of wages and the competitive pressure persist, it is likely that firms have to be restructured and, ultimately, workers might be laid off. I do not claim that workers should get equally flexible claims as residual claimholders in order to permanently strengthen firm financial results. For policy makers it is important, however, to see the financial implications of rigid labor costs when making policy decisions with respect to labor. One such example is the introduction of short-time working plans like the German *Kurzarbeitergeld*. This temporary measure allows firms to decrease labor leverage while retaining its workforce. Second, we investigate the effects of a policy intervention on banker's pay in Paper 2. It is well-established that mis-aligned compensation practices played a role in the financial crisis of 2007-2009 (e.g. Efing, Hau, Kampkötter, and Steinbrecher, 2015). The brute-force approach of the EU banker bonus cap—that might have largely been motivated by emotions rather than consultations of experts on the matter—is unlikely to realign bankers' incentives. We document that compensation contracts after the introduction of the EU banker bonus cap offered higher levels of fixed pay, implying more insurance to bankers against their own poor performance. Consistently, we find no evidence on decreased risk-taking—which was the policy's goal—but even increases in some of the risk-measures we investigate.

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Paper 1:

Competition, Cost Structure, and Labor Leverage: Evidence from the U.S. Airline Industry

Competition, Cost Structure, and Labor Leverage: Evidence from the U.S. Airline Industry*

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Abstract

I study the effect of increasing competition on financial performance through labor leverage. To capture competition, I exploit variation in product market contestability in the U.S. airline industry. First, I find that increasing competitive pressure leads to increasing labor leverage, proxied by labor share. This explains the decrease in operating profitability through labor rigidities. Second, by exploiting variation in human capital specificity, I show that contestability of product markets induces labor market contestability. Whereas affected firms might experience more stress through higher wages or loss of skilled human capital, more mobile employee groups benefit from competitions through higher labor shares.

JEL Classification: G39, J31, L93

Keywords: Competition, labor leverage, labor share, threat of entry

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1 Introduction

Evaluating the effects of competitive pressure on firms is key to understand an economy's ability to adapt to a changing economic environment. At the firm level, competitive shocks often materialize as contractions in revenues. How hard these shocks hit firms depends on how flexibly they can react to such adverse events. Operating leverage—the ratio of fixed to total costs—expresses the sensitivity of a firm's income to changes in revenues. Consequently, firms with high operating leverage will suffer more from a negative demand shock than firms that can easily adapt to a changing economic environment.

In the presence of labor rigidities, labor expenses contribute to labor leverage, a crucial component of operating leverage. The labor share, which captures the fraction of output that goes to labor, has been used in the finance literature as a measure of labor leverage (Marfè, 2017a; Donangelo, Gourio, Kehrig, and Palacios, 2019). This paper investigates how economic shocks driven by competitive pressure affect firm performance and how these relate to labor leverage. By capturing competitive pressure through threat of entry, I address endogeneity concerns associated with decisions of entry (e.g., Goolsbee and Syverson, 2008; Parise, 2018).

Whereas labor leverage is sensitive to both competition in product markets and labor markets, prior studies have neglected the latter aspect of contestability. My testing ground provides a comprehensive assessment of the interplay between competitive pressure and labor leverage. More specifically, I study the effects of product market contestability and whether product market contestability induces labor market contestability.

To investigate firm-level competition, I focus on the U.S. airline industry. The distinctive setting allows me to study the effects of competition on firm-level labor shares and performance. The U.S. airline industry is characterized by high competitive pressure and frequent entries of competitors into spatially segmented markets. Using highly granular data on air carriers, I am able to assess competition at the route-market level.

I identify the effect of competitive pressure on firm profit margins by exploiting the threat of entry by a budget carrier. On the level of route markets, I find that incumbent airlines decrease ticket prices by -2.1% on average, once a market becomes contestable. This leads to a decrease in incumbents' size by -5.5% on average, as proxied by ticket sales in a market. Second, I show that the firm-level labor share of incumbents is positively related to both realized entry and threat of entry. That is, a higher fraction of total revenues is spent on wages, once competitive pressure on airlines increases. Third, I decompose the labor share in different ways to illustrate how lower operating profitability is directly linked to increases in labor leverage. Whereas the share of non-labor related expenses instantly adjusts to competitive pressure, the share of labor expenses, i.e., the labor share, increases. This result is economically significant. I find that more than 80% of the decrease of an airline's EBIT margin caused by competitive pressure is related to the increase in labor leverage.

I provide evidence that the labor shares of different groups of employees are differentially affected by competitive pressure. Management compensation does not contribute to increases in the labor share. One explanation of this result might be lower levels of variable pay at times of tougher competition owing to weaker financial performance of incumbent airlines. This is in line with a narrative that variable compensation is a risk-sharing contract and as such allows firms greater flexibility at times of poorer economic performance (e.g., Efing, Hau, Kampkötter, and Rochet, 2018). In contrast, both ground crews and flight crews benefit from more competition. The results for the latter group can partially be attributed to labor market effects. This is consistent with labor market contestability induced by product market contestability.

In the empirical analysis, I use a measure of human capital specificity to investigate whether product market contestability can induce labor market contestability. If an entry into a product market becomes more likely, the entering firm will also demand more labor and thus contestability of related labor markets will increase, too. Oligopsonists' rents will be challenged in a similar way as those of oligopolists. Additional pressure on labor markets can increase operating leverage through higher wages, which potentially crowds out financing opportunities. At the same time, contestability of labor markets could induce a loss of skilled human capital through poaching.

There is a growing body of literature on how labor rigidities affect financing conditions of firms. For instance, Marfè (2017b) demonstrates how the labor share—a proxy of labor leverage—can explain the premia of value firms over growth firms. In addition, Marfè (2017a) argues that income insurance from shareholders to workers comes at the expense of higher short-run dividend risk. Donangelo et al. (2019) document that firms with higher labor leverage exhibit higher equity returns. These returns come at the cost of a higher sensitivity to economic shocks. Simintzi, Vig, and Volpin (2015) show that higher levels of labor protection—which make labor expenses arguably more rigid—increase operating leverage, crowding out financial leverage. This is in line with

Favilukis, Lin, and Zhao (2019) who find that higher operating leverage through higher labor shares leads to higher credit risk. I contribute to this literature by showing that the deterioration of firms' operating performance from competitive pressure is linked to changes in labor leverage. My results support the narrative that rigid labor costs lead to increases in a firm's sensitivity to adverse sales shocks through operating leverage. More specifically, the lower ability to turn revenues into profits, i.e., lower EBIT margins caused by labor rigidities in my setting, narrows firms' abilities to finance operations with retained earnings.

As a result of both its distinct competitive structure and regulated mandatory data disclosure, the U.S. airline industry has been intensively researched in fields related to industrial organization, competition and entry decisions (e.g., Berry, 1992; Borenstein and Rose, 1994; Goolsbee and Syverson, 2008). More recently, the setting of the U.S. airline industry has also been used to investigate pay determination on various levels of corporations. For instance, Hirsch and Macpherson (2000) look at wages of airline labor around deregulation, Benmelech, Bergman, and Enriquez (2012) investigate how airlines in financial distress renegotiate wages, He, Whited, and Guo (2018) study how relative performance evaluation in executive compensation affects competition, and Aggarwal and Schenone (2019) exploit the availability of on-time performance data—a key performance indicator for airlines—to evaluate the nexus between non-financial performance and executives' incentive schemes. I contribute to this literature by extending the analysis to airline-level labor shares and by investigating how competitive pressure affects different labor groups differentially.

This paper is also related to the literature on the dynamics and determinants of labor shares. Recently, researchers have found evidence of decreasing labor shares for various developed economies (e.g., Karabarbounis and Neiman, 2014; Dao, Das, Koczan, and Lian, 2017), contradicting the traditional view that the labor share is constant (e.g., Kaldor, 1957). Explanations for this phenomenon are manifold and range from a decrease in the cost of capital, increased trade and international outsourcing, and the decline of labor market unionizations to measurement issues.[1] Autor, Dorn, Katz, Patterson, and van Reenen (2017) argue that firm heterogeneity in productivity leads to industry concentration and ultimately lower labor shares. In their setting, industry structure is driven by highly productive superstar firms. I investigate similar regularities as Autor et al. (2017) but at the firm-level rather than the industry level.

[1]For a thorough description of potential drivers of the labor share, see Dao et al. (2017), for instance.

Whereas the specific setting of the US airline industry allows me to observe increasing competition rather than increasing industry concentration, I come to the same conclusion. My findings verify the negative relation between market power and labor shares, i.e., that a decrease (increase) in market power is related to an increase (decrease) in labor shares.

More recently, we observe higher industry concentration, larger firms and fewer competitors (e.g., De Loecker and Eeckhout, 2017), and job market polarization (e.g., Autor, Katz, and Kearney, 2006; Goos and Manning, 2007). In the light of these developments, it is of particular interest to investigate the distribution of total revenues among different groups of employees. Whereas the evolution of top-level pay has been intensively researched in finance (e.g., Rosen, 1981; Gabaix and Landier, 2008), the interest in within-firm pay inequality is new to this literature (e.g., Mueller, Ouimet, and Simintzi, 2017; Dittmann, Montone, and Zhu, 2018a; Dittmann, Schneider, and Zhu, 2018b). I contribute by examining how competitive pressure on firms affects different groups of employees differentially and by documenting that especially mobile labor groups benefit from this situation through higher labor shares.

2 The economics of labor share, operating leverage, and labor leverage

2.1 Measurement and interpretation

The labor share is the sum of labor costs over a measure of output. At the macro-level, the labor share is usually defined as total labor compensation over gross domestic product (e.g., Karabarbounis and Neiman, 2014). In this case, the labor share expresses the fraction of the market value of final goods produced in a country going to wage-earners. Hence, changes in the labor share capture the workforce's time-varying participation in national value-added through wages.

Firm-level studies often define the labor share as the fraction of labor expenses over a firm-level measure of value-added (e.g., Marfè, 2017b; Donangelo et al., 2019). The advantage of using value-added as the basis for firm-level labor shares is that the macro-level labor share can be constructed through aggregation. Whereas the exclusion of intermediaries omits double-counting, it neglects output of firms with high shares of intermediary good production. As I do not provide a general equilibrium analysis, I use total revenues as the basis of the calculation of labor shares, in line with the labor share definitions of non-manufacturing sectors used by Autor et al. (2017).[2] In this

[2]Estimations based on value-added in the appendix are based on the definition of value-added used

way, I capture the share of labor expenses relative to the gross output produced by firms.

The concept of labor share is closely related to the concept of operating leverage. Operating leverage captures the effect of changes in revenues on profits. The channel of these changes is a firm's cost structure, namely the relation of fixed costs to variable costs. In the model of operating leverage, a higher share of fixed costs increases profitability in times of high revenues, whereas it reduces profitability in times of low revenues. This mechanism is analogous to financial leverage. High financial leverage increases the positive impact of asset returns on equity returns in good times, but also amplifies the negative impact in bad times.[3] Operating leverage induced by labor expenses is referred to as labor leverage (e.g., Lev and Zambon, 2003).

Marfè (2017a) uses labor share as a proxy for wage insurance from shareholders to employees and shows that higher wage insurance can lead to higher short-term dividend risk. The amplification of existing labor rigidities can have sizable effects on firm performance. For instance, Simintzi et al. (2015) show that employment protection has an impact on capital structure through the crowding out of financial leverage by operating leverage. The work by Efing et al. (2018) confirms these findings. In their study on the banking sector they show that banks with compensation plans that rely more on variable components have lower operating leverage. At the same time, riskier banks prefer to choose lower operating leverage.

The use of total revenues in the calculation of labor shares allows me to interpret the labor share in the context of operating profitability. Based on accounting identities of the profit and loss account, I decompose estimated effects on the EBIT margin into the contribution of non-labor related expenses and of labor expenses, where the latter is captured by the labor share. In this way, I can relate the estimated effects of competitive pressure on profitability to different cost components, where labor share can be interpreted as labor leverage, i.e., labor induced operating leverage.

2.2 Labor share and competition

In a simple model of oligopoly, a decrease in oligopolistic market power is followed by a decrease in prices and an increase in aggregate quantities of goods sold. If product

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by Favilukis et al. (2019).

[3]Note that operating leverage is closely related to the concept of adjustment costs in production with fixed costs (e.g., Lucas, 1967) or to situations where firms can only change production after incurring additional adjustment costs (e.g., Hamermesh and Pfann, 1996).

market power is reduced by the entry of new firms, market shares of incumbent firms will also decrease. In a first step, I therefore analyse the effects of competitive pressure on ticket sales on distinct routes to determine the impact of competition in my setting. More specifically, I estimate the price and quantity effects of competition both on the total market and on the market subset, where only the incumbents' tickets are considered.

By construction, the labor share captures both competition in product markets (revenues, denominator) and competition in labor markets (labor expenses, numerator) in which firms operate. I therefore decompose the aggregate effect into its two components to pin down the importance of each channel—product market competition and labor market competition—in my setting.

Compared to a setting where there is perfect competition, uncontested labor markets are characterized by lower wages and a lower demand for labor. For instance, Benmelech, Bergman, and Kim (2018) document that higher employer concentration in local labor markets and lower wages go hand in hand. Following the idea of contestability, the expansion of a competitors' activities should affect labor market outcomes. Higher demand for labor and subsequently higher wages would then translate into higher labor shares. Under the assumption of a perfect labor market, all firms would be affected in the same way at a given point in time. It might be more realistic, however, to relax this assumption. Relaxations might be necessary because of regional fragmentation, limited mobility of labor groups, or human capital specificity of employee groups across airlines. Differential affectedness of employee groups might thus be explained by airline-employee group specific aspects that make the labor force of some airlines more attractive to a potential entrant. In my empirical analysis, I apply a measure of human capital specificity based on aircraft types employed by carriers. I argue that airlines with matching human capital specificity would be affected more by competitive pressure if contestability of labor markets is induced by product market contestability.

3 The U.S. airline industry

3.1 Studying competition in the U.S. airline industry

One major challenge in studying the effects of competition is the definition of markets and the identification of firms competing therein. This is particularly challenging when considering differentiated multi-product firms or industries that are characterized by a high level of market fragmentation (e.g., Hoberg, Phillips, and Prabhala, 2014; Hoberg and Philips, 2016). The setting of the U.S. airline industry offers some special features that help to deal with these challenges. First, flights are relatively homogeneous goods. When compared, a connection between city A and city B by a legacy carrier and a flight executed by a budget airline are close substitutes. The assumption of substitutability is important, as I will use the threat of entry by a budget carrier to capture competitive pressure. Homogeneity of goods is also underpinned by national regulation and industry standardization of the U.S. carrier business. I show this substitutability by investigating whether a budget carrier's entry affects incumbent airlines' quantity and price decisions.

Second, a study of the U.S. airline industry has to consider the sub-markets in which carriers operate. Spatial segmentation can be tackled by an analysis that takes into account connections between regions. The U.S. airline data enables me to capture precisely which airlines are competing with each other on routes between city markets. In this way, I can evaluate a carrier's exposure to competition.

Apart from the observability of the industry structure, an analysis of the U.S. airlines has another benefit when it comes to investigating competition. The continuous entry by budget carriers into the industry—and particularly the evolution of Southwest Airlines' business—is perceived as an industry-disrupting phenomenon. Budget airlines are seen as one of the major reasons for the failure of the U.S. airline industry to be profitable for decades (Borenstein, 2011). This makes it a suitable setting in which to study tough competition at the firm-level.

3.2 Market penetration by Southwest Airlines

I focus on changes in competitive pressure which I capture by threat of entry at firm-level to evaluate subsequent effects on labor shares of firms. Threat of entry is directly linked to the concept of contestability. A market is said to be contestable if there are no barriers that deter a potential competitor's entry. According to the theory of contestable markets, this alone is sufficient for competitive pricing of goods, even without a single realized entry into the incumbents' market (Baumol, Panzar, and Willig, 1982). Early evidence from the literature on contestability suggests that airline markets are in principle contestable: "once a carrier has a station at an airport it appears to be relatively easy to start new service into that station" (Bailey and Panzar, 1981, p. 131).

In my analysis, I focus on changes in contestability that increase competitive pressure on incumbent airlines. In order to evaluate the effect of competition, I look at changes in contestability by considering changes in airline-level threat of entry. In deriving measures of competitive pressure at the airline level, I follow the approach of Goolsbee and Syverson (2008), which is based on threat of entry by the budget carrier Southwest Airlines.

The reasons for using threat of entry by Southwest Airlines for this study are threefold. First, the airline industry is characterized by alliances and cooperation between airlines, which makes identifying truly competing firms challenging. In this respect, Southwest is different from other airlines in that it has not been involved in code sharing or interline ticketing on national routes since its incorporation. Therefore, Southwest can be considered a true competitor to other airlines.

Second, Southwest is not a budget airline that wins market shares by offering low ticket prices accompanied by extra costs. Southwest is one of the leading carriers in customer satisfaction, according to the Bureau of Transportation Statistics (BTS). In an effort to ensure cost-efficiency and good on-time performance, Southwest has developed its own boarding procedures to keep turnaround times short. In general, low ticket prices are possible because of lean structures in the company. For instance, to reduce complexity in training and route planning Southwest has kept to the Boeing 737 as the only aircraft type since the airline's inception. Later in my analysis, I make use of this feature when investigating the effects of contestability of product markets on labor markets through human capital specificity.

Third, since the operation of its first flights in Texas in the 1970s, Southwest has continued to expand its route-network all over the country, posing a severe threat to the profitability of legacy carriers' routes. As early as 1990 operating revenues from domestic operations of Southwest corresponded to 12% of those of American Airlines and increased steadily to 95% in 2010. In 2012, 2013 and 2014, Southwest Airlines' operating revenues from domestic operations exceeded those of American Airlines.

4 Empirical approach

4.1 Threat of entry in airline industry and empirical methodology

Market entries decrease incumbents' market power and industry concentration but are costly if entry barriers exist. If such costs are sufficiently small or even zero there is a threat of entry to the incumbents' market. In order to capture competitive pressure, I look at changes in entry costs to potential entrants.

Quantitative evaluation of threat of entry requires a definition of when a market is threatened. I build on the work by Goolsbee and Syverson (2008), who evaluate the anticipation effect by incumbent airlines to the threat of entry by Southwest. In their work, threat of entry is defined at the level of routes, where a route is fully characterized by its two endpoints. A route served by an incumbent airline is said to be threatened if Southwest is active at both endpoints but is not yet serving the route itself. Figure 1 depicts how an incumbent's route A–B (solid line) is threatened (dash-dotted line) once Southwest serves routes (dotted lines) from both endpoints of the incumbent's route, but does not serve route A–B. Whenever Southwest enters a new airport, all routes between this airport and the airports that it already serves are threatened. This places severe stress on incumbents. This has been documented by Goolsbee and Syverson (2008), who find that legacy carriers decrease ticket prices in anticipation of entries by Southwest.

Note that contestability is not limited to product markets but also applies to labor markets. For instance, if there are no or only low entry costs to an oligopsony of labor, observed wages and labor demand should be higher than in a labor market with sufficiently high entry costs. When a potential entrant threatens the product market and entry barriers to labor markets are sufficiently small, labor markets might also be contested, as the potential entrant eventually demands higher quantities from labor markets. Increases in wages in anticipation of a potential entry could in principle have the same entry-deterring effect as decreases in product prices. In this way, product market contestability can lead to labor market contestability.

4.2 Identification strategy

The endogenous nature of entry decisions poses a serious challenge to identification in studies aiming at evaluating the effect of changes in competition. I therefore make use of variation in threat of entry based on Southwest's route network expansion. This expansion has a direct effect through entry to the entered route. In addition, it has an indirect effect by threatening as yet unentered route markets.

The key assumption underlying identification is closely linked to the concept of direct and indirect effects of the extension of Southwest's network. The intention of Southwest to enter a new airport is purportedly to service initially entered route markets. In this case, threat of entry is exogenous to both threatened routes and threatened airlines. Whereas this seems to be a rather restricting assumption at first sight, it becomes clearer when considering a numerical example. As of the end of year 1990 (2000, 2010), Southwest operated flights between 29 (55, 88) distinct city markets. When starting to operate flights between an already captured city market A and a new city market B there is a direct effect of entry on the route market connecting A and B. In addition, there is an indirect effect of threat of entry on 28 (54, 87) additional route markets, i.e., the connections between newly entered city market B and the existing city markets that are not yet connected to B. Given the numbers of route markets that are affected by an expansion of Southwest's network, it seems somewhat unlikely that Southwest's decision to enter a new city market is primarily driven by characteristics of one of the 28 (54, 87) specific route markets.

The measure of threat of entry captures a change in contestability based on endpoint presence. Even after a route market is threatened, entry to it might be easier or more difficult for Southwest for various reasons connected to, e.g., the airlines operating there or slot availability at airports in the market. Here, I build on the result of previous results that full endpoint presence substantially increases the likelihood of an entry and as such increases contestability (Bailey and Panzar, 1981; Parise, 2018).

It is important to account for realized entries as variation in threat of entry may have at least two sources in this setting. First, increases in the number of threatened routes may stem from increased city market presence by Southwest. Second, decreases in the number of threatened routes may stem from realized entries, i.e., an entry into a previously threatened market. Once entry is realized, route markets that used to be threatened are reclassified from threatened to unthreatened. Therefore, it is of crucial importance to account for entered routes: If not, the absence of a threat does not discriminate between two very different circumstances, namely an incumbent's routes being unentered and not threatened, and an incumbent's previously threatened routes being entered.

Figure 2 depicts four stages of entry to underline the importance of accounting for realized entry. As before, the routes served by the incumbent are solid, the routes served by Southwest are dash-dotted, and routes threatened by Southwest are dotted. In stage I, none of the incumbent airlines' routes are affected by Southwest. In stage II, one of the three routes of the incumbent is threatened, because Southwest has entered two routes connected to C and D. In stage III, Southwest also services the connection B–D, resulting in all routes of the incumbent being threatened. In stage IV, Southwest enters all the previously threatened routes resulting in no route being threatened.

In this example, it becomes clear that without considering a measure capturing entry, unthreatened route markets can comprise two very different stages of competition: markets without any presence by Southwest (stage I.) and markets where Southwest is servicing all relevant connections (stage IV.). Not incorporating entry into the analysis should yield lower estimated effects of threat of entry. Therefore, I account for entries to pin down the effect of contestability more precisely.

4.3 Market fragmentation and measurement of competitive pressure

When firms are active in multiple markets, a firm-level quantitative measure must reflect the importance of single market segments in the aggregate measure. In this analysis, route markets are defined as connections between city markets rather than connections between airports. City markets include all the airports that are within a metropolitan area. Corresponding identifiers are assigned by the U.S. Department of Transportation. Using city markets is important in accounting for the business model followed by Southwest and to fully capture competitive pressure on incumbent airlines. For instance, Chicago has multiple airports, the largest of which is Chicago O'Hare International Airport, which is a hub for American Airlines. Southwest, however, uses the older Midway International Airport for all its connections to the Chicago metropolitan area. Using city markets that comprise multiple airports rather than connections between single airports takes into account the close substitutability of connections to different airports within metropolitan areas.

In order to quantify the threat of entry intensity θ_{it} by Southwest, I follow the approach used by Parise (2018).

$$\theta_{it} = \sum_{k} \theta_{ikt} = \sum_{k} \frac{\text{Passengers}_{ikt}}{\text{Passengers}_{it}} \times \text{I(Threatened route)}_{kt} \; . \tag{1}$$

In equation (1) $\text{I(Threatened route)}_{kt}$ is an indicator that takes the value of 1 if both endpoints of route k have been entered by Southwest at or before time t, whereas route k is not serviced by Southwest. This is weighted by the relative importance of this route market to the airline i by considering passenger numbers at route k at time t as a share of total passengers of airline k at t. Summing up the route-airline-time specific measure of threat of entry θ_{ikt} over all routes k returns the aggregate figure θ_{it} at the level of airline i. This measure takes values between zero and one. Economically, it expresses the fraction of passengers transported by an airline that is contestable by

Southwest.

Following the above equation, I also construct a measure capturing realized entries:

$$\gamma_{it} = \sum_k \gamma_{ikt} = \sum_k \frac{\text{Passengers}_{ikt}}{\text{Passengers}_{it}} \times \text{I}(\text{Route entered})_{kt} \ . \tag{2}$$

In an analogous manner to the calculation of threat of entry intensity, equation 2 constitutes the computation of entry intensity γ_{it} of firm i at time t. The indicator takes the value of 1 if Southwest has entered route k at or before time t. Economically, γ_{it} expresses the fraction of passengers transported by an airline in a period on a market that was entered by Southwest. Controlling for entry is important in this analysis to distinguish between unentered or unthreatened markets and contested markets.

Compared to other studies that use threat of entry in the US airline industry to capture product market competition, my main outcome variable labor leverage is also related to labor markets. Endpoint presence of an airline—which is the pre-condition for a route to be threatened—also implies labor market presence. The weighting factor in equation (1) reflects an airline's share of threatened passenger flights. As this threat can only be realized by Southwest using additional staff, θ_{it} also is a proxy for unrealized labor demand aggregated at the firm-level. Hence, the applied measure of contestability also captures unrealized labor demand that carriers on contested routes face. In contrast, the realized labor demand from the decision of Southwest to enter routes is captured by γ_{it}.

4.4 Regression analysis

In the first step of the analysis I investigate the impact of threat of entry by Southwest on the route level. This is important in order to verify the impact of competitive pressure and contestability on prices and quantities in my setting. If flights by Southwest and incumbent airlines are not substitutes, I would not expect to find any effect at this level. The unit of observation is the route market-quarter:

$$\ln(y_{kt}) = \beta_1 \Gamma_{kt} + \beta_2 \Theta_{kt} + \mathbf{1}\boldsymbol{\alpha}_{kt} + \epsilon_{kt} \ . \tag{3}$$

The outcome variables y_{kt} in equation (3) are average ticket prices, numbers of tickets sold, and ticket sales on route k in time t. The variable Γ_{kt} is one if route k was entered by Southwest at or before time t. The indicator variable Θ_{kt} is one if route k is threatened by Southwest at time t. I include route market fixed effects to control for route market characteristics that are time-invariant, such as distance between endpoints. Time fixed effects capture general trends in ticket prices and account for countrywide time-varying effects, such as national (de)regulation and changes in ticket demand resulting from economic conditions. Using log-prices and time fixed effects, coefficient estimates can be interpreted as percentage changes in real terms. Both types of fixed effects are included in the vector α_{kt}.

The main analysis in this paper is of the effect of changes in competition on firm-level outcome variables. The unit of observation is the airline-quarter.

$$\ln(y_{it}) = \beta_1 \gamma_{it} + \beta_2 \theta_{it} + \delta x_{it} + \mathbf{1}\boldsymbol{\alpha}_{it} + \epsilon_{it} \tag{4}$$

The outcome variables y_{it} in equation (4) comprise firm financials, labor shares, and other wage-related quantities of firm i in time t. Main explanatory variables are the aforementioned realized entry intensity γ_{it} and threat of entry intensity θ_{it}. The vector of fixed effects α_{it} is defined at the level of firm i in time t and comprises airline fixed effects and time fixed effects. In order to account for merged entities, I assign merged entities a new firm identifier. In this way, I account for cases in which previously separate entities had different wage policies in place and might have been exposed to different levels of competitive pressure. In addition to this, I control for firm size x_{it}. This is essential when investigating pay-related outcome variables in a highly competitive industry over a long time period, as firm size is seen to be a major determinant of employee pay evolution, in the cross-section, along the time-series dimension, and within-firms (Gabaix and Landier, 2008; Mueller et al., 2017).

4.5 Decomposition of the labor share

The labor share can be decomposed in various ways. Inspired by Baker and Wurgler (2002), I use three different decompositions to deepen the analysis of firm-level effects of competition on the labor share.

The first decomposition is based on the accounting identity defining operating income. Starting from the definition of EBIT, dividing by operating revenues and splitting operating expenses into total labor expenses and non-labor expenses yields

$$\frac{\text{EBIT}}{\text{Revenues}} = 1 - \frac{\text{Labor expenses}}{\text{Revenues}} - \frac{\text{Non-labor expenses}}{\text{Revenues}}\,, \tag{5}$$

where the expression on the left-hand side of the equation is the EBIT margin and the first subtrahend on the right is the labor share. I estimate regressions with each of the three fractions as dependent variables. In this way, the aggregate effect of contestability on EBIT margin can be broken down into its components relating to the labor share and the non-labor expense share. Estimating equation (5) in this way allows inference on how firms' operating profitability is affected by competitive pressure. In addition, we gain insights into how cost structure related to labor expenses translates into financial performance when firms are exposed to greater competition.

Second, I decompose the labor share into its constituting components, i.e., labor expenses and revenues, using the logarithm. Equation (6) is then estimated in the manner described above.

$$\log\left(\frac{\text{Labor expenses}}{\text{Revenues}}\right) = \log\left(\text{Labor expenses}\right) - \log\left(\text{Revenues}\right) \tag{6}$$

This decomposition is interesting for two reasons. First, I can verify whether my baseline results also hold once I account for potential skewness of the labor share distribution by applying the natural logarithm. Second, I can identify which of the two components is the main driver of the baseline result of competitive pressure on the labor share, i.e., whether changes in labor share stem from changes in pay levels or from changes in revenues.

Lastly, I decompose the labor share into labor shares of functional subgroups of employees, using aggregate salary figures.[4] I then estimate equation (7) in the manner described above.

$$\begin{aligned}\frac{\text{Labor expenses}}{\text{Revenues}} = \frac{\text{Ground crew sal.}}{\text{Revenues}} + \frac{\text{Flight crew sal.}}{\text{Revenues}} + \frac{\text{Management sal.}}{\text{Revenues}} \\ + \frac{\text{Others' sal.}}{\text{Revenues}} + \frac{\text{Total benefits}}{\text{Revenues}}\end{aligned} \tag{7}$$

This decomposition addresses potential redistributive effects that a competitive shock might have. If the changes in labor share are driven by decreases in operating revenues, all groups of employees should be affected in a similar fashion. However, different groups might be differentially affected by competition. For instance, Cuñat and Guadalupe (2009) document that import competition increases top management compensation. This can be explained by higher demand for managerial skills in periods when firms are under pressure. At the same time, management could also be disciplined

[4] *Total benefits* cannot be attributed to functional subgroups. I therefore list it as a separate category.

with lower pay resulting in a lower management labor share if managers are not able to maintain the original market position, once Southwest is threatening or expanding into the domain of incumbent firms.[5]

A major distinction between flight crew and ground crew is the different level of mobility. Whereas flight crews are mobile by the definition of their professional activity, ground crews are located at the specific airport from which a carrier operates flights. At the same time, both groups might be affected by a higher demand by Southwest for labor related to the operation of flights into a new station. Both 'others' and 'total benefits' are residual groups that cannot be assigned to one of the aforementioned groups. I keep them in my analysis to make sure to decompose the full effect on labor share that I capture.[6]

5 Data

5.1 Sources

Ticket data are taken from the Airline Origin and Destination Survey (DB1B) provided by BTS. This dataset represents a 10% random sample of all domestic tickets. The observation is on the level of domestic itineraries. Apart from details on market fare, origin and destination, information on the identity of the ticketing carrier and the operating carrier, the number of passengers and the number of coupons is also provided. I calculate fares per passenger by dividing the market fare by the number of passengers.

I obtain airline financial information from BTS's Form 41 Financial Data. Quarterly operating balance sheet data are from Schedule B-1, and quarterly profit and loss statement data are from Schedule P-1.2.

Data on quarterly wages and employment can be found in Form 41 Financial Data. Wage data are contained in Schedule P-6 on operating expenses. Salaries are reported by labor categories. Corresponding numbers of employees in these labor categories can be found in Schedule P-10.[7]

[5]Note that management share of airlines captures not only compensation to executive managers but also compensation to lower levels of management and general administration. Owing to this aggregation, estimated effects on management share must be interpreted in a more general way.

[6]Note that all but the last decomposition are not feasible using value-added as the basis of the calculation of the labor share, as EBIT margin requires revenues in the denominator (Equation (5)) and value-added based on sum of labor expenses and EBITDA can take negative values (Equation (6)). The decomposition of the value-added labor share based on different groups of employees is part of the appendix.

[7]The procedure applied to attain average wages by group is the one described by Benmelech et al. (2012).

Data on connections between airports come from the T-100 Domestic Market Database, which is part of Form 41 Traffic data. The observation is at the level of airline-itinerary-quarter, where itineraries are characterized by their two endpoint airports. I retrieve information on number of transported passengers, transported freight and mail, capacity, scheduled departures, and departures performed.

5.2 Sample selection and descriptive statistics

For the route-level analysis, I remove observations with more than five passengers per ticket and observations that are indicated as bulk fares to omit potential group discounts. In line with Snider and Williams (2015), I then exclude interline tickets and tickets that have more than three coupons. Observations for which fees per passenger are less than \$25 or more than \$2,500 in 2008 dollars are also removed from the sample. This is done to omit key punch errors or redemption of frequent flier bonus programs. For the regression analysis, I calculate average per passenger fares on the level of route markets whenever there are at least 100 passenger observations available. Calculations of average ticket prices in my sample are based on 192,205,136 market fare-passenger observations from the DB1B database.

The sample for the airline-level analysis comprises airlines that have quarterly coverage of their financials data through the BTS, i.e., carriers with an annual operating revenue of at least \$20 million. I exclude airlines that are mainly active in the cargo business or that operate as charter airlines. I further limit the analysis to the years 2001 to 2017, i.e., after the AIR-21 regulation was signed into law (Snider and Williams, 2015). The aim of this regulation was to enhance competition in the U.S. airline industry. Thus, I only consider observations from the new regime.[8] In order to account for outliers, I exclude the observations for which the labor share is above or below the 2nd percentile or the 98th percentile, respectively. The final sample for the airline analysis consists of 1,433 airline-quarter observations that refer to 40 distinct airlines.

Descriptive statistics are reported in Table 1. About one thrid (28%) of the route-market observations in my sample are threatened, whereas 61% have experienced entry by Southwest. At the level of airlines, 33% of passenger-weighted routes are threatened, whereas 51% of passenger-weighted routes are entered by Southwest during the sample

[8] The regulation was effective at the level of airports rather then at the level of route-markets. This means it is not feasible to exploit this regulatory shock for my identification. See Table A.4 of the appendix for estimation results where I include pre-2001 data. Whereas results are generally robust, effects are less pronounced than in the baseline analysis in Table 3.

period. These numbers illustrate the significant impact that Southwest's expansion has had on the airline industry.

The average labor share based on revenues is 31%, whereas the average labor share based on value-added is at 85%. Flight crews' salaries make up for the largest fraction of total labor expenses (30%), followed by those for ground crew (25%), others (14%), and management (2%). As total benefits—which make up 30% of labor expenses—cannot be attributed to distinct groups, they are separately reported.

6 Results

6.1 How does competitive pressure affect prices, quantities, and sales?

In the route-level analysis, I investigate the impact of threat of entry by Southwest on the level of route markets. Table 2 reports coefficient estimates from Equation (3) to verify the impact of contestability on prices and quantities.

The sample in columns 1 to 3 contains all covered carriers within a route market. Once Southwest has entered a market, average ticket prices drop by 9.3% whereas the number of tickets sold increases by 11.1%. This is in line with the general view that more competition leads to more goods sold at lower prices. Note that this includes the tickets sold by Southwest. Thus, the results from columns 1 to 3 do incorporate but are not limited to the effect on incumbents. It could be that decreases in average ticket prices and increases in quantities are driven by the additional supply of tickets that is observed because of the entrance of Southwest.

Columns 4 to 6 refer to analyses based on the incumbents' ticket sales only, i.e., all airlines but Southwest's tickets are used to calculate route market data. Results suggest that incumbents' ticket prices drop by 7.9% whereas quantities increase by 4.4%. These results are in line with the findings of Parise (2018), who documents a drop in ticket prices once budget carriers enter a route. Whereas part of the effects observed in columns 1 and 2 might be driven by the additional supply of low-price tickets by Southwest, results in columns 4 and 5 indicate that incumbent airlines do react to an entry of Southwest with changes in prices and quantities. The result in column 6 on total sales implies that incumbents' ticket sales decrease once Southwest enters, whereas the total market size is unaffected (column 3). This evidence is supportive of the assumption of substitutability of flights operated by budget airlines and flights operated by legacy carriers.

Columns 6 to 9 refer to analyses in which I consider changes in contestability by incorporating threat of entry. This setting can be directly related to the firm-level analysis where both entry and threat of entry are incorporated in the estimation. In line with the results of Goolsbee and Syverson (2008), I find that endpoint presence of Southwest has an impact on ticket prices of incumbents in anticipation of entry. The point estimate of -2.2% suggests a lower average effect on prices than the one in the aforementioned paper. One reason for this might be that my investigation is not conditional on eventual entry within a certain time period. The negative effect on ticket sales of -5.1% is also meaningful. Relating this to the point estimate of the sales reaction on eventual entry in the same specification—which is -8.4%—anticipation affects total sales in an economically significant way. Firm size—which is often proxied by total sales—is an important determinant of both employee pay and within firm pay inequality. For instance, larger firms benefit more from highly talented labor because of economies of scale (Gabaix and Landier, 2008; Mueller et al., 2017). At the same time, aggregated sales enters labor share in the denominator. In the subsequent firm-level analysis, I examine the impact of contestability on firm level pay-related outcomes.

6.2 How does competitive pressure affect labor leverage?

Table 3 depicts results on the effect of competition on the labor share. Estimations relate to the specification of equation (4). Column 1 relates to a model where I do not control for entry, similar to the baseline specification by Parise (2018). Threat of entry has a positive impact on labor share. Once I control for entry, the magnitude of the coefficient estimate of threat of entry further increases. This is consistent with the prediction on the importance of incorporating *entry* in the estimation.[9] In order to ensure that threat of entry captures higher levels of contestability precisely, I thus include both entry and threat of entry in all other estimations.

In all specifications, threat of entry maintains its positive effect on labor share, i.e., higher levels of contestability lead to higher labor shares. From column 3 onward, I introduce separate identifiers for merged entities and unmerged entities to account for changes in labor shares resulting from mergers or acquisitions. I use this specification as the baseline for the regression analyses of the decomposition of the labor share in Section 6.3 and 6.4. The incorporation of fixed effects that account for mergers has only minor effects on point estimates. The coefficient estimate for threat of entry

[9] In Section 4.2 I argue that the coefficient estimate underestimates the true effect as the counterfactual to threat-of-entry incorporates both zero exposure to competition and full exposure, i.e., entry.

is quite sizable at 28.5%. In other words, an increase from the 25th percentile to the 75th percentile relates to an increase in the labor share of 8.5 percentage points ($(0.445 - 0.148) \times 28.5\%$). Firm size generally correlates negatively with labor share, in line with Autor et al. (2017), who argue that large (superstar) firms have smaller labor shares. My results are robust to the exclusion of firm size as a control variable (column 4).

Column 5 shows results of a regression in which management pay is excluded from the calculation of labor share, to ensure that peculiarities of management pay (such as high fractions of variable pay) are not driving my results. I exclude total related fringe benefits when calculating labor shares in column 6. Whereas results are more sensitive to the exclusion of benefits, they generally hold and do not lose their economic significance. Even under the most conservative approach, an increase from the 25th to the 75th percentile relates to an increase in the labor share of 5.6 percentage points ($(0.445 - 0.148) \times 18.8\%$).

Table A.2 of the appendix reports estimation results similar to those described above but uses value-added as the denominator in the calculation of labor shares. The results reveal the same patterns: The incorporation of entry intensity into the estimation strengthens the identification of the effect of threat of entry on labor shares, labor shares are positively related to higher values of contestability across specifications, and firm size is negatively related to labor shares.

6.3 Do labor rigidities explain the decrease in firms' financial performance?

In this section, I look at various decompositions of the labor share, building on accounting identities from the profit and loss statement.

Table 4 reports estimation results from the decomposition of the EBIT margin. Results suggest that threat of entry has a negative impact on operating profitability. The negative effect on EBIT margin can be explained by the increase in labor share. More specifically, more than 80% of the decrease in EBIT margin is related to the increase in labor leverage ($81.89\% = 0.285 \times | - 0.348|^{-1}$). The impact of threat of entry on non-labor expense share is statistically insignificant at conventional levels and economically small. An increase from the 25th percentile to the 75th percentile of threat of entry corresponds to an increase in the non-labor expense share of only 1.9 percentage points ($(0.445 - 0.148) \times 6.3\%$). This is about one fifth of the estimated increase of the labor share in the same scenario which is 8.5 percentage points.

These findings support the idea that labor expenses are closer to the notion of fixed cost to firms than non-labor expenses and that labor rigidities are responsible for decreasing operating performance. The insignificant and economically small estimates for non-labor expenses indicate that airlines can easily adjust these expenses in times of higher competitive pressure.

Table 5 reports estimation results from the decomposition of the logarithm of labor share into its components. Whereas the point estimate on the logarithm of labor expenses is positive, it remains statistically insignificant at conventional levels. This suggests that the effect might be driven primarily by changes in revenues, caused by contestability in product markets. This evidence is consistent with the route-level results in Table 2.

6.4 Are all groups of employees equally affected by competitive pressure?

If the rise in labor shares as a response to increased contestability is driven by changes in revenues as Table 5 suggests, all groups of employees should be affected in the same manner. Table 6 tests this conjecture by considering the decomposition of the labor share into labor shares by distinct employee groups.

The impact of contestability on ground crews' labor share is economically small with a point estimate of 5 percentage points, but statistically significant at the 5% level. The impact on the flight crew is almost three times that on the ground crew. The statistically significant point estimate of 14.3 percentage points is economically sizable. Relating the point estimate to the average flight crew share and considering an increase from the 25th to the 75th percentile of threat of entry implies a rise in the flight crew's labor share of almost a fifth ($18.9\% = (0.445 - 0.148) \times 14.3\%/0.108$). Whereas there is a sizable difference between ground crew and flight crew in Table 6, both participate in increases in labor share owing to contestability. In contrast, there is no evidence that the management share rises. The point estimate is economically small and statistically insignificant at conventional levels. Whereas payments from bonuses and profit sharing are reflected in the management share, stock options are part of the benefit share which is indeed increasing. However, the considerable increase in the benefit share is most likely linked to changes in incidental wage costs. The relative changes in benefits share associated with contestability is almost proportional to the relative changes observed in the labor shares of flight crew and ground crew as a result of to contestability.

One reason for the difference in economic magnitude of effects of contestability among the ground crew and flight crew could be the greater mobility of the latter group of employees. Flight crews might therefore be particularly targeted by Southwest on the labor market. Then, increases in the labor share of the flight crew might not only reflect product market contestability through changes in revenues, but also contestability of labor markets through higher competitive wages. In Table 7, I use the share of aircrafts of the Boeing 737 family in the fleet of an airline to capture human capital specificity. More specifically, *Human capital specificity* is an indicator that takes the value of 1 if an airline has a Boeing 737 share in its fleet above the median of all carriers in my sample.[10] As Southwest only uses aircrafts of the Boeing 737 family, this measure indicates how attractive a competitor's crew is to Southwest in the labor market.

Results in columns 1 and 2 of Table 7 indicate that human capital specificity does not amplify results for ground crews' labor shares. In contrast to this, columns 3 and 4 confirm that flight crews' labor shares with human capital more suitable to Southwest react more strongly to competitive pressure. Reasons might be both greater mobility and greater relevance of aircraft-specific training for the latter group. This evidence supports the idea that increased competition in the product market can affect labor markets. Thus, changes in labor shares through competitive pressure can also be the result of labor market contestability.

Not surprisingly, human capital specificity does not amplify effects of the group of management employees in columns 5 and 6 of Table 7. Even if administrative employees are dealing with logistics relating to aircraft types, their human capital will be far less linked to a specific aircraft type than members of flight crews. Also, the mobility of this employee group, inherent in their task, is lower than for flight crews.

Table A.3 in the appendix reports results of the decomposition by employee groups based on value-added in the calculation of labor shares. These results generally confirm the findings in Table 5.

7 Conclusion

I investigate the nexus between changes in the competitive environment, firm-level labor shares, and firm profitability. First, I document that increased competition has an impact on incumbent firms. The reduction of firm profitability caused by

[10] The median of Boeing 737 share is 0 in my sample, as displayed in Table 1. In unreported tests I use the top quartile as a robustness check which refers to a Boeing 737 share of at least 17.7%. Results are robust to this alteration.

competitive pressure is largely related to increases in labor shares, owing to labor rigidities. Whereas an increasingly challenging environment demands more flexibility from firms, higher shares of fixed labor costs, i.e., higher labor leverage, exacerbate the severity of a competitive shock.

Second, the decrease in EBIT margin, which is tightly linked to the increase in labor leverage, limits firms' ability to finance business with retained earnings. This corroborates with previous evidence that a rise in labor leverage changes investors' perception of firms and can ultimately tighten financing conditions. Tighter financial constraints imply less financing or at least financing at a higher cost. In particular, when funding is sorely needed to respond to fierce competition, financial constraints can result in a doom loop. The absence of necessary investments induces further losses in market share, resulting in even higher labor leverage, yielding even tighter financial constraints, and so on.

Third, the decomposition of the effect of competition on the labor share reveals that employee groups are differentially affected by competitive pressure. On the one hand-side, managerial pay does not react to increased competitive pressure. One explanation might be performance-based compensation for management staff. On the other hand, employees of the potentially most mobile labor group—flight crews—benefit from increased competitive pressure. This evidence is supporting a narrative that more competition can amplify pay inequality within firms and within industries.

Lastly, I find evidence in support of the narrative that labor markets become contested once entry to product markets is significantly facilitated. This poses challenges for incumbent firms at two different stages of entry. In anticipation of potential entries, increased wages depress profit margins. Once entry occurs, competitors might poach staff, which further complicates incumbents' businesses. In times of severe competitive stress particularly, firms might require highly skilled human capital to maintain quality standards.

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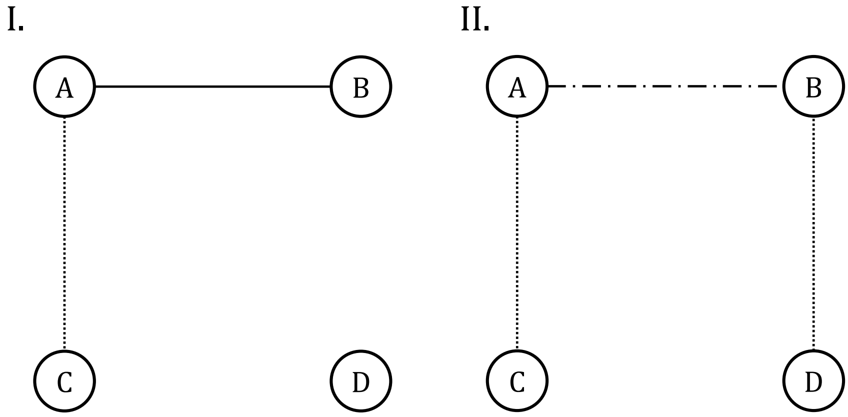

Figure 1: Example of a threatened route
Solid lines indicate the incumbent's connections between route markets, dotted lines indicate routes serviced by Southwest airlines, and dashed lines indicate routes by the incumbent that are threatened by Southwest. In stage I, the connection between route markets A and B of a legacy carrier is not threatened, as Southwest only operates flights from A but not from B. In stage II, the connection between route markets A and B of a legacy carrier (solid line between A–B) is said to be threatened (dash-dotted line between A–B), as Southwest has connections to both endpoints (dotted lines between A–C and B–D).

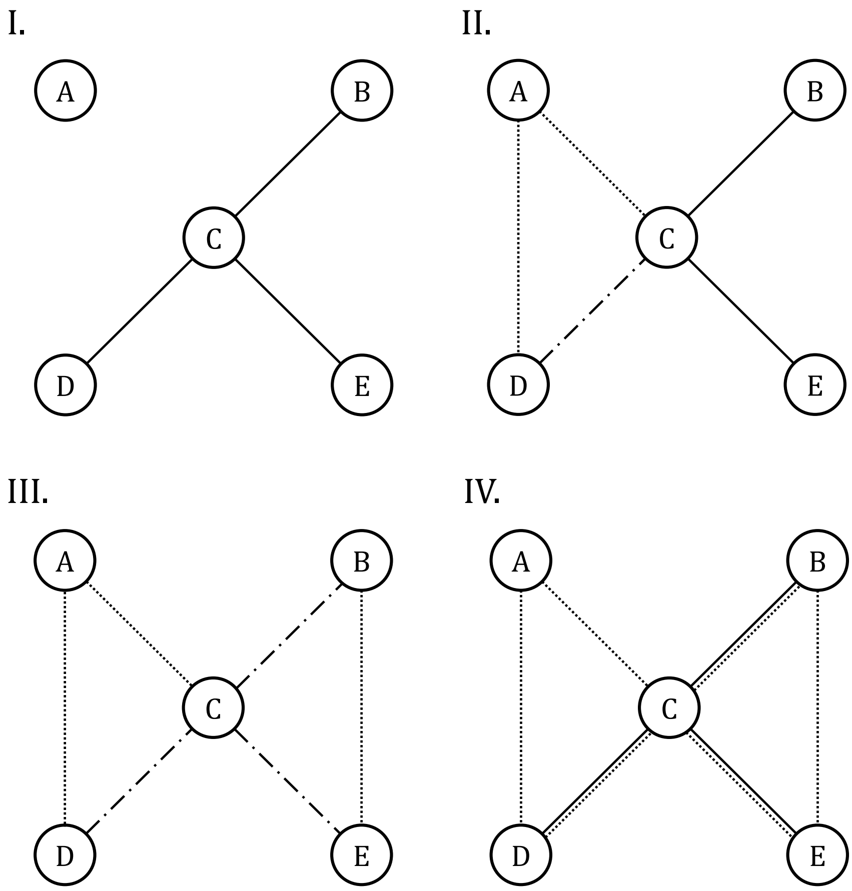

Figure 2: Example of the importance of considering realized entry
Solid lines indicate the incumbent's connections between route markets, dotted lines indicate routes serviced by Southwest airlines, and dash-dotted lines indicate routes by the incumbent that are threatened by Southwest. In stage I, the legacy carrier operates three routes. Southwest does not operate any routes and thus does not threaten routes of the legacy carrier. In stage II, Southwest has started to operate connections from C and D but not the connection C–D. Thus, C–D is threatened. In stage III, Southwest also serves connections from B and E such that all three routes by the incumbent are threatened. However, no route of the incumbent has been entered. In stage IV, Southwest enters all previously threatened routes. The legacy carrier is exposed to no threat of entry but all the routes it serves are now challenged through realized entries.

Table 1: Summary statistics
This table shows summary statistics for route-markets and airline characteristics of my sample. Refer to Appendix Table A.1 for variable definitions.

	N	Average	S.E.	p25	Median	p75
Route level analysis:						
Entry indicator	118,295	0.612	0.487	0.000	1.000	1.000
Threat of entry indicator	118,295	0.281	0.449	0.000	0.000	1.000
Average ticket price (USD)	118,295	196.269	71.100	148.198	185.395	231.748
Number of passengers	118,295	1,624.795	2,918.916	264.000	629.000	1,743.000
Ticket sales (USD)	118,295	296,697.379	566,392.604	51,586.195	117,038.203	308,759.781
Airline characteristics:						
Total assets (mln. USD)	1,433	6,607.660	11,848.075	248.112	931.125	5,249.399
Revenues (mln. USD)	1,433	936.547	1,509.724	102.172	197.344	1,151.640
Expenses (mln. USD)	1,433	914.684	1,425.506	101.579	188.951	991.297
EBIT (mln. USD)	1,433	21.862	221.307	-8.417	3.416	26.581
Entry intensity	1,433	0.512	0.290	0.238	0.556	0.755
Threat of entry intensity	1,433	0.325	0.219	0.148	0.300	0.445
Share of Boeing 737 aircrafts	1,389	0.168	0.309	0.000	0.000	0.177
Pay-related variables:						
Labor share (based on revenues)	1,433	0.311	0.107	0.229	0.285	0.371
Labor share (based on value-added)	1,433	0.845	0.482	0.630	0.799	1.016
Total labor expenses (mln. USD)	1,433	259.228	403.587	32.676	59.790	259.212
Management total salaries (mln. USD)	1,433	3.999	5.652	0.614	2.222	4.897
Flight crew total salaries (mln. USD)	1,433	78.889	120.524	10.806	22.255	86.135
Ground crew total salaries (mln. USD)	1,433	65.416	104.182	6.508	15.476	52.171
Others' total salaries (mln. USD)	1,433	32.858	64.188	2.318	4.467	37.263
Total benefits (mln. USD)	1,433	78.066	122.669	9.067	16.993	74.313

Table 2: Ticket prices, ticket quantities, ticket sales and the effect of competition

This table reports estimates from regressions of average ticket prices, average ticket quantities and average ticket sales on measures of competition by Southwest Airlines in the US airline industry between 2001 and 2017. The data frequency is quarterly. A route market describes connections between two city markets as defined by the bureau of transportation statistics (BTS). The dependent variable in columns 1, 4, and 7 is the log of ticket prices ($\log(p)$), in columns 2, 5, and 8 the dependent variable is the log of quantities of tickets sold, and in columns 3, 6, and 9 the dependent variable is the log of ticket sales ($\log(p \times q)$). Ticket prices and quantities are taken from the BTS Airline Origin and Destination Survey (DB1B). The DB1B database is a 10% sample of all tickets. The independent variables are *Threat of entry*, which is a dummy variable that is equal to one if Southwest Airlines is present at an airport in both the origin city market and the destination city market but has not yet serviced flights between the city markets, i.e. in the route market, and *Entry*, which is a dummy variable equal to one if Southwest Airlines has entered the route market in this or a previous quarter. Columns 1 to 3 report results on the influence of competition on the total route market. Here, dependent variables are calculated based on all tickets sold in a route market. Columns 4 to 9 report results on the influence of competition and the threat of entry on incumbents only. Here, dependent variables are calculated based only on the tickets sold by non-budget airlines. All columns include route market fixed effects and time fixed effects. Robust standard errors are clustered by route markets and are displayed in brackets below parameter estimates. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

	Complete Route Market			Only Incumbent Airlines (Ex-Southwest)					
Dependent variable:	log(p)	log(q)	log(p × q)	log(p)	log(q)	log(p × q)	log(p)	log(q)	log(p × q)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Threat of entry							-0.022***	-0.029	-0.051**
							(0.007)	(0.021)	(0.021)
Entry	-0.093***	0.111***	0.018	-0.079***	0.044***	-0.035***	-0.100***	0.016	-0.084***
	(0.004)	(0.012)	(0.012)	(0.004)	(0.012)	(0.013)	(0.008)	(0.023)	(0.023)
Time FE	X	X	X	X	X	X	X	X	X
Route market FE	X	X	X	X	X	X	X	X	X
Mean(y)	5.219	6.575	11.795	5.245	6.363	11.609	5.245	6.363	11.609
S.D.(y)	0.347	1.225	1.209	0.345	1.174	1.182	0.345	1.174	1.182
R^2	0.703	0.537	0.528	0.707	0.511	0.503	0.707	0.511	0.503
N	118,295	118,295	118,295	118,295	118,295	118,295	118,295	118,295	118,295

Table 3: Labor shares and the effect of competition

This table reports estimates from regressions of labor shares on measures of competition by Southwest Airlines in the US airline industry between 2001 and 2017. The data frequency is quarterly. The dependent variable in columns 1 to 4 is the labor share calculated as total labor expenses over total revenues, in column 5 the dependent variable is the labor share calculated as total labor expenses excluding salaries to management over total revenues, and in column 6 the dependent variable is the labor share calculated as total labor expenses excluding benefits over total revenues. The independent variables are *Threat of entry*, which is the relative importance of a route to an airline measured by the share of passengers on this route relative to all passengers of this airline times an indicator for threat of entry and summed up on the airline-level, *Challenge*, which is the relative importance of a route to an airline measured by the share of passengers on this route relative to all passengers of this airline times an indicator for threat of entry and summed up on the airline-level, and *Firm size*, which is the log of total assets of each airline. All columns include airline fixed effects and time fixed effects. I account for mergers in fixed effects by distinguishing pre- and post-merger entities. Robust standard errors are clustered at the level of airlines and displayed in brackets below parameter estimates. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

Dependent variable:	Labor share				Labor share, w/o management	Labor share, w/o benefits
	(1)	(2)	(3)	(4)	(5)	(6)
Threat of entry	0.106*	0.351***	0.285***	0.273***	0.235***	0.188***
	(0.061)	(0.096)	(0.082)	(0.082)	(0.087)	(0.060)
Entry		0.300**	0.256**	0.228*	0.215*	0.164**
		(0.118)	(0.108)	(0.119)	(0.108)	(0.076)
Firm size	-0.072***	-0.072***	-0.067***		-0.063***	-0.047***
	(0.013)	(0.013)	(0.014)		(0.013)	(0.010)
Time FE	X	X	X	X	X	X
Airline FE	X	X	X	X	X	X
Accounting for mergers			X	X	X	X
Mean(y)	0.311	0.311	0.311	0.311	0.299	0.222
S.D.(y)	0.107	0.107	0.107	0.107	0.103	0.076
R^2	0.631	0.656	0.682	0.606	0.667	0.671
N	1,433	1,433	1,433	1,433	1,433	1,433

Table 4: Decomposition of the effect of competition on labor share based on operating profit and loss
This table reports estimates from regressions of EBIT margin, labor share and non-labur expense share on measures of competition by Southwest Airlines in the US airline industry between 2001 and 2017. The data frequency is quarterly. The dependent variables in this table are chosen based on the following decomposition of the of labor share:

$$\underbrace{\frac{\text{EBIT}}{\text{Revenues}}}_{\text{EBIT margin}} = 1 - \underbrace{\frac{\text{Labor expenses}}{\text{Revenues}}}_{\text{Labor share}} - \underbrace{\frac{\text{Non-labor expenses}}{\text{Revenues}}}_{\text{Non-labor expense share}}$$

Note that the constant on the right-hand side of the equation is omitted due to the incorporation of fixed effects. The dependent variable in column 1 is the EBIT margin calculated as EBIT over total revenues, in column 2 the dependent variable is the labor share calculated as total labor expenses over total revenues and in column 3 the dependent variable is non-labor expense share calculated as total non-labor expenses over total revenues. The independent variables are *Threat of entry*, which is the relative importance of a route to an airline measured by the share of passengers on this route relative to all passengers of this airline times an indicator for threat of entry and summed up on the airline-level, *Challenge*, which is the relative importance of a route to an airline measured by the share of passengers on this route relative to all passengers of this airline times an indicator for threat of entry and summed up on the airline-level, and *Firm size*, which is the log of total assets fo each airline. All columns include airline fixed effects and time fixed effects. I account for mergers in fixed effects by distinguishing pre- and post-merger entities. Robust standard errors are clustered at the level of airlines and displayed in brackets below parameter estimates. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

Dependent variable:	EBIT margin	Labor share	Non-labor expense share
	(1)	(2)	(3)
Threat of entry	-0.348**	0.285***	0.063
	(0.155)	(0.082)	(0.156)
Entry	-0.311*	0.256**	0.055
	(0.158)	(0.108)	(0.140)
Firm size	0.077***	-0.067***	-0.011
	(0.020)	(0.014)	(0.026)
Time FE	X	X	X
Airline FE	X	X	X
Accounting for mergers	X	X	X
Mean(y)	0.004	0.311	0.685
S.D.(y)	0.165	0.107	0.168
R^2	0.509	0.682	0.580
N	1,433	1,433	1,433

Table 5: Decomposition of the effect of competition on labor share based on the logarithm
This table reports estimates from regressions of labor shares, labor expenses and revenues on measures of competition by Southwest Airlines in the US airline industry between 2001 and 2017. The dependent variables in this table are chosen based on the following decomposition of the log of labor share:

$$\log\left(\frac{\text{Labor expenses}}{\text{Revenues}}\right) = \log\left(\text{Labor expenses}\right) - \log\left(\text{Revenues}\right)$$

The data frequency is quarterly. The dependent variable in column 1 is the log of labor share calculated as total wages over total revenues, in column 2 the dependent variable is the log of labor expenses and in column 3 the dependent variable is the log of revenues. The independent variables are *Threat of entry*, which is the relative importance of a route to an airline measured by the share of passengers on this route relative to all passengers of this airline times an indicator for threat of entry and summed up on the airline-level, *Challenge*, which is the relative importance of a route to an airline measured by the share of passengers on this route relative to all passengers of this airline times an indicator for threat of entry and summed up on the airline-level, and *Firm size*, which is the log of total assets of each airline. All columns include airline fixed effects and time fixed effects. I account for mergers in fixed effects by distinguishing pre- and post-merger entities. Robust standard errors are clustered at the level of airlines and displayed in brackets below parameter estimates. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

Dependent variable:	log(Labor share)	log(Labor expenses)	log(Revenues)
	(1)	(2)	(3)
Threat of entry	0.949***	0.096	-0.853**
	(0.225)	(0.344)	(0.321)
Entry	0.908***	0.215	-0.693
	(0.298)	(0.368)	(0.424)
Firm size	-0.193***	0.223***	0.415***
	(0.038)	(0.077)	(0.066)
Time FE	X	X	X
Airline FE	X	X	X
Accounting for mergers	X	X	X
Mean(y)	0.311	0.004	0.685
S.D.(y)	0.107	0.165	0.168
R^2	0.682	0.509	0.580
N	1,433	1,433	1,433

Table 6: Decomposition of the effect of competition on the labor share with respect to different groups of employees

This table reports estimates from regressions of labor share and labor share by subgroups of labor on measures of competition by Southwest Airlines in the US airline industry between 2001 and 2017. The data frequency is quarterly. The dependent variables in this table are chosen based on the following decomposition of the of labor share:

$$\frac{\text{Labor expenses}}{\text{Revenues}} = \frac{\text{Ground crew salaries}}{\text{Revenues}} + \frac{\text{Flight crew salaries}}{\text{Revenues}} + \frac{\text{Management salaries}}{\text{Revenues}} + \frac{\text{Others' salaries}}{\text{Revenues}} + \frac{\text{Total benefits}}{\text{Revenues}}$$

The dependent variable in column 1 is the labor share calculated as total labor expenses over total revenues and in column 2 to column 5 the dependent variable is total salaries over total revenues for each of the listed groups of employees. The dependent variable in column 6 is the benefit share calculated as total benefits over total revenues. The independent variables are *Threat of entry*, which is the relative importance of a route to an airline measured by the share of passengers on this route relative to all passengers of this airline times an indicator for threat of entry and summed up on the airline-level, *Challenge*, which is the relative importance of a route to an airline measured by the share of passengers on this route relative to all passengers of this airline times an indicator for threat of entry and summed up on the airline-level, and *Firm size*, which is the log of total assets of each airline. All columns include airline fixed effects and time fixed effects. I account for mergers in fixed effects by distinguishing pre- and post-merger entities. Robust standard errors are clustered at the level of airlines and displayed in brackets below parameter estimates. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

Dependent variable:	Labor share	Ground crew share	Flight crew share	Management share	Others' share	Benefit share
	(1)	(2)	(3)	(4)	(5)	(6)
Threat of entry	0.285***	0.050*	0.143***	0.027	-0.004	0.069***
	(0.082)	(0.028)	(0.039)	(0.018)	(0.014)	(0.025)
Entry	0.256**	0.001	0.173***	0.021	-0.005	0.066**
	(0.108)	(0.035)	(0.050)	(0.018)	(0.014)	(0.032)
Firm size	-0.067***	-0.018**	-0.020***	-0.006***	-0.003*	-0.019***
	(0.014)	(0.008)	(0.005)	(0.001)	(0.002)	(0.005)
Time FE	X	X	X	X	X	X
Airline FE	X	X	X	X	X	X
Accounting for mergers	X	X	X	X	X	X
Mean(y)	0.311	0.073	0.108	0.012	0.029	0.089
S.D.(y)	0.107	0.040	0.050	0.016	0.018	0.037
R^2	0.682	0.778	0.755	0.738	0.659	0.678
N	1,433	1,433	1,433	1,433	1,433	1,433

Table 7: The effect of competition on the labor share with respect to different groups of employees considering human capital specificity

This table reports estimates from regressions of labor share and labor share by subgroups of labor on measures of competition by Southwest Airlines in the US airline industry between 2001 and 2017. The data frequency is quarterly. The dependent variable in column 1 to column 6 is total salaries over total revenues for each of the groups of employees. The independent variables are *Threat of entry*, which is the relative importance of a route to an airline measured by the share of passengers on this route relative to all passengers of this airline times an indicator for threat of entry and summed up on the airline-level, interaction of *Threat of entry* and a *Human capital specificity* which is a dummy variable that takes the value of 1 if an airline has a Boeing 737 share in its inventory larger than the median airline of my sample in a year. As control variables I use *Challenge*, which is the relative importance of a route to an airline measured by the share of passengers on this route relative to all passengers of this airline times an indicator for threat of entry and summed up on the airline-level, and *Firm size*, which is the log of total assets of each airline. Uneven columns use actual inventory rates in the calculation of *Human capital specificity* which limits the analysis to the year 2006 to 2017. In even columns, *Human capital specificity* is based on actual inventory rates from 2006 onwards. In years prior to 2006, I use the 2006 inventory rate. All columns include airline fixed effects and time fixed effects. I account for mergers in fixed effects by distinguishing pre- and post-merger entities. For brevity, only the interaction term is reported in the table. Robust standard errors are clustered at the level of airlines and displayed in brackets below parameter estimates. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

Dependent variable:	Ground crew share		Flight crew share		Management share	
	(1)	(2)	(3)	(4)	(5)	(6)
Threat of entry × Hum. cap. spec.	-0.032	-0.024	0.112**	0.137**	-0.006	0.004
	(0.023)	(0.020)	(0.053)	(0.051)	(0.011)	(0.009)
Entry and size controls	X	X	X	X	X	X
Time FE	X	X	X	X	X	X
Airline FE	X	X	X	X	X	X
Accounting for mergers	X	X	X	X	X	X
Full sample	X		X		X	
Post-2006 only		X		X		X
Mean(y)	0.073	0.064	0.108	0.110	0.012	0.011
S.D.(y)	0.040	0.038	0.050	0.056	0.016	0.014
R^2	0.788	0.845	0.778	0.876	0.753	0.782
N	1,389	991	1,389	991	1,389	991

Appendix for

"Competition, Cost Structure, and Labor Leverage: Evidence from the U.S. Airline Industry"

Table A.1: Definition of variables

Unless otherwise stated, all data are provided by the US Department of Transportation through the Bureau of Transportation Statistics (https://www.bts.gov/).

Variable	Databases	Definition
Route-level		
Average ticket price ($\log(p)$)	Airline Origin and Destination Survey (DB1B)	(Logarithm of) Average price of a route market's tickets in USD
Entry	T-100 Domestic Market Database	Indicator that is equal to one if route market is entered by Southwest and zero otherwise
Number of passengers ($\log(q)$)	Airline Origin and Destination Survey (DB1B)	(Logarithm of) Number of passengers of a route market
Threat of entry	T-100 Domestic Market Database	Indicator that is equal to one if route market is threatened by Southwest and zero otherwise
Ticket sales ($\log(p \times q)$)	Airline Origin and Destination Survey (DB1B)	(Logarithm of) Average price of a route market's tickets times number of passengers of a route market
Airline-level		
Benefit share	Form 41, P-1.2 and P-6	Total related fringe benefits over total revenues (Total related fringe benefits over sum of total labor expenses and EBITDA, when based on value-added)
EBIT	Form 41, P-1.2	Operating profit or loss
EBIT margin	Form 41, P-1.2	EBIT over operating revenues
EBITDA	Form 41, P-1.2	EBIT plus depreciation and amortization
Entry	T-100 Domestic Market Database	Intensity of entry as defined in formula 2
Expenses	Form 41, P-1.2	Operating expenses
Firm size	Form 41, B-1	Log of total assets
Flight crew labor share	Form 41, P-1.2, P 5.2, and P-6	Sum of salaries of pilots and co-pilots, flight attendants, and other flight personnel over total revenues (Sum of salaries of pilots and co-pilots, flight attendants, and other flight personnel over sum of total labor expenses and EBITDA, when based on value-added)
Flight crew salaries	Form 41, P 5.2, and P-6	Sum of salaries of pilots and co-pilots, flight attendants, and other flight personnel
Ground crew labor share	Form 41, P-1.2 and P-6	Sum of salaries of maintenance labor and aircraft and traffic handling personnel over total revenues (Sum of salaries of maintenance labor and aircraft and traffic handling personnel over sum of total labor expenses and EBITDA, when based on value-added)
Ground crew salaries	Form 41, P-6	Sum of salaries of maintenance labor and aircraft and traffic handling personnel
Human capital specificity	Form 41, B-43	Indicator that takes the value of 1 if Share of Boeing 737 aircrafts of an airline is above the median
labor expenses	Form 41, P-6	Sum of total salaries and total related fringe benefits
Labor share	Form 41, P-1.2 and P-6	Total labor expenses over total revenues (Total labor expenses over sum of total labor expenses and EBITDA, when based on value-added)

(Continued)

Table A.1: – *Continued*

Labor share w/o management	Form 41, P-1.2 and P-6	Total labor expenses excluding management salaries over total revenues (Total labor expenses excluding management salaries over sum of total labor expenses and EBITDA, when based on value-added)
Management labor share	Form 41, P-1.2 and P-6	Management salaries over total revenues (Management salaries over sum of total labor expenses and EBITDA, when based on value-added)
Management salaries	Form 41, P-6	Sum of management salaries
Non-labor expense share	Form 41, P-1.2	Operating expenses minus total labor expenses
Revenues	Form 41, P-1.2	Operating revenues
Threat of entry	T-100 Domestic Market Database	Intensity of threat of entry as defined in formula 1
Others' salaries	Form 41, P-6	Sum of salaries of other personnel and trainees
Others' share	Form 41, P-1.2 and P-6	Sum of salaries of other personnel and trainees over total revenues (Sum of salaries of other personnel and trainees over sum of total labor expenses and EBITDA, when based on value-added)
Share of Boeing 737 aircrafts	Form 41, B-43	Share of aircrafts of the Boeing 737 family of a carrier's fleet in a given year
Value-added	Form 41, P-1.2	Sum of labor expenses and EBITDA

Table A.2: Labor shares based on value-added and the effect of competition
This table reports estimates from regressions of labor shares on measures of competition by Southwest Airlines in the US airline industry between 2001 and 2017. The data frequency is quarterly. The dependent variable in columns 1 to 3 is the labor share calculated as total labor expenses over value-added, in column 4 the dependent variable is the labor share calculated as total labor expenses excluding salaries to management over value-added, and in column 5 the dependent variable is the labor share calculated as total labor expenses excluding benefits over value-added. Value-added is calculated as the sum of total labor expenses and EBITDA. The independent variables are *Threat of entry*, which is the relative importance of a route to an airline measured by the share of passengers on this route relative to all passengers of this airline times an indicator for threat of entry and summed up on the airline-level, *Challenge*, which is the relative importance of a route to an airline measured by the share of passengers on this route relative to all passengers of this airline times an indicator for threat of entry and summed up on the airline-level, and *Firm size*, which is the log of total assets of each airline. All columns include airline fixed effects and time fixed effects. I account for mergers in fixed effects by distinguishing pre- and post-merger entities. Robust standard errors are clustered at the level of airlines and displayed in brackets below parameter estimates. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

Dependent variable:	Labor share				Labor share, w/o management	Labor share, w/o benefits
	(1)	(2)	(3)	(4)	(5)	(6)
Threat of entry	0.316**	0.671**	0.598**	0.527*	0.535**	0.497**
	(0.148)	(0.257)	(0.266)	(0.299)	(0.253)	(0.197)
Entry		0.428	0.359	0.262	0.319	0.277
		(0.289)	(0.308)	(0.352)	(0.296)	(0.223)
Firm size	-0.140***	-0.141***	-0.132***		-0.121***	-0.086***
	(0.033)	(0.033)	(0.037)		(0.033)	(0.029)
Time FE	X	X	X	X	X	X
Airline FE	X	X	X	X	X	X
Accounting for mergers			X	X	X	X
Mean(y)	0.845	0.845	0.845	0.845	0.812	0.602
S.D.(y)	0.482	0.482	0.482	0.482	0.458	0.361
R^2	0.278	0.281	0.286	0.270	0.305	0.263
N	1,433	1,433	1,433	1,433	1,433	1,433

Table A.3: Decomposition of the effect of competition on the labor share based on value-added with respect to different groups of employees
This table reports estimates from regressions of labor share and labor share by subgroups of labor on measures of competition by Southwest Airlines in the US airline industry between 2001 and 2017. The data frequency is quarterly. he dependent variables in this table are chosen based on the following decomposition of the of labor share:

$$\frac{\text{Labor expenses}}{\text{Value-added}} = \frac{\text{Ground crew salaries}}{\text{Value-added}} + \frac{\text{Flight crew salaries}}{\text{Value-added}} + \frac{\text{Management salaries}}{\text{Value-added}} + \frac{\text{Others' salaries}}{\text{Value-added}} + \frac{\text{Total benefits}}{\text{Value-added}}$$

The dependent variable in column 1 is the labor share calculated as total labor expenses over total value-added and in column 2 to column 5 the dependent variable is total salaries over total value-added for each of the listed subgroups of labor. The dependent variable in column 6 is the benefit share calculated as total benefits over total value-added. Value-added is calculated as the sum of total labor expenses and EBITDA. The independent variables are *Threat of entry*, which is the relative importance of a route to an airline measured by the share of passengers on this route relative to all passengers of this airline times an indicator for threat of entry and summed up on the airline-level, *Challenge*, which is the relative importance of a route to an airline measured by the share of passengers on this route relative to all passengers of this airline times an indicator for threat of entry and summed up on the airline-level, and *Firm size*, which is the log of total assets of each airline. All columns include airline fixed effects and time fixed effects. I account for mergers in fixed effects by distinguishing pre- and post-merger entities. Robust standard errors are clustered at the level of airlines and displayed in brackets below parameter estimates. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

Dependent variable:	Labor share	Ground crew share	Flight crew share	Management share	Others' share	Benefit share
	(1)	(2)	(3)	(4)	(5)	(6)
Threat of entry	0.598**	0.130**	0.324**	0.063	-0.018	0.099
	(0.265)	(0.055)	(0.131)	(0.040)	(0.044)	(0.080)
Entry	0.359	-0.039	0.302**	0.041	-0.026	0.082
	(0.308)	(0.070)	(0.150)	(0.037)	(0.039)	(0.091)
Firm size	-0.132***	-0.032**	-0.038**	-0.011*	-0.006	-0.044***
	(0.037)	(0.014)	(0.015)	(0.006)	(0.005)	(0.009)
Time FE	X	X	X	X	X	X
Airline FE	X	X	X	X	X	X
Accounting for mergers	X	X	X	X	X	X
Mean(y)	0.845	0.205	0.285	0.033	0.081	0.242
S.D.(y)	0.482	0.154	0.177	0.055	0.068	0.137
R^2	0.286	0.545	0.250	0.445	0.410	0.384
N	1,433	1,433	1,433	1,433	1,433	1,433

Table A.4: Labor shares and the effect of competition, including pre-2001 data
This table reports estimates from regressions of labor shares on measures of competition by Southwest Airlines in the US airline industry between 1990 and 2017. The data frequency is quarterly. The dependent variable in columns 1 to 3 is the labor share calculated as total labor expenses over total revenues, in column 4 the dependent variable is the labor share calculated as total labor expenses excluding salaries to management over total revenues, and in column 5 the dependent variable is the labor share calculated as total labor expenses excluding benefits over total revenues. The independent variables are *Threat of entry*, which is the relative importance of a route to an airline measured by the share of passengers on this route relative to all passengers of this airline times an indicator for threat of entry and summed up on the airline-level, *Challenge*, which is the relative importance of a route to an airline measured by the share of passengers on this route relative to all passengers of this airline times an indicator for threat of entry and summed up on the airline-level, and *Firm size*, which is the log of total assets of each airline. All columns include airline fixed effects and time fixed effects. I account for mergers in fixed effects by distinguishing pre- and post-merger entities. Robust standard errors are clustered at the level of airlines and displayed in brackets below parameter estimates. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

Dependent variable:	Labor share			Labor share, w/o management	Labor share, w/o benefits
	(1)	(2)	(3)	(4)	(5)
Threat of entry	0.096*	0.144*	0.101**	0.095**	0.079**
	(0.057)	(0.072)	(0.048)	(0.045)	(0.035)
Entry		0.090	0.099*	0.099**	0.076**
		(0.073)	(0.052)	(0.049)	(0.035)
Firm size	-0.035**	-0.036**	-0.035***	-0.033***	-0.023***
	(0.014)	(0.014)	(0.013)	(0.012)	(0.008)
Time FE	X	X	X	X	X
Airline FE	X	X	X	X	X
Accounting for mergers			X	X	X
Mean(y)	0.310	0.310	0.310	0.298	0.226
S.D.(y)	0.094	0.094	0.094	0.092	0.066
R^2	0.487	0.494	0.586	0.595	0.580
N	2,354	2,354	2,354	2,354	2,354

Paper 2:

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

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. Capping the share of variable compensation spurred average turnover rates driven by CEOs at poorly performing banks. Other than that, banks' responses to raise fixed compensation sufficed to retain the vast majority of non-CEO executives and those at well performing banks. We fail to find evidence that banks with executives that are more affected by the bonus cap became less risky. In fact, numerous results indicate an increase of risk, even in its systemic dimension according to selected measures. The return component of bank performance appears to be unaffected by the bonus cap. Risk hikes are consistent with an insurance effect associated with raised the increase in fixed compensation of executives. The ability of the policy to enhance financial stability is therefore doubtful.

JEL Classification: G21, G32, G34
Keywords: Banks, Bonus Cap, Executive Compensation, Executive Turnover

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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—henceforth 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 Financial Crisis 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, thereby serving as an undesirable insurance mechanism that increases systemic risk (Carlson and Lazrak, 2010; Albuquerque, Cabral, and Guedes, 2019).

Given this theoretical ambiguity, we assemble a novel sample of all executives 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 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 Financial Crisis, 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, 2020), 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 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, 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 in general. Banks simply indemnified their CEO and non-CEO executives sufficiently when adjusting compensation packages to comply with the new regulation. The increase in turnover rates is driven by CEOs at poorly performing banks, suggesting a tougher governance response towards under-performance by these executives after the bonus cap. In addition, we find no compelling evidence that the bonus caps accomplished the objective to reduce risk-taking and to enhance financial system resilience. The risk profile of the average EU bank did not improve for any of the main stakeholders of banks: shareholders, creditors, and the general public. Most empirical results suggest rather clearly that banks affected by the bonus cap exhibit a hike in risk, even in its systemic dimension according to selected measures. Importantly, these results obtain also under various alternative specifications to account for a plethora of confounding regulatory shocks at the time. These empirical results raise concerns about the usefulness of the EU bonus cap in fostering 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. 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 generally not exceed 100% or 200% subject to shareholder approval. The data allows 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 the treatment group whereas those with compliant contracts are the control group. By differentiating between plausibly forced and voluntary executive turnover in a difference-in-differences framework, we find no evidence of collateral damage. Voluntary turnover is not significantly more likely for executives with higher treatment intensity. 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 only treated executives at under-performing banks—in particular CEOs, who are commonly more subject to shareholder discipline—leave the industry at a significantly higher rate and are replaced by younger and less experienced successors following the EU cap. 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 executives' 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, without substantial differences across non-CEO executives and CEOs. Banks only changed the face value of variable compensation and whereas we observe an increased use of equity and deferred compensation, overall ex post pay-for-performance sensitivity does not change significantly. Against the backdrop that also KPI remained unchanged, the practice to leave pay-performance incentives apparently untouched casts doubt on whether the regulation succeeded to alter managerial risk-taking incentives as planned.

The third contribution is therefore to test if these indemnification responses to the bonus cap did taper observable risk-taking at the bank level. We assess if EU bank performance in terms of risk and return realizations changed after the regulatory shock. Contrary to the common narrative about performance compensation, often perceived to be akin to risk-taking incentives, treated banks do not exhibit any significant risk reduction following the cap. In fact, multiple risk metrics hike even after accounting for unobservable factors at the bank and country-year level by means of fixed effects. The return dimension of bank performance, in turn, does not exhibit statistically significant regulation response. Increased risk-taking manifests itself through different risk dimensions that are of direct relevance to shareholders (beta), creditors (credit risk), and the public and policy-makers (selected systemic risk metrics). These patterns are 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 executives 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 Financial Crisis.

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 Financial Crisis, 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 (see Mukharlyamov, 2016, for a review of bank labor market studies). 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 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 (2020) 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 Financial Crisis. 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 (2020) 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 (2020) 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).[1] 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 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 in terms of risk and return.

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 Financial Crisis (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 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

[1] Abudy, Amiram, Rozenbaum, and Shust (2020) investigate a cap on *total* compensation in the Israeli finance industry and find that it helped to reduce rent extraction.

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 FSB principles sparked the amendment of existing and the drafting of new national and pan-European compensation regulations, such as the Remuneration Code in the UK or Germany (*Institutsvergütungsverordnung*) that were both enacted in late 2010. Thus, some national regulations were enacted after the first publication of the agreed-upon text of the EU Capital Markets Directive (CRD) III in July 2010, but before the publication of the Directive 2010/76/EU in December 2010 that became effective as of January 2011. This iterative development process of regulation sparked by the FSB principles implied that various national regulations en route towards CRD III had to be adjusted after January 2011 so as to comply with the EU regulation (see, e.g., FSA, 2010).

The main upshot of these various ongoing and interacting legislative processes at national and EU level was, however, that all were sparked by the FSB remuneration principles of 2009. Put differently, national processes to revisit remuneration as one aspect of a larger effort to enhance financial stability applied to all EU banking markets alike, ultimately leading to the enactment of the CRD III. Regarding remuneration aspects, this regulation 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 aligned with long-term interests of the credit institution (e.g., by granting share-linked compensation).

The CRD IV was introduced in 2013 and its rules on compensation became binding as of January 2014. The main goal was to limit bank risk-taking.[2] 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.[3] Studying this regulatory shock complements the existing evidence on vesting

[2] 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.

[3] 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

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; predetermined, in terms of conditions and amount; non-discretionary, non-revocable and transparent to staff".[4] 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, 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 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 that of non-financial firms (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, non-financial firms, and households (Acharya, 2009; Brunnermeier, 2009). Hence, the traditional agency problem between shareholders, creditors, and management is nested in the broader one between shareholders and the public, which has an interest in a stable

specific features of the compensation plan of the executive (see EBA Guidelines, EBA/GL/2014/01, p. 3). Robustness tests using a threshold of 250% (Reuters UK, 2013) confirm the main results.

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

banking system (The Economist, 2010; Freixas and Rochet, 2013).

This interest was severely violated when poor bank governance arrangements contributed significantly to financial instability, which eventually led to the Great Financial Crisis. Critically weak governance practices prior to 2007 failed to align interests between shareholders and management that fostered excessive risk taking. In addition, the crisis also illuminated how the presence of government safety nets and limited liability gave rise to negative externalities in terms of socially suboptimal levels of risk-taking. (see, e.g., Chaigneau, 2013; Eufinger and Gill, 2016; Anginer et al., 2018). Given the limitations of standard governance practices for banks, the scope of bank regulation was extended continuously since the Great Financial Crisis by tightening microprudential requirements and by launching novel macroprudential regulation.

Relevant to our study, ensuring sound management processes and corporate governance received substantial attention besides the regulation of financial quantities (Bank for International Settlements, 2011). Significant attention has been devoted in particular to bankers' pay packages since 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 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 effectively prevents risk-shifting. 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.

Whereas executive compensation contracts encompasses many dimensions (e.g. level of pay, debt vs. equity incentives, maturity mix, etc.), Section 2 highlighted that most compensation regulation aims to reduce short-term incentives by constraining the structure of bank executives' payment packages. The focus on vesting periods under the 2010 regulation of CRD III, was supplemented with an explicit cap of bonuses in the CRD IV of 2013. Accordingly, we focus on one particular facet of compensation structure: the ratio of incentive pay relative to fixed pay.

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), doubts about bank resolution continue to prevail among market participants (Beck, Da-Rocha-Lopes, and Silva, 2020; Carmassi, Dobkowitz, Evrard, Parisi, Silva, and Wedow, 2020). 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 under-investment in risk-reducing strategies. 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 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 (see also Jokivuolle, Keppo, and Yuan, 2019). As such, their model suggests that bonus caps effectively reduce risk-taking only under fairly specific conditions. Albuquerque et al. (2019) demonstrate that bonus caps can even increase systemic risk because they reduce managerial effort if executive performance is evaluated relative to peers, which is commonplace among large EU financial institutions (see Appendix Figure A.1 for an example). Systemic risk increases if low-effort bankers invest in correlated projects (Acharya and Yorulmazer, 2007; Farhi and Tirole, 2012).

Overall, theoretical priors how bonus caps influence risk-taking are mixed. Fewer short-term incentives may reduce managerial risk appetite. But compensation packages with large fixed components reduce managers' incentives to exert effort and may induce them to invest more in correlated projects. Since these theories hinge on inherently unobservable quantities, a structural empirical test of each economic mechanism is infeasible. 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 in the labor market for bank 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, 2019). 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 than inducing optimal effort. Murphy (2013b) cautions that the most talented executives would suffer the most from a more performance-insensitive compensation structure, hence they might be the first to leave. 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 executives are usually capped at a maximum level (Murphy, 2001; Bettis, Bizjak, Coles, and Kalpathy, 2018), which applied to 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 ($X \leq A_T \leq Z$), executives 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} is 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 as described in Section 2. To assess the consequences of the regulatory shock for the managerial labor market, we investigate *how* banks complied with it. Figure 2 relates an executive's preferences to the possible adjustments in the compensation plan with the payoff as in (1) in terms of fixed compensation vs. expected variable compensation $E_t\left[Var.\ comp.\right]$ 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 and maintain fixed compensation (point A);
2. Increase fixed and maintain expected variable compensation (point B);
3. Rebalance so that risk-averse executives are indifferent (e.g., point C).

These 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 executives. If banks *indemnify* their executives as in case 3, we expect no significant change in voluntary turnover rates.

Several additional bank executive and bank characteristics 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). Banks may decide not to indemnify managers either because they do not want or they cannot afford to retain them. Both scenarios have become increasingly relevant for the banking sector, which became much less attractive as an employer after the Great Financial Crisis.

Therefore, as far as these inherently opaque motives can be approximated, we control below for unobservable and observable bank-level traits when we test empirically if bank executives leave their positions around the introduction of the EU cap more often (voluntarily or due to forced attrition). 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.

4 Empirical approach

We study the January 2014 introduction of the EU bank bonus cap and test empirically its effects on bank executive turnover, their compensation structures, and bank performance in terms of risk and return. We focus on executives serving on the management board, to whom shareholders delegated their control rights to operate the bank.

4.1 Turnover rate

We study the first-order consequences of the EU bonus cap for executives' mobility in managerial labor markets by adopting a difference-in-differences design similar to Guo and Masulis (2015). To explain executive turnover, we estimate a linear probability model, where the unit of observation is executive i at bank j in year t:

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

The dependent variable y_{ijt} is an indicator equal to 1 if an executive leaves. The baseline estimations comprise all turnover events. Given 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 executives after the cap are worse (better) off, the number of voluntary turnovers should increase (decrease).

Since the bonus cap was imposed on banks across all EU countries at the same time, 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 this difference-in-differences approach. Bank executives with compliant compensation packages as of 2013 constitute instead the control group. Appendix 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. We define treatment in the baseline tests on the basis of the 200% threshold because most of the sampled large banks sought approval for a threshold above 100% (see Figure 1 of European Banking Authority, 2015) and because it minimizes the number of false positives in the treatment group. Rather than using a binary treatment indicator, we exploit variation in compensation structure across treated executives, also within banks. $Treatment\ intensity_i$ equals 0 for the control group whereas it is equal to the distance between ρ and 200% as of 2013 for treated executives. For example, an executive with 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. 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.

Executive-level control variables $\boldsymbol{x_{it}}$ comprise age, a CEO indicator, professional experience, a retirement age indicator (1 if the executive is older than 65 years), a female indicator, and tenure. $\boldsymbol{z_{jt}}$ comprises bank-level control variables, namely size (natural logarithm of total assets), risk-adjusted performance as proxied by the lagged Sharpe ratio, the number of executives serving on the board, and an indicator for CEO turnover. To approximate at least indirectly outside options of executives, we follow Custódio, Ferreira, and Matos (2013) and use principal component analysis of employment history information (see Appendix Table A.2 for computational details).

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, in equation (2) 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.

Identifying forced and voluntary turnovers through news searches à la Jenter and Kanaan (2015) is infeasible due to the sparse media coverage of non-CEOs in our sample. 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 follow instead the intuition of Jenter and Lewellen (2020) and 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 executives 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 variables 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 executives serving on the board. The most saturated compensation regression specification also includes executive fixed effects.

4.3 Bank performance and risk-taking

Given the importance of executives' compensation structures to shape managerial incentives, we explore in a third step the evolution of performance in terms of returns and risk-taking 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 and its components (stock return and its volatility), credit default swap (CDS) spreads, and measures of systemic and market risk taking.[5] Most notably, we conduct our analysis at the bank level, because we do not observe individual executives' performance in terms of return of risk-taking.

$Treatment\ intensity_j$ at the bank-level equals the average across executives serving on a bank's board as of the enforcement of the EU cap. Thus, it refers to the same executives that are in the post-treatment sample in executive-level regressions.[6] An important difference of these bank-level analyses vis-á-vis executive-level regressions concerns the potential bias arising from confounding regulatory events. The latter isolate responses in turnover and compensation towards the EU bonus cap by exploiting variation within banks and across executives. Hence, any regulation affecting entire banks identically would not contaminate *executive* responses. But bank-level exposure to other relevant regulation launched around the same time poses a chal-

[5] We argue that banks' CDS spreads gauges idiosyncratic credit risk because we consider the bank's spread in excess of its sovereign's CDS spread and since the beta of debt is conventionally small.

[6] Distinguishing bank-level treatment intensity of non-CEO executives vs. CEOs yields qualitatively similar results.

lenge to isolate the EU bonus cap effect on bank return and risk if it correlates with $Treatment\ intensity_j$.

We tackle this challenge with a "brute-force" approach by saturating bank-level specifications with country-by-year instead of year fixed effects, in addition to bank-specific fixed effects. Thereby, we purge all variation in bank performance that is either attributable to confounding national legislation, such as heterogeneous deposit insurance schemes and bailout practices but also the regulation of gender quotas on boards per country (Jourová, 2016), or staggered transposition of EU directives related to the European Banking Union into national legislation (Koetter, Tonzer, and Krause, 2019).[7] We disregard control variables because they are arguably endogenous to bank return and risk, thus qualifying as "bad controls" (Angrist and Pischke, 2009).

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

[7] Consequently, we cannot estimate performance regressions for countries that only host one bank, see Appendix Table A.1. More parsimonious specifications with bank- and year-fixed effects yield qualitatively identical results. Although less of an issue, we also check the sensitivity of confounding regulation in executive-level analyses. Results are unaffected and available upon request.

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 executives as the baseline control group. Second, we use a standard binary treatment indicator $Treated_i$, equal to 1 for treated executives, 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 potentially confounding regulation events after the Great Financial Crisis as discussed in Section 2. Importantly, many of these regulatory changes were introduced before the EU bonus cap, which alleviates some concerns. But 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, in the baseline analysis 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).[8] Together with the CRD IV, which contains the EU bonus cap, it implemented Basel III in the EU. Spurious effects may arise if banks' exposures to the cap correlated with changes in capital and liquidity requirements introduced 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 liquidity. As a third approach, we conduct 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

[8]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).

as the exclusion of UK banks.

Third, we need to isolate the economic mechanism underlying the effects estimated with equation (2). Given the mixed theoretical predictions paired with the inherent limitations of empirical exercise discussed in Section 3, we conduct various ad hoc tests for executive- and bank-level regressions. First, we study differential changes in the turnover rate across executives based on the approximated attractiveness of their outside options. Next, we study 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 at the bank-level.

5 Data

Whereas most literature focused on the turnover and performance of CEOs (e.g., Jenter and Kanaan, 2015), we consider the entire board of executive directors with managerial duties, executives for short. This group is more comparable to CEOs than supervisory directors or non-executive managers, which we disregard. For a panel of EU banks with available executive compensation data over the 2010–2016 period, we obtain information on executive boards and executives' characteristics from BoardEx. 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. To construct an alternative control group of executives from the largest 25 US banks, we obtain compensation data from Standard and Poor's ExecuComp, and accounting and stock price data from CRSP-Compustat merged (CCM). We use three systemic risk measures. The first two are the raw long-run marginal expected shortfall (LRMES) and the expected shortfall adjusted for the size and the leverage of banks (SRISK%), respectively (Acharya, Pedersen, Philippon, and Richardson, 2016; Brownlees and Engle, 2017). We obtain SRISK% and LRMES from the V-Lab at New York University's Volatility Institute for the EU and the US banking systems, respectively, to gauge the bank's expected capital shortfall conditional on a large drop in equity markets. The third measure is ΔCoVaR (Adrian and Brunnermeier, 2016). The data are provided by the Systemic Risk Lab at the Center for Sustainable Architecture of Finance in Europe for EU and US banks. Sovereign debt exposure data are from the EBA Transparency Exercise of 2011.

We manually collect information on post-evaluation grants and on the structure of compensation at EU banks from publicly available remuneration reports in the years around the introduction of the EU bonus cap. The exact measurement of the quantity that is actually regulated by the EU bonus cap, namely the *maximum* variable-to-fixed compensation ratio, permits much more precise analyses compared to commercial databases, which only report *granted* or *realized* variable compensation. Appendix Table A.1 lists untreated and treated EU and US banks, respectively. Banks with at least one treated executives are considered a treated bank and we show the number of (un)treated executives to illustrate existing within-bank variation in compensation schemes.

The final sample contains 995 bank-executive-year observations from 45 banks. Table 1 summarizes the main executive- and bank-level variables for the treatment group (Panel A) and the control group (Panel B) and for the periods before (2010–2013) and after (2014–2016) the introduction of the EU bonus cap, respectively. The data are winsorized at the 1st and 99th percentiles and variables are defined in Appendix Table A.3. The 24 treated executives (200% threshold) serve on the boards of nine distinct banks. They exhibit higher levels of compensation, receive more performance-based pay, and serve 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.

Column (3) in panel D of Table 1 shows univariate difference-in-differences tests between average changes of the main variables in the treatment and the control group around the introduction of the EU bonus cap. 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. In contrast, bank performance indicators exhibit neither in the return nor in the risk dimension unconditionally significant difference-in-differences. Below, we revisit this prima facie evidence extensively in a regression framework. This approach is necessary to adequately account for observable and unobservable factors that may also explain different turnover rates and the absence of unconditional bank performance differentials.

5.1 Post-turnover career trajectories of bank executives

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 101 turnover events (57 at listed banks).

Table 2 groups executives by pre-turnover type of appointment (Panel A) and by post-turnover employment category (Panel B). Among leaving executives, 84% (86% at listed banks) are below CEO level. We retrieve information on the career trajectory of 77% of departing executives (67% at listed banks),[9] of which 27% (28% at listed banks) remain executives at another bank or company. Another 20% (14% at listed banks) become senior managers, partners, self-employed, or work as advisors. In this subset, 6% (4% at listed banks) advise the bank which they left as executives. 9% (5% at listed banks) stay active as supervisory board members or as non-executive directors.

Overall, considering that the executive positions that we consider 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 effects of the EU bonus cap on bank executive turnover. Second, we analyze commensurate changes in executive compensation structure. Third, we test for return and risk responses including ad-hoc tests on the respective channels.

6.1 Turnover rate

Table 3 shows results from difference-in-differences tests to examine executive turnover rates of CEO and non-CEO executives in EU banking around the introduction of the EU bonus cap. In columns 1 and 2, the dependent variable is an indicator variable equal to 1 for any turnover. Average turnover rates of treated executives are significantly

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

higher in the post-EU bonus cap period.[10] To better understand the drivers of executive labor market dynamics after this regulatory shock, we further dissect this headline results.

A first question that arises is if increased turnovers 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. The true nature of turnover is ultimately inherently opaque as we do not observe if turnovers are due to executives’ or due to employers’ choices. Our first approach to tackle this question in column 3 focuses 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.[11] 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, 2020). The frequency of turnover events at below-median performing banks increases significantly for treated executives. 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.

Table 4 examines this result in more depth by explaining turnover behavior of non-CEO executives (columns 1, 2, and 5) separately from that of CEOs (columns 3, 4, and 6). This approach also helps to compare our evidence to the existing turnover literature where CEOs took center stage. The point estimate of the change in the turnover rate of non-CEO executives is positive, but insignificant. Hence, the significant overall effects for the full sample of executives documented above hinges on departing CEOs. Column

[10] 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 6). Overall, executive turnovers among EU banks exhibit similar patterns diagnosed in previous studies for US firms.

[11] Executive performance is often evaluated relative to peers and KPIs are often linked to short-term metrics like ROE (Bennett et al., 2020), which crucially depends on leverage (Engel, Hayes, and Wang, 2003). Defining poor performance based on ROA does not affect our results (analysis available upon request). Furthermore, KPIs may also comprise “soft” metrics, such as employee satisfaction. For example, Barclays considers besides traditional KPIs also “sustanaibility metrics” that are defined in the bank’s “Citizenship Agenda” (Barclays PLC, Annual Report 2011, p. 60). Due to the difficulty of measuring soft KPIs, we resort to equity performance in all compensation sensitivity analyses.

6 suggests that average turnover responses are driven in particular by performance-induced turnover events involving CEOs. This result aligns well with the evidence that non-CEO executive turnover is in comparison less sensitive to performance, possibly suggesting that firm performance is a good measure of productivity only for CEOs (Fee and Hadlock, 2004). We further 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 done so far, we predict turnover rates from a linear probability model specification of equation (2) 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 5 to tease out differential changes in turnovers that reflect forced versus voluntary departures conditional on observable executive traits. Specifically, we interact proxies for executives' skill that should gauge the attractiveness of their outside option and, thus, the ease of leaving their current position. In column 1, 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 columns 2 and 3, we assume that the best executives are also the highest paid in the bank and measure skills accordingly by compensation in the pre–EU bonus cap period. The indicator variable *Top total pay* in column 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 column 3 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, in Appendix Table A.4 we replace the dependent variable 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.[12]

Overall, we find no evidence that banks fail to retain their executives following the EU bonus cap. Whereas average attrition of all executives increases after the regulatory shock, this surge in the turnover rate is driven by treated CEOs at under-performing banks. These results suggest that the bonus cap prompted tougher governance responses to poor executive performance in general (and for weak bank CEOs in particular), instead of marking the beginning of an uncontrolled exodus of the most talented managers.

[12] We cannot rule out that some unobserved regulation affects also executives within one bank differently. A prime example would be heterogeneous approaches towards regulating the share of female board members across EU countries (Jourová, 2016). Therefore, we also specified country-by-year fixed effects in turnover regressions. Results are qualitatively identical and available upon request.

6.2 *Compensation structure*

The preceding section documents that only CEOs at poorly performing banks exhibit higher turnover rates under the bonus cap, whereas non-CEO executives at well-performing banks are not more likely to leave. Next, we investigate if 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.[13] 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 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 6 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.

[13]Some banks applied for higher thresholds according to the rules detailed in footnote 3. Therefore, a few executives exhibit a maximum variable-to-fixed compensation ratio above 200% after 2013.

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 control variables are statistically insignificant once we specify fixed effects for unobservable time, bank, and executive factors 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 with 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 Panel 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 adherence 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 7 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.[14]

The decline of the maximum variable-to-fixed compensation ratio according to the described mechanism coupled with the lack of evidence of a change in expected compensation points to a substantial change in the specification of the payoff schedule and its

[14]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.

intrinsic incentives. Consider the type of performance-based compensation plan visualized in Figure 1. After the EU cap, the lower compensation bound rises for the average executive while the upper bound decreases. Conditional on the resulting changes in the incentive zone and the slope of the payoff schedule associated with it, executives will face different sets of incentives. Measuring the width of the incentive zone consistently across banks is challenging, but there is a natural proxy for the slope of the payoff schedule: pay-for-performance sensitivity. This approach allows to indirectly draw conclusions on the incentive zone as well.

We analyze *ex post* pay-for-performance sensitivity 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). The goal achievement rate allows us to investigate if it is harder for an executive to achieve a percentage of his/her bonus plan rather than an absolute amount. Changes in performance sensitivity and risk-adjusted performance sensitivity of treated executives' compensation are statistically insignificant.[15]

The analysis of ex post pay-for-performance sensitivity is helpful (see, e.g., Jensen and Murphy, 1990), but looking at *ex ante wealth*-performance-sensitivity would be preferable according to Edmans, Gabaix, and Landier (2008). Sadly, this approach is infeasible in our setting because public access to the necessary individual EU executive's firm-related wealth information to compute ex ante sensitivities is hampered by data disclosure practices in the EU. Moreover, EU banks tend to use more long-term accounting-based incentive plans than standard equity incentives. Therefore, the computation of portfolio delta and vega in the spirit of the Core and Guay (2002) framework is challenging.

To gain some further insights about the ex ante riskiness of pay despite these binding data limitations, we consider two empirical proxies of the future payoff schedule of executives. A first, admittedly coarse proxy in comparison to the delta of compensation is the *Equity rate*, which relates all equity-linked grants that are provided to the manager post-performance to total pay. The second proxy is the fraction of deferred compensation, which relates positively to the riskiness of pay. In Table A.8 we estimate

[15] 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.

difference-in-differences specifications for the equity rate (columns 1 – 3) and the deferral rate (columns 4 – 6). We generally observe an increase in both the equity rate and the deferral rate around the introduction of the cap, pointing to an increase in the riskiness of variable pay. Higher equity compensation and deferrals stem from (1) stronger reliance on long-term compensation plans and (2) fixed allowances that are used to increase fixed compensation. 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 differential increase around the cap is of $4.6\% \times 2.3 = 10.58\%$ for the equity rate and $3.6\% \times 2.3 = 8.28\%$ for the deferral 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 3). Whereas the change in the equity and deferral rate is sizable, it is unlikely to have a major impact on the implementation of the regulation.

Finally, recall that only CEOs exhibit a significant increase in (performance-induced) turnover following the EU cap. Therefore, in Table 8 we investigate if this differential effect on turnover behavior of non-CEO executives and CEOs originates from differences in the adjustment of compensation structure. To that end, we specify a triple interaction with a CEO indicator. The estimated differences between the two groups of executives in terms of the impact of the EU cap on realized variable compensation and fixed compensation are not statistically significant. The only significant difference relates to maximum variable compensation. Importantly, this finding does neither translate into a significant differential effect on the maximum variable-to-fixed compensation ratio nor on expected compensation. Hence, these results corroborate again that even for CEOs increased turnover rates are unlikely due to voluntary moves sparked by less attractive pay packages. We consider instead the narrative of altered shareholder discipline by means of turnover in case of disappointing bank performance more plausible.

All in all, the tests on pay-for-performance sensitivity provide a mixed picture. Whereas we do observe an increased use of equity-linked post-performance grants and deferred compensation, overall ex post pay-for-performance sensitivity does not change significantly. Going back to the diagram in Figure 1, we provide evidence suggestive of several effects of the EU cap: (1) an increase of the lower bound of pay (fixed salary), (2) a decrease of the upper bound of pay (fixed salary plus maximum variable compensation), (3) an insignificant change of the slope of the schedule within the incentive zone. Together, these findings point to a compressed incentive region after the EU cap. More managers may therefore reach performance levels that reduce incentives to exert effort more easily.

6.3 Bank performance: returns 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. Traditionally, important interest groups are shareholders and creditors, who hold 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 terms of bank-specific return and risk indicators.

In addition to this conventional agency conflict, explicit and implicit public guarantees on banks' debt imply potentially severe negative externalities beyond the individual banking firm as discussed in Section 3. Therefore, we also consider systemic risk responses to the EU bonus cap to gauge implications for the financial stability of the entire banking system, in which the public has an interest. But whereas the Great Financial Crisis underpinned the first-order importance of financial stability for the welfare of modern economies, systemic risk remains an elusive 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 exposures of banks to overvalued assets that are subject to sudden corrections, subsequent liquidity freezes, and fire sales that cause financial market breakdowns (see, e.g., Acharya, 2009; Tirole, 2011; Wagner, 2011; Brunnermeier, Rother, and Schnabel, 2020). Gridlock in financial markets fuels the contagion of insolvency risk via observable and unobservable financial networks among banks (Glasserman and Young, 2016; Bosma, Koetter, and Wedow, 2019), of which some are considered too big, too connected, too many, or otherwise too important to fail, triggering government intervention (Acharya and Yorulmazer, 2007; Brown and Dinc, 2009; Farhi and Tirole, 2012;

Freixas and Rochet, 2013). Given the ongoing debate about the sources of systemic financial crises, we remain agnostic as to the exact mechanisms explaining systemic risk. Instead, we take advantage of three fairly established systemic risk measures. The first two, SRISK% and LRMES (Acharya et al., 2016; Brownlees and Engle, 2017), approximate the vulnerability of individual institutions towards financial crises. The third measure, ΔCoVaR (Adrian and Brunnermeier, 2016), gauges the contribution of an individual bank to the fragility of the entire financial system.

We address the relationships between the EU bonus cap and performance indicators by adapting the specification in equation (2) to the bank instead of the executive level as the unit of analysis, as described in Section 4.3. The pre- and post-treatment unconditional summary statistics reported in Panel C and Panel D of Table 1 bode well for this approach. But those tests compare time-collapsed data around the introduction of the EU cap, which bear little information as to the validity of our approach in terms of meeting the parallel trends assumption.

Thus, we start to scrutinize our approach by visualizing estimated average marginal effects (AMEs) of the EU cap on selected bank-level performance and risk measures by interacting a binary treatment indicator with year-specific indicators. Plotted AMEs in Figure 6 underpin the non-violation of the parallel trends assumption during the pre-treatment period. Not one performance metric exhibits a significant response in the three pre-treatment years, but each displays a significant and large response in at least one post-treatment year. These responses point to a temporary deterioration of returns and to a persistent increase in risk. Yet, the benefit of an intuitive visualization as in Figure 6 implies some important cost, too. First, obtaining sufficiently precise point estimates of differences across numerous strata in an already small sample is challenging due low statistical power. Second, the binary treatment indicator used to visualize AMEs gauges bank-specific exposure to the regulatory shock less precise compared to the intensity measure specified in executive-level regressions so far. Third, we do not account for unobserved confounding shocks by means of country-by-year fixed effects as in the fully saturated specification discussed in Section 4.3.

Therefore, we further refine this preliminary evidence and conduct a difference-in-differences analysis including country-by-year fixed effects for alternative variables capturing the motives of the various stakeholders involved. Recall that bank-level *Treatment intensity* equals the average treatment intensity of executives within a bank's board when the cap became effective. The results are shown in Table 9.

Panel A considers first the return and risk dimensions of bank performance from a shareholder perspective. The Sharpe ratio of treated banks does not respond significantly to the policy shock as shown in column 1. Also its two components, returns in column 2 and return volatility in column 3, exhibit insignificant differential effects. These results suggests that the reform did not alter shareholders' position in the bank once we augment the bank-level specifications with country-by-year fixed effects. The EU bonus cap appears to exert no additional impact on shareholder performance above and beyond any variation in country-specific business cycles or the regulatory environments like deposit insurance schemes or bank bailout practices.

Implications differ from a creditor perspective. Five-year CDS spreads approximate default risk and we specify banks' excess CDS spreads vis-á-vis their corresponding sovereign CDS spread as the dependent variable in column 4, thus capturing a crucial facet of idiosyncratic risk. The evidence suggests that treated banks' credit risk increased after the regulatory shocks compared to untreated peers. Unreported specifications using absolute CDS spreads that are not adjusted for sovereign debt spreads as dependent variable corroborate this result. The documented increase in risk-taking is at odds with the original intention of the EU bonus cap. However, it is consistent with theories cautioning that less variable pay imposes inferior incentives for managers to exert (risk-management) effort or by providing insurance to risk-averse managers as in Carlson and Lazrak (2010). Hence, this result provides evidence of unintended consequences of the EU bonus cap.

In Panel B of Table 9, we specify proxies for systemic and market risk to address the potential of banks to generate negative externalities beyond the individual institution. In column 1, SRISK% 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 in column 2 represents the expected equity loss faced by the bank in such a severely adverse market scenario. As such, these two metrics are closely related, but gauge different aspects of systemic risk.[16] ΔCoVaR in column 3 equals the end-of-year difference between the VaRs of the financial system when a bank is distressed versus when it exhibits median performance. Whereas SRISK% and LRMES gauge the consequences of a system meltdown for an individual bank, this measure therefore aims to gauge the contribution of each individual bank to aggregate systemic risk. We approximate market risk using the bank's market beta and correlation (columns 4 and 5).

The results in columns 1 through 3 indicate that both systemic risk indicators

[16] For computation details, see: https://vlab.stern.nyu.edu/help/risk_summary_en.html.php?gmes.

gauging the effect of a financial meltdown on financial institutions increased significantly after the policy shock. Given this conservative specification, which accounts for a plethora of regulatory, prudential, governance, and other differences over time and across countries, this marks an important result. Not only did the bonus cap possibly induce more idiosyncratic credit risk, but these two systemic risk metrics even suggest that the policy did even increase systemic risk – the very opposite of its declared objective.

However, column 3 also highlights that any inference depends critically on the choice of systemic risk metrics. Treated banks do not exhibit statistically different ΔCoVaR after the introduction of the EU bonus cap. Taken together, these results indicate that banks' vulnerability in terms of potentially being critically under-capitalized in very adverse market scenarios increased, but that the contribution of the average bank to the entire system's value-at-risk did not change in response to the policy. However, the latter insignificant result may also simply reflect the data-intensive quantile regression approach required to compute ΔCoVaR. Related, Adams, Gropp, and Füss (2014) documented that this approach is sensitive to the chosen time period to specify state-dependent controls, which might pose a challenge given the relatively short and low-frequency data underlying our analysis. Finally, note that treated banks also exhibit a statistically significant increase in their market risk as gauged by beta in column 4. Hence, those banks with management boards that had to be compensated differently to comply with the new rules also faced higher market risk. Simple return correlations do not exhibit significant differential effects in column 5.

Overall, we therefore interpret our findings as indications of possibly severe unintended consequences cast by the introduction of the EU bonus cap for idiosyncratic credit risk, selected metrics of systemic risk, and non-diversifiable market risk. The deterioration of bank performance metrics in the risk dimension, especially the increase of selected, but important systemic risk metrics, paints a bleak picture of the ability of the EU bonus cap to enhance financial stability. Given the potentially high policy relevance of this finding, we devote considerable attention to the robustness of these results towards various competing shocks in Section 7. Beforehand, we aim to shed some light on possible economic channels how the bonus cap may affect bank performance.

6.4 Economic channels

Given that the EU bonus cap's primary goal was to curb risk-taking, these results are remarkable. Table 10 seeks to unveil possible drivers of the increase in risk. We estimate again a difference-in-differences model including bank- and country-by-year fixed effects.

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). Treated banks do not significantly modify their reliance on this source of funding following the cap. In column 2, 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* (column 3) as opposed to safer assets, such as 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.

Structural tests of the specific theories about the effects of bonus caps discussed in Section 3 are beyond the scope of our analysis. But it is still important to disentangle the mechanics of changes in bank riskiness around the introduction of the cap. Therefore, we consider 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., 2020).

In Panel B, we thus turn attention to three theory-founded mechanisms possibly underlying the rise in bank risk. The approach we follow can neither structurally test the diverging predictions from theoretical models nor provide "smoking gun" empirical evidence as most relevant quantities at the executive level (effort, skills, etc.) are inherently unobservable. However, our exercise supplies a set of correlations against which we can assess the plausibility of different channels. 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., 2020). 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 limitations

7.1 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. Following Boyallian and Ruiz-Verdú (2017), we identify banks in ExecuComp 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. 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 awarded or realized variable compensation, but does not report the maximum variable compensation. Therefore, we prefer to use EU banks' untreated executives in the baseline analysis.

Table 11 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 in terms of return and risk-taking, using the same dependent variables as before. All key results described in Section 6.3 are confirmed. Idiosyncratic credit risk of treated banks hikes significantly, a result now also supported by a positive differential effect obtained for higher stock return volatility in column (3) of Panel C.

More importantly, the pattern for the three systemic risk metrics is confirmed. Both SRISK% and LRMES exhibit statistically significant increases after the policy shock, whereas the differential effect of ΔCoVaR remains not discernible from zero. Market risk responses also remain significantly positive. Only the negative point estimate for correlation as a gauge of market risk is one qualitative change among these robustness tests.

Bearing this exception in mind, we find that coefficients obtained under the baseline tests in Table 9 and those using US banks as the control group in Table 11 are qualitatively strikingly similar and exhibit comparable orders of magnitude.

7.2 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 specific confounding events in addition to the brute-force approach of including country-by-year fixed effects. Specifically, we conduct 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.[17]

First, the EU bonus cap is contained in the CRD IV, which, together with the CRR, implements Basel III in the EU.[18] Both the bonus cap and the CRR became effective in the 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.[19] In contrast, the EU bonus was fully implemented already in 2014 without a phase-in process.

[17] 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.

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

[19] 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.

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.[20] 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 market 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., MPS, Dexia, etc.). It is possible that these interventions bias our 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 replicate the analysis of Table 9 without all banks that were bailed out since the Great Financial Crisis.[21] Overall, the qualitative findings are robust to this adjustment, especially the evidence on turnover, compensation, and idiosyncratic credit risk. Systemic risk responses lose statistical significance, but remain statistically significant at the 10% level in the case of SRISK%. Besides the mechanistic explanation

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

[21] The data are obtained from Table B.I of Carbó-Valverde, Cuadros-Solas, and Rodríguez-Fernández (2020), 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/).

that already a few degrees of freedom less in an already small sample may make an important difference for the precision of point estimates, the result is also economically intuitive. With the benefit of hindsight, we know and exclude exactly those banks that were bailed out. By definition, these banks are the most risky and simultaneously sufficiently important ones to warrant their rescue. Not too surprisingly, the sample selection then yields less significant systemic risk responses. We interpret this result as tentative support for the view that it is crucial to empower the Single Supervisory Mechanism and to implement an effective Single Resolution Mechanism. The former ensures to monitor and discipline systemically relevant banks closely enough before they become too risky. The latter is helpful to resolve distressed banks swiftly and according to rule-based procedures to prevent mounting systemic risk.

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.

7.3 Additional tests

Whereas the baseline treatment group 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 Appendix Table A.12, we therefore exclude UK banks both from the treatment and the control group. The results remain identical with the exception of expected compensation in Panel B. The specification of a goal achievement rate from the pre-reform period yields a positive and significant change in expected compensation (column 5). By contrast, the estimated change is negative and significant if we use a contemporaneous goal achievement rate (column 6). Apart from this last negative estimate—which is smaller than the one in column 5 (-227.63 vs. 457.12)—, all other results in Panel B are consistent with the indemnification narrative explaining the absence of an executive exodus from the EU banking sector following the bonus cap.

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 3). At the same time, the 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 intensity variable. Appendix Table A.13 shows regression estimates using this treatment definition. Our results generally continue to hold. Moreover, unreported tests confirm the main findings also when using thresholds above 200%.

In Appendix Table A.14, we specify a binary treatment indicator using the 200% threshold instead of the treatment intensity variable. Our findings stay generally robust.

7.4 Limitations

This paper provides a comprehensive analysis of the (un)intended consequences of the EU bonus cap, looking at different dimensions pertaining to the job market of bank executives and bank performance. But despite its richness, both our manually collected data as well as the empirical design are subject to some limitations that warrant readers' attention.

First, both executive and bank-level analyses hinge on relatively small samples, which poses a general challenge to precise point estimations of coefficients. Our approach to saturate models at both levels of analyses with many fixed effects further increases the burden on the data to draw firm inference. Whereas the overall tendencies of effects are surprisingly robust across a wide range of scrutiny checks, we want to caution to put too much emphasis on point estimates.

Second, the approach to use country-by-year fixed effects to isolate responses of bank performance variables to the EU cap implies that already the baseline specification considers only banks from countries with more than one bank. Hence, we report relationships for fewer than the maximum of 14 EU countries used for the analyses conducted at the executive level. Although the qualitative robustness of empirical results obtained after excluding the home to most banks in the sample, the UK in Table A.12, bodes well for some general association reported here, one needs to acknowledge that the regulatory perimeter of the EU bonus cap is larger than just the seven countries, which host more than one listed bank in this sample.

Third, the collected compensation data comprise top executives in management boards. However, non-board executives and middle management, such as traders (European Banking Authority, 2013), might also be subject to the cap if they qualify as material risk-takers. Since the compensation of non-executive material risk takers is not reported publicly per individual, we cannot gauge the effect of changed incentives on managerial labor markets below the management board level. Future research that collects and analyzes compensation information of all material risk-takers in banking is thus warranted.

Bearing these inevitable limitations in mind, the overarching empirical indications regarding the effects of the EU bonus cap on executive turnover, compensation structure, and bank performance based on our manually collected and novel dataset yield overall robust results and fairly few contradictions.

8 Conclusion

Bankers' compensation has been subject to significant regulatory activity following the Great Financial Crisis, ultimately aiming to enhance financial stability. 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 particular 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 existence of an uncontrolled exodus of the most talented and successful executives from banking. In fact, our results indicate that the average increase in turnover rates was driven by departing CEOs from poorly performing banks. Hence, the evidence suggests that the governance stance toughened-up in banks most affected by the cap, including a prompter punishment of poor CEO performance. There are few indications that banks lose their ability to retain their most skilled managers after introducing the cap. Instead, the empirical results consistently point to banks complying with the regulation by offering their executives higher fixed compensation and reduced maximum variable compensation. Put differently, banks indemnified their executives for the introduction of the cap.

Bank-level evidence suggests that treated banks exhibit higher risk-taking propensities across a wide range of robustness checks regarding possible confounding policy shocks and alternative control groups. This result 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 selected systemic risk metrics. Whereas metrics that gauge banks' vulnerability in case of a system meltdown, such as marginal expected shortfalls, consistently exhibit significant hikes in response to the bonus cap introduction, other measures like ΔCoVaR never exhibit significant reactions.

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 overstated. At the same time, the EU cap's risk-mitigating and system-stabilizing effects in the banking sector appears to be questionable at best. With the caveat in mind that the proper measurement of systemic risk and financial stability remains an ongoing matter of debate, the empirical regularities that emerge from our analyses do not bode well for the bonus cap's ability to tame risk-taking and financial instability in the EU banking system.

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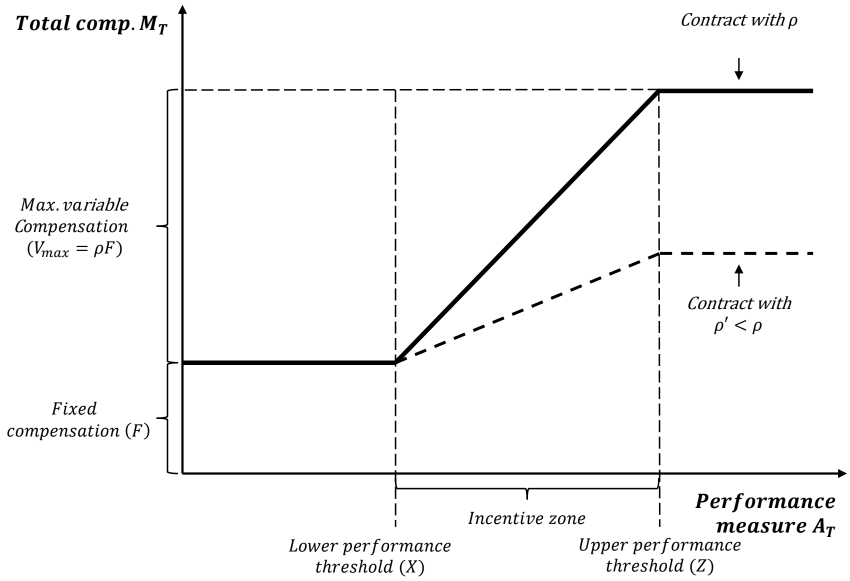

Figure 1: A stylized performance-based compensation plan
This figure shows the terminal payoff M_T of a stylized performance-based compensation plan as a function of a given measure of performance A_T at time T. The executive participates in the bank's performance $\Pi = A_T - X$ at the participation 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.

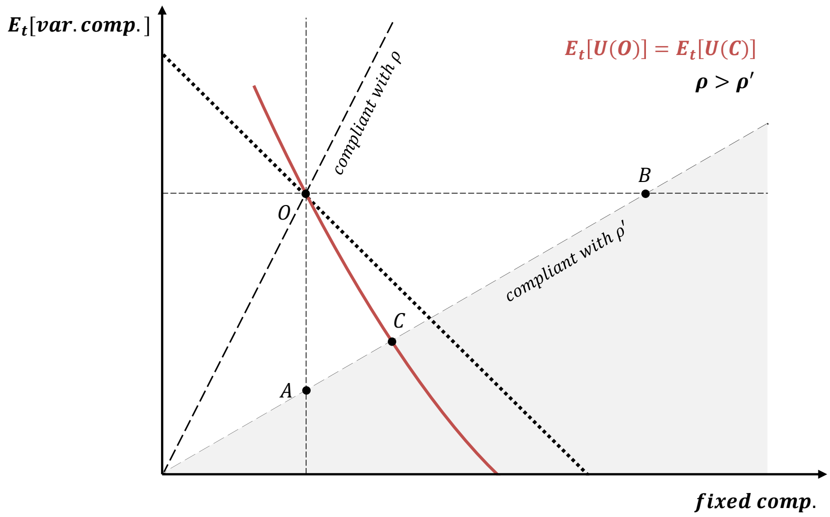

Figure 2: Adjustment schemes of executive compensation structure in reaction to the EU bonus cap This figure visualizes how the bank can adjust executives' compensation packages to comply with the EU bonus cap. Consider an executive with an initial maximum variable-to-fixed compensation ratio ρ (point 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. $E_t\left[U(O)\right] = E_t\left[U(C)\right]$ (point C).

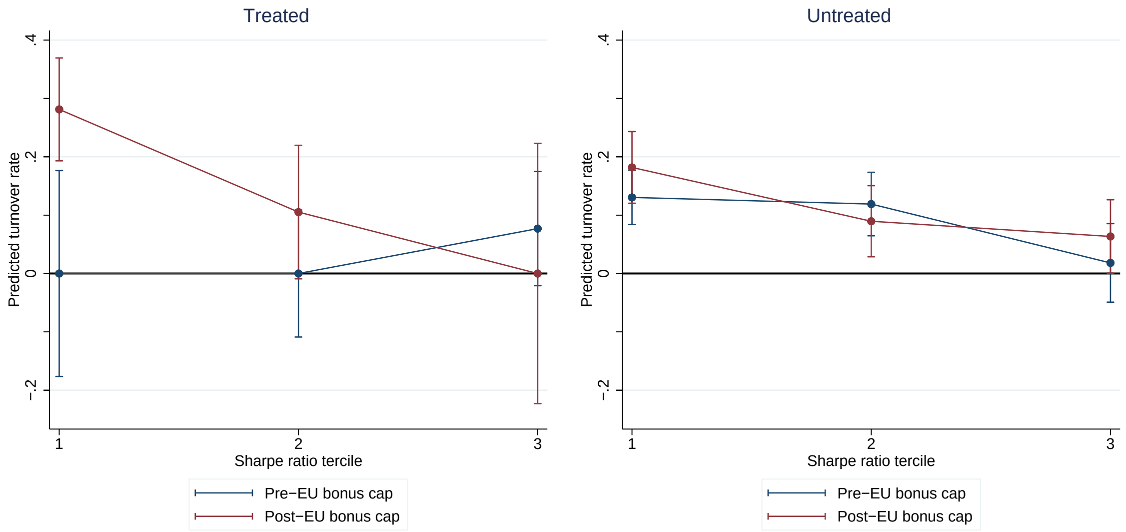

Figure 3: Prediction of turnover rate
This figure shows the predicted turnover rate at different terciles of the Sharpe ratio from linear probability models. The left plot refers to treated executives (those whose compensation structure is non-compliant with the EU bonus cap as of 2013: maximum variable-to-fixed 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 90% confidence intervals.

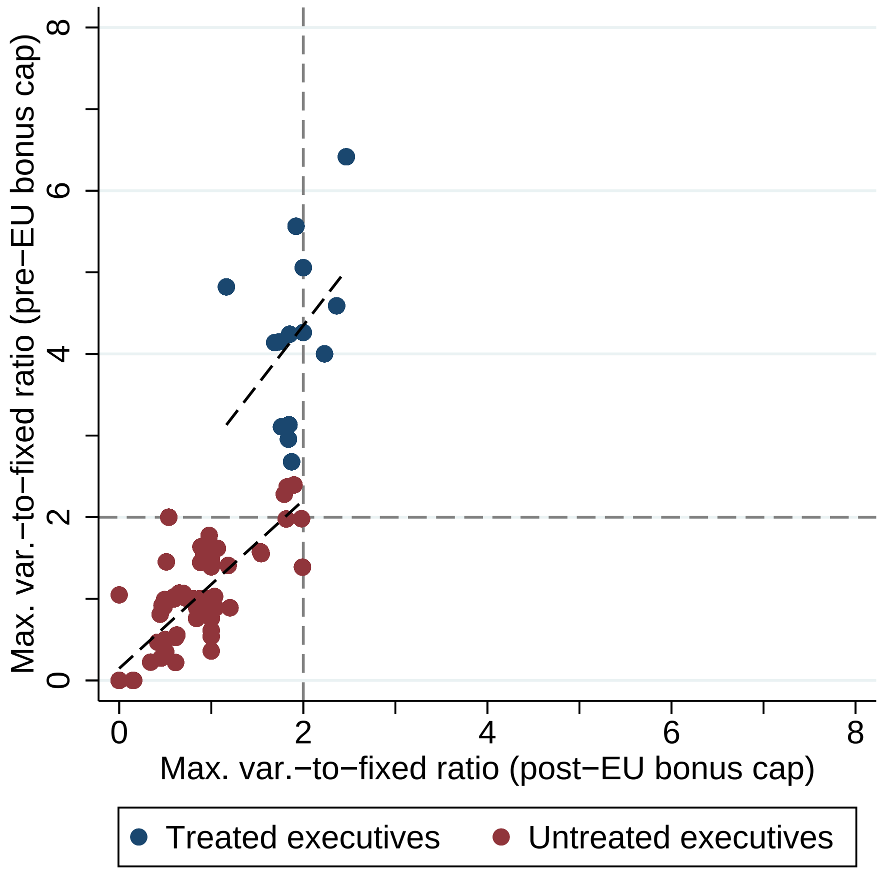

Figure 4: Adjustment of compensation structures to the EU bonus cap
This figure shows the maximum variable-to-fixed compensation ratio for treated and untreated executives at EU banks before (median over 2010–2013) and after (median over 2014–2016) the introduction of the EU bonus cap. Blue dots represent 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.

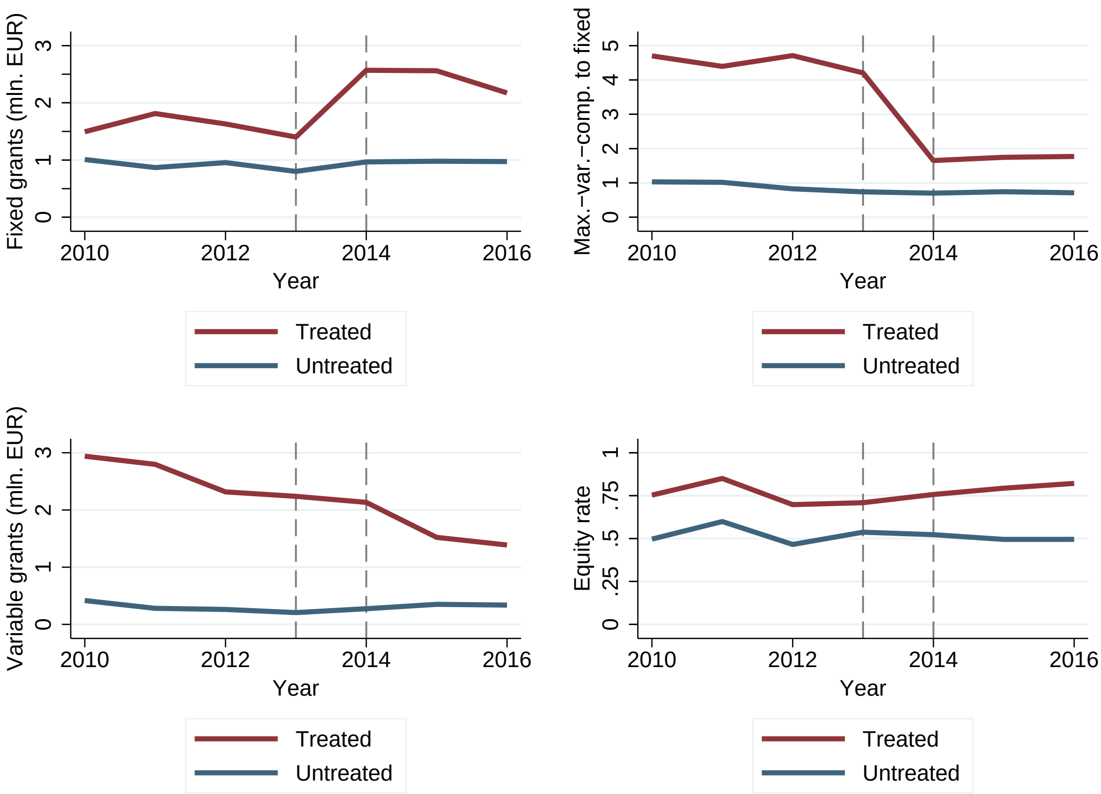

Figure 5: Evolution of compensation structure around the introduction of the EU bonus cap
This figure shows the evolution of executives' fixed compensation, maximum variable compensation-to-fixed compensation ratio, variable compensation, and equity rate around the introduction of the EU bonus cap for 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).

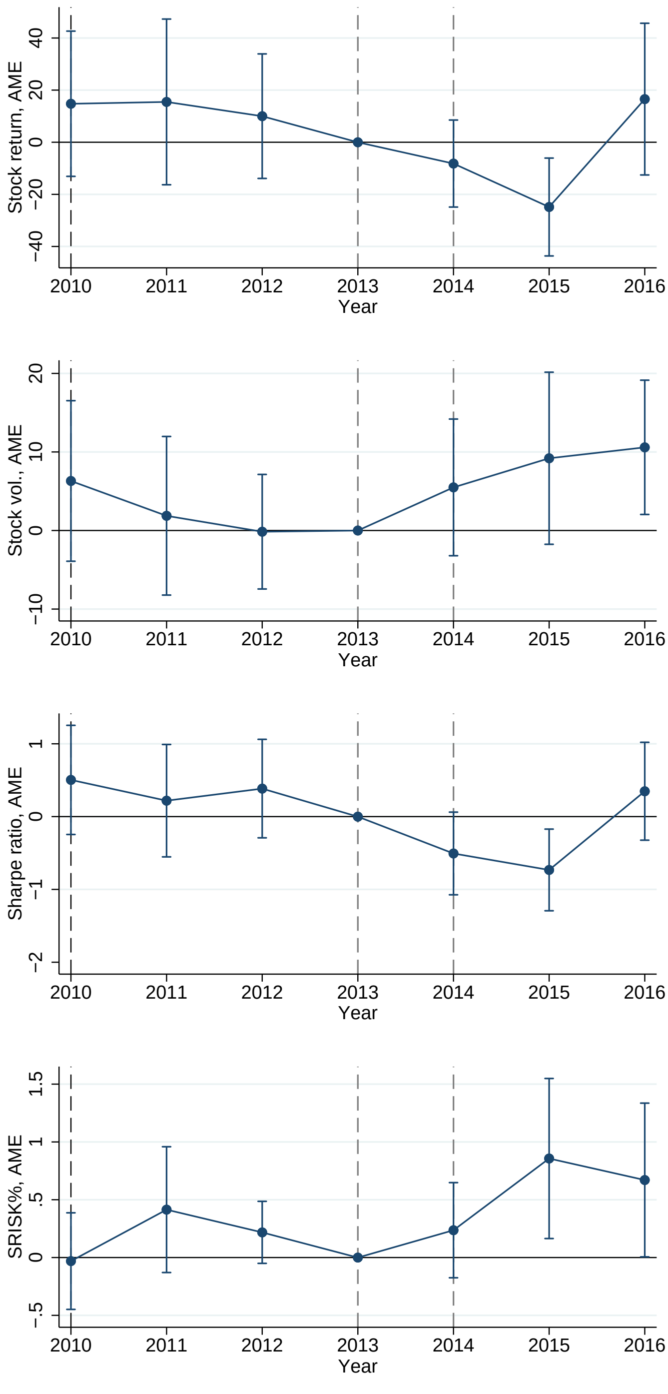

Figure 6: Evolution of bank performance and risk around the introduction of the EU bonus cap
This figure shows the average marginal effect (AME) of the EU bonus cap on bank performance and risk (stock return, stock volatility, Sharpe ratio, and SRISK%) year-by-year. This is obtained by estimating the coefficients β_t from the following specification:

$$y_{jt} = \sum_{t} \beta_{1t} Treated_j \times \mathbf{1}_{\{Year=t\}} + \alpha_j + \alpha_t + \epsilon_{jt}.$$

$Treated_j$ is equal to 1 if bank j has at least one executive whose compensation structure is noncompliant with the EU bonus cap as of 2013 (maximum variable-to-fixed compensation ratio>200%), and 0 otherwise. The specification includes bank (α_j) and year (α_t) fixed effects. The sample comprises EU banks over 2010–2016, using 2013 as the reference year. 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). Vertical bars indicate 90% confidence intervals.

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 executives (i.e., those with a maximum variable-to-fixed compensation ratio exceeding 200% as of 2013). Panel B reports summary statistics for untreated executives. Panel C reports differences over the pre-treatment period, i.e., between 2013 and 2010, for treated (column 1) and untreated executives/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 executives/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 executives

	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

Panel B: Untreated executives

	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

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

	Δ Treated (1)	Δ Untreated (2)	Diff. (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)

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)

Table 2: Career trajectories of bank executives
This table shows information on the employment paths of bank executives around turnover events. Panel A classifies departing executives based on the whether they were CEOs or not before the turnover. Panel B follows them after the turnover (up to one year after leaving the board). Both panels are structured in the same way. Column 1 and 2 cover all executive 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 executives by employment category. For Panel B, we collected data through searches of news stories and professional networking websites. 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.

Panel A: Turnover events by position held

	All banks		Listed banks	
	#	%	#	%
	(1)	(2)	(3)	(4)
CEO	16	15.84%	8	14.04%
Non-CEO	85	84.16%	49	85.96%

Panel B: Career trajectories after turnovers

	All banks		Listed banks	
	#	%	#	%
	(1)	(2)	(3)	(4)
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 executives around the introduction of the EU bonus cap of 2013. The sample covers executives of EU banks between 2010 and 2016. In columns 1 and 2, the dependent variable is *Turnover*, an indicator variable equal to 1 if the executive leaves the board of the bank in a given year. In column 3, the dependent variable is *Turnover (poor perf.)*, an indicator variable equal to 1 if the executive leaves the board of the bank and the bank's ROE is below the median in a given year. Treated executives are those whose maximum variable-to-fixed compensation ratio exceeds 200% as of 2013. *Treatment intensity* is (1) equal to 0 for executives in the control group and (2) equal to the distance between ρ (maximum variable-to-fixed compensation) and 200% as of 2013 for treated executives. *Post* is an indicator variable equal to 1 from 2014 onward. All specifications include bank and executive control variables (bank size, lagged Sharpe ratio, number of executives serving on the board, age, a retirement age indicator, tenure, a female indicator, professional experience, and a CEO indicator). Included fixed effects are indicated below. 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)
Treat. int.	-0.006	-0.027	-0.012
	(-0.53)	(-0.99)	(-0.68)
Post × Treat. int.	0.044*	0.054**	0.063**
	(1.94)	(2.27)	(2.60)
Sharpe ratio (lag)	-0.036**	-0.020	-0.023
	(-2.63)	(-0.96)	(-1.27)
# Executives	-0.004	-0.066***	-0.069***
	(-0.85)	(-3.89)	(-3.96)
Bank size	-0.012	-0.046	-0.175
	(-0.99)	(-0.34)	(-1.38)
Age	0.000	-0.001	-0.002
	(0.05)	(-0.39)	(-0.65)
Retirement age	0.092	0.105*	0.085*
	(1.67)	(2.03)	(1.93)
Female	-0.100***	-0.081*	-0.019
	(-3.70)	(-1.72)	(-0.37)
Tenure	0.002	0.006	0.007**
	(1.20)	(1.38)	(2.06)
Prof. experience	0.004	0.006	0.007
	(0.43)	(0.71)	(0.86)
CEO	-0.060***	-0.050**	-0.032
	(-2.78)	(-2.19)	(-1.44)
Year fixed effects	X	X	X
Bank fixed effects		X	X
# Executives	130	130	130
# CEOs	36	36	36
# Banks	32	32	32
Mean(y)	0.109	0.109	0.086
S.D.(y)	0.312	0.312	0.280
R^2	0.132	0.221	0.243
N	561	561	561

Table 4: Executive turnover: Non-CEO executives vs. CEOs
This table reports estimates from difference-in-differences regressions (linear probability models) for turnover of executives around the introduction of the EU bonus cap of 2013, analyzing separately non-CEO executives and CEOs. The sample covers executives 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 executive 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 executive leaves the board of the bank and the bank's ROE is below the median in a given year. Treated executives are those whose maximum variable-to-fixed compensation ratio exceeds 200% as of 2013. *Treatment intensity* is (1) equal to 0 for executives in the control group and (2) equal to the distance between ρ (maximum variable-to-fixed compensation) and 200% as of 2013 for treated executives. *Post* is an indicator variable equal to 1 from 2014 onward. All specifications include bank and executive control variables (bank size, lagged Sharpe ratio, number of executives serving on the board, age, a retirement age indicator, tenure, a female indicator and professional experience). In columns 1, 2, and 5 we additionally control for CEO turnover. Data in columns 1, 2, and 5 include only non-CEO executives. Data in columns 3, 4, and 6 include only CEOs. Included fixed effects are indicated below. 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.)	
	Ex-CEOs		CEOs only		Ex-CEOs	CEOs only
	(1)	(2)	(3)	(4)	(5)	(6)
Post × Treat. int.	0.032	0.034	0.097*	0.116**	0.043	0.122**
	(1.35)	(1.36)	(1.75)	(2.50)	(1.68)	(2.62)
Bank and executive controls	X	X	X	X	X	X
Year fixed effects	X	X	X	X	X	X
Bank fixed effects		X		X	X	X
# Executives	107	106	36	35	106	35
# CEOs	0	0	36	35	0	35
# Banks	28	27	30	29	27	29
Mean(y)	0.127	0.125	0.059	0.060	0.096	0.053
S.D.(y)	0.334	0.331	0.237	0.238	0.294	0.225
R^2	0.145	0.233	0.173	0.438	0.270	0.421
N	409	408	152	151	408	151

Table 5: Executive turnover (the role of managerial skills)
This table reports estimates from triple difference-in-differences regressions (linear probability models) for turnover of executives around the introduction of the EU bonus cap of 2013. The sample covers executives of EU banks between 2010 and 2016. The dependent variable is *Turnover*, an indicator variable equal to 1 if the executive leaves the board of the bank in a given year. Treated executives are those whose maximum variable-to-fixed compensation ratio exceeds 200% as of 2013. *Treatment intensity* is (1) equal to 0 for executives in the control group and (2) equal to the distance between ρ (maximum variable-to-fixed compensation) and 200% as of 2013 for treated executives. *Post* is an indicator variable equal to 1 from 2014 onward. The specification in column 1 includes a triple interaction term with *High exp.*, an indicator variable equal to 1 if *Professional experience* is above its median for a given executive. The specification in column 2 includes a triple interaction term with *Top total pay*, an indicator variable equal to 1 if the executive is the highest paid (or the second highest paid) within the board in terms of total compensation (for boards with at least five executives). The specification in column 3 *Top var. pay*, an indicator variable computed in the same way but based on variable compensation. All specifications include bank and executive control variables (bank size, lagged Sharpe ratio, number of executives serving on the board, age, a retirement age indicator, tenure, a female indicator, professional experience, and a CEO indicator). Included fixed effects are indicated below. 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		
	(1)	(2)	(3)
Post × Treat. int. × High exp.	0.050		
	(0.86)		
Post × Treat. int. × Top total pay		-0.050	
		(-1.57)	
Post × Treat. int. × Top var. pay			-0.035
			(-1.04)
Bank and executive controls	X	X	X
Year fixed effects	X	X	X
Bank fixed effects	X	X	X
# Executives	130	122	122
# CEOs	36	34	34
# Banks	32	30	30
Mean(y)	0.109	0.117	0.117
S.D.(y)	0.312	0.322	0.322
R^2	0.231	0.233	0.229
Observations	561	521	521

Table 6: Executive compensation structure

This table reports estimates from difference-in-differences regressions for compensation structure of executives around the introduction of the EU bonus cap of 2013. The sample covers executives 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 executives are those whose maximum variable-to-fixed compensation ratio exceeds 200% as of 2013. *Treatment intensity* is (1) equal to 0 for executives in the control group and (2) equal to the distance between ρ (maximum variable-to-fixed compensation) and 200% as of 2013 for treated executives. *Post* is an indicator variable equal to 1 from 2014 onward. All specifications include bank and executive control variables (bank size, ROE, number of executives serving on the board, age, tenure, professional experience, a CEO indicator, and a female indicator). Included fixed effects are indicated below. 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)
# Executives	-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
Executive fixed effects			X			X
# Executives	205	204	185	206	206	200
# CEOs	52	52	51	52	52	52
# Banks	45	44	44	45	45	45
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
Observations	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)			(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)
# Executives	-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
Executive fixed effects			X			X
# Executives	206	206	200	205	204	185
# CEOs	52	52	52	52	52	51
# Banks	45	45	45	45	44	44
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 7: Expected utility from executive compensation packages

This table reports estimates from difference-in-differences regressions for expected compensation of executives around the introduction of the EU bonus cap of 2013. The sample covers executives of EU banks between 2010 and 2016. The dependent variable is expected utility for a risk-neutral executive (i.e., *Expected pay*) 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 executive-level goal achievement rate. Columns 3, 4, 7, and 8 are based on the board-level goal achievement rate. Treated executives are those whose maximum variable-to-fixed compensation ratio exceeds 200% as of 2013. *Treatment intensity* is (1) equal to 0 for executives in the control group and (2) equal to the distance between ρ (maximum variable-to-fixed compensation) and 200% as of 2013 for treated executives. *Post* is an indicator variable equal to 1 from 2014 onwards. All specifications include bank and executive control variables (bank size, ROE, number of executives serving on the board, age, tenure, professional experience, a CEO indicator, and a female indicator). Included fixed effects are indicated below. 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)			
	Executive-level prob.		Board-level prob.		Executive-level prob.		Board-level prob.	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
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 executive 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
Executive fixed effects		X		X		X		X
# Executives	172	157	173	158	177	161	178	163
# CEOs	42	42	44	44	45	45	46	46
# Banks	36	36	37	37	38	38	39	39
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 8: Executive compensation structure: Non-CEO executives vs. CEOs
This table reports estimates from triple difference-in-differences regressions for compensation structure of executives around the introduction of the EU bonus cap of 2013, distinguishing between non-CEO executives and CEOs. The sample covers executives of EU banks over the years between 2010 and 2016. The dependent variables are *Maximum variable compensation to fixed* (column 1), *Variable compensation* (2), *Fixed compensation* (columns 3), *Maximum variable compensation-to-fixed* (columns 4), both *Expected pay based on pre-probabilities* (column 5), and *Expected pay based on post-probabilities* (column 6), based on board-level. Treated executives are those whose maximum variable-to-fixed compensation ratio exceeds 200% as of 2013. *Treatment intensity* is (1) equal to 0 for executives in the control group and (2) equal to the distance between ρ (maximum variable-to-fixed compensation) and 200% as of 2013 for treated executives. *CEO* is an indicator variable equal to one if an executive serves as the CEO. *Post* is an indicator variable equal to 1 from 2014 onward. All specifications include bank and executive control variables (bank size, ROE, number of executives serving on the board, age, tenure, professional experience, a CEO indicator, and a female indicator). Included fixed effects are indicated below. 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:	Max. var. to fixed	Var. comp.	Fixed comp.	Max. var. comp.	Expected pay, pre prob.	Expected pay, post prob.
	(1)	(2)	(3)	(4)	(5)	(6)
CEO	0.103	493.233	329.028	961.587	904.476	848.500
	(0.84)	(1.55)	(1.42)	(1.50)	(1.55)	(1.58)
Post × CEO	0.070	57.433	72.579	-75.775	98.007	153.699
	(0.89)	(0.58)	(0.74)	(-0.53)	(0.61)	(0.96)
Post × Treat. int.	-0.834***	-532.968**	340.153**	-674.893*	41.546	-281.372
	(-6.85)	(-2.35)	(2.67)	(-1.90)	(0.15)	(-0.83)
CEO × Treat. int.	-0.657	-240.626	374.653**	1,652.113	975.708	618.187
	(-0.91)	(-0.70)	(2.47)	(1.65)	(1.69)	(1.36)
Post × CEO × Treat. int.	-0.239	40.667	-25.864	-1,061.890**	-342.323	-192.257
	(-1.17)	(0.11)	(-0.19)	(-2.11)	(-1.10)	(-0.72)
Bank and executive 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
Executive fixed effects	X	X	X	X	X	X
# Executives	185	200	200	185	158	163
# CEOs	51	52	52	51	44	46
# Banks	44	45	45	44	37	39
Mean(y)	1.126	521.452	1,058.330	1,525.059	1,718.688	1,729.927
S.D.(y)	1.207	1,047.108	758.716	2,431.648	1,733.656	1,691.123
R^2	0.877	0.765	0.824	0.902	0.902	0.875
N	855	989	989	853	722	737

Table 9: Bank performance

This table reports estimates from difference-in-differences regressions for different bank performance metrics around the introduction of the EU bonus cap of 2013. The sample covers EU banks between 2010 and 2016. Panel A considers measures of return 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 market risk: *SRISK%* (column 1), *LRMES* (column 2), $\Delta CoVaR$ (column 3), *Beta* (column 4), and *Correlation* (column 5). *Treatment intensity* is the average treatment intensity of executives within a bank as of 2014 (based on those executives for whom $Post \times Treated = 1$, where *Treated* is the executive-level binary treatment indicator). *Post* is an indicator variable equal to 1 from 2014 onward. Included fixed effects are indicated below. 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: Return and credit 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)
Bank fixed effects	X	X	X	X
Country-year fixed effects	X	X	X	X
# Banks	30	30	30	17
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 market risk

	Systemic risk			Market risk	
Dependent variable:	SRISK%	LRMES	ΔCoVaR	Beta	Corr.
	(1)	(2)	(3)	(4)	(5)
Post × Treat. int.	0.689***	3.723**	-1.435	0.142**	0.015
	(2.79)	(2.45)	(-1.02)	(2.39)	(0.91)
Bank fixed effects	X	X	X	X	X
Country-year fixed effects	X	X	X	X	X
# Banks	30	30	23	30	30
Mean(y)	2.321	50.854	23.099	1.433	0.472
S.D.(y)	2.505	10.201	10.025	0.413	0.114
R^2	0.977	0.851	0.901	0.835	0.891
N	189	189	143	189	189

Table 10: 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 executives within a bank as of 2014 (based on those executives for whom *Post* × *Treated* = 1, where *Treated* is the executive-level binary treatment indicator). *Post* is an indicator variable equal to 1 from 2014 onward. Included fixed effects are indicated below. 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.	-0.020	-0.015	0.005
	(-1.26)	(-1.17)	(0.65)
Bank fixed effects	X	X	X
Country-year fixed effects	X	X	X
# Banks	30	30	17
Mean(y)	0.408	0.089	0.140
S.D.(y)	0.156	0.056	0.092
R^2	0.964	0.900	0.935
N	189	189	94

Panel B: Risk drivers

Dependent variable:	Nonperf. loans	Operating leverage	Exec. pay safety
	(1)	(2)	(3)
Post × Treat. int.	0.003	-0.000	0.671***
	(0.34)	(-0.49)	(3.47)
Bank fixed effects	X	X	X
Country-year fixed effects	X	X	X
# Banks	30	30	30
Mean(y)	0.043	0.008	-0.587
S.D.(y)	0.049	0.003	0.648
R^2	0.922	0.959	0.796
N	189	189	189

Table 11: 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 return and credit risk (Panel C), and measures of systemic risk and market risk (Panel D). The treatment sample covers executives 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 executives are those EU banks' executives 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 executives in the control group and (2) equal to the distance between ρ (maximum variable-to-fixed compensation) and 200% as of 2013 for treated executives. In Panel C and Panel D, *Treatment intensity* is the average treatment intensity of executives within a bank as of 2014 (based on those executives for whom $Post \times Treated = 1$, where *Treated* is the executive-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 6, and Table 9. 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. Included fixed effects are indicated below. 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)
Post × Treat. int.	0.049**	0.049**	0.055***
	(2.07)	(2.32)	(2.95)
Bank and executive controls	X	X	X
Year fixed effects	X	X	X
Bank fixed effects		X	X
# Executives	276	276	276
# CEOs	41	41	41
# Banks	34	34	34
Mean(y)	0.118	0.118	0.053
S.D.(y)	0.323	0.323	0.224
R^2	0.038	0.069	0.117
N	1,042	1,042	1,042

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 executive controls	X	X	X	X	X
Year fixed effects	X	X	X	X	X
Bank fixed effects	X	X	X	X	X
Executive fixed effects	X	X	X	X	X
# Executives	231	231	231	231	231
# Banks	33	33	33	33	33
# CEOs	41	41	41	41	41
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: Return and credit 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.	0.035	-0.538	5.249***	0.169***
	(0.72)	(-0.34)	(8.09)	(7.40)
Bank fixed effects	X	X	X	X
Country-year fixed effects	X	X	X	X
# Banks	32	32	32	16
Mean(y)	0.731	15.337	24.789	3.213
S.D.(y)	1.225	34.919	10.272	1.434
R^2	0.605	0.467	0.756	0.978
N	218	218	218	110

Panel D: Systemic and market risk

	Systemic risk			Market risk	
Dependent variable:	SRISK%	LRMES	ΔCoVaR	Beta	Corr.
	(1)	(2)	(3)	(4)	(5)
Post × Treat. int.	0.512***	2.338***	-0.476	0.093***	-0.004**
	(3.91)	(3.78)	(-0.69)	(3.86)	(-2.22)
Bank fixed effects	X	X	X	X	X
Country-year fixed effects	X	X	X	X	X
# Banks	32	32	30	32	32
Mean(y)	2.528	43.184	23.703	1.131	0.586
S.D.(y)	4.202	8.779	9.029	0.319	0.106
R^2	0.936	0.880	0.788	0.877	0.913
N	218	218	206	218	218

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.

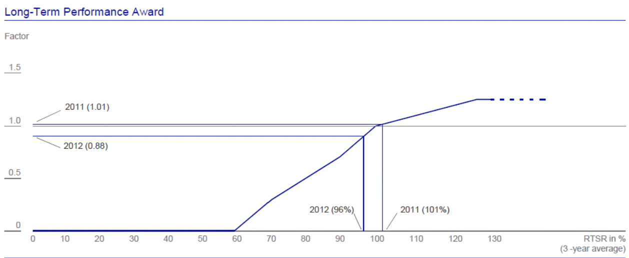

Figure A.1: Examples of performance-based compensation plans
This figure reports examples of performance-compensation plans in place at EU banks before the introduction of the EU bonus cap. The plan on the left was given by Barclays to its executives in 2011 (source: Barclays PLC, Annual Report 2011, 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 executive-year observations refers to the baseline estimation sample in column 4 of Panel A of Table 6.

	Banks with treated executives	Country	Treat. exec.-years	Untr. exec.-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 executives	Country	Treat. exec.-years	Untr. exec.-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. exec.-years	Untr. exec.-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 executives' employment history
We apply a principal component analysis to proxy for executives' 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
# Exec. dir.	0.4266	0.263	-0.6282	0.5893	-0.0831
# Industries	0.3129	0.6454	0.6681	0.1979	0.0021
# Firms	0.4923	0.2466	-0.2643	-0.6946	0.3802
# Positions	0.5306	-0.3317	0.1332	-0.1988	-0.7424
# 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 11), additional information on the database and the variable definition is given [in brackets].

Variable	Databases	Definition
Executive characteristics:		
Turnover	BoardEx [ExecuComp]	Dummy variable that is one if an executive 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 an executive 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 executives' 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 executive.
Retirement age	BoardEx [ExecuComp]	Dummy variable that is one if an executive is older than 65 years.
Tenure	BoardEx [ExecuComp]	Number of years an executivehas served as executive for the bank.
Female	BoardEx [ExecuComp]	Dummy variable that is one if an executive is female.
Turnover to other executive position	Manually collected	Dummy variable equal to *Turnover* if the executive leaves the board of the bank in a given year and moves to another executive 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.

(Continued)

Table A.3: – *Continued*

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.
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 executives in the control group and equal to the distance between ρ (maximum variable-to-fixed compensation) and 200% as of 2013 for treated executives. Treated executives are those whose maximum variable-to-fixed compensation ratio exceeds 200% as of 2013.
Treated	Manually collected	Dummy equal to 1 if an executive 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.
ΔCoVaR	Systemic Risk Lab at SAFE	Following Adrian and Brunnermeier (2016), ΔCoVaR of bank i is defined as the difference of the CoVaR of the financial system with respect to bank i and the Value-at-Risk (VaR_i) of the financial system, whereas the CoVaR of the financial system with respect to bank i is the VaR of the financial system, conditional on bank i being in distress, i.e., bank i being at VaR_i.
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.
# Executives	BoardEx	Number of executives 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.

(Continued)

Table A.3: – *Continued*

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.
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 executive-level treatment intensity of executives within a bank as of 2014. We use 2014 as reference year to ensure that only executives' 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 executives around the introduction of the EU bonus cap of 2013 conditional on post-turnover outcomes. The sample covers executives of EU banks between 2010 and 2016. The dependent variable is *Turnover to other executive position*, an indicator variable equal to 1 if the executive leaves the board of the bank in a given year and moves to another executive position afterwards. Treated executives are those whose maximum variable-to-fixed compensation ratio exceeds 200% as of 2013. *Treatment intensity* is (1) equal to 0 for executives in the control group and (2) equal to the distance between ρ (maximum variable-to-fixed compensation) and 200% as of 2013 for treated executives. *Post* is an indicator variable equal to 1 from 2014 onward. Both columns 1 and 2 specifications include bank and executive control variables (bank size, lagged Sharpe ratio, number of executives serving on the board, age, a retirement age indicator, tenure, a female indicator, professional experience, and a CEO indicator). Included fixed effects are indicated below. 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)
Post × Treat. int.	0.005	0.014
	(0.38)	(1.20)
Bank and executive controls	X	X
Year fixed effects	X	X
Bank fixed effects		X
# Executives	130	130
# CEOs	36	36
# Banks	32	32
Mean(y)	0.030	0.030
S.D.(y)	0.172	0.172
R^2	0.039	0.135
N	561	561

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 executives around the introduction of the EU bonus cap of 2013. The sample covers executives of EU banks between 2010 and 2016. The dependent variable is *Turnover (poor perf.)*, an indicator variable equal to 1 if the executive leaves the board of the bank and the bank's ROE is below the median in a given year. Treated executives are those whose maximum variable-to-fixed compensation ratio exceeds 200% as of 2013. *Treatment intensity* is (1) equal to 0 for executives in the control group and (2) equal to the distance between ρ (maximum variable-to-fixed compensation) and 200% as of 2013 for treated executives. *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*. Both specifications include bank and executive control variables (bank size, lagged Sharpe ratio, number of executives serving on the board, age, a retirement age indicator, tenure, a female indicator, professional experience, and a CEO indicator). Included fixed effects are indicated below. 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)
Post × Treat. int. × Sharpe ratio (lag)	-0.048	-0.043
	(-1.69)	(-0.95)
Bank and executive controls	X	X
Time fixed effects	X	X
Bank fixed effects		X
# Executives	130	130
# CEOs	36	36
# Banks	32	32
Mean(y)	0.086	0.086
S.D.(y)	0.280	0.280
R^2	0.144	0.248
N	561	561

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

Panel A: Executives at treated banks

	Leaving executives				New executives			
	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
# Executive directorships held	13	2.846	1.994	3.000	12	2.333	1.303	2.000
# Supervisory directorships held	13	3.385	3.404	3.000	12	0.833	1.528	0.000
# Previous sectors	13	1.385	0.506	1.000	12	1.333	0.651	1.000
# Previous firms	13	4.615	1.805	4.000	12	6.250	5.396	4.000

Panel B: Executives at untreated banks

	Leaving executives				New executives			
	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
# Executive directorships held	48	2.438	1.785	2.000	25	2.480	2.044	1.000
# Supervisory directorships held	48	5.313	4.406	4.000	25	3.240	4.456	1.000
# Previous sectors	48	1.208	0.504	1.000	25	1.280	0.542	1.000
# 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 executives around the introduction of the EU bonus cap of 2013. The sample covers executives of EU banks between 2010 and 2016. The dependent variable is the realized *Variable compensation-to-maximum variable compensation* ratio. Treated executives are those whose maximum variable-to-fixed compensation ratio exceeds 200% as of 2013. *Treatment intensity* is (1) equal to 0 for executives in the control group and (2) equal to the distance between ρ (maximum variable-to-fixed compensation) and 200% as of 2013 for treated executives. *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 executive control variables (bank size, ROE, number of executives serving on the board, age, tenure, professional experience, a CEO indicator, and a female indicator). Included fixed effects are indicated below. 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 executive controls	X	X	X	X	X	X
Time fixed effects	X	X	X	X	X	X
Bank fixed effects		X	X		X	X
Executive fixed effects			X			X
# Executives	125	124	103	125	124	103
# CEOs	32	32	31	32	32	31
# Banks	30	29	29	30	29	29
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 executives around the introduction of the EU bonus cap of 2013. The sample covers executives of EU banks between 2010 and 2016. The dependent variables are *Equity rate* (columns 1 – 3) and *Deferral rate* (columns 4 – 6). Treated executives are those whose maximum variable-to-fixed compensation ratio exceeds 200% as of 2013. *Treatment intensity* is (1) equal to 0 for executives equal to 1 from 2014 onwards. All specifications include bank and executive control variables (bank size, ROE, number of executives serving on the board, age, tenure, professional experience, a CEO indicator, and a female indicator). Included fixed effects are indicated below. 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:	Equity rate			Deferral rate		
	(1)	(2)	(3)	(4)	(5)	(6)
Post × Treat. int.	0.040**	0.037***	0.046**	0.039**	0.027	0.036
	(2.14)	(2.94)	(2.28)	(2.39)	(1.64)	(1.51)
Bank and executive controls	X	X	X	X	X	X
Year fixed effects	X	X	X	X	X	X
Bank fixed effects		X	X		X	X
Executive fixed effects			X			X
# Executive	117	115	101	117	115	101
# CEOs	38	38	34	38	38	34
# Banks	33	31	29	33	31	29
Mean(y)	0.565	0.565	0.565	0.685	0.686	0.686
S.D.(y)	0.305	0.305	0.307	0.222	0.222	0.222
R^2	0.160	0.882	0.892	0.101	0.656	0.692
N	451	449	435	451	449	435

Table A.9: Bank performance, capital requirements and liquidity regulation
This table reports estimates from difference-in-differences regressions for bank performance 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 return 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 market risk: *SRISK%* (column 1), *LRMES* (column 2), Δ *CoVaR* (column 3), *Beta* (column 4), and *Correlation* (column 5). *Treatment intensity* is the average treatment intensity of executives within a bank as of 2014 (based on those executives for whom *Post* × *Treated* = 1, where *Treated* is the executive-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. Included fixed effects are indicated below. 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: Return and credit 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.	-0.184	-6.625	6.169	0.309***
	(-1.32)	(-1.18)	(1.68)	(3.15)
Δ Tier I	-0.050	0.078	-0.854	-0.018
	(-1.37)	(0.04)	(-1.40)	(-0.82)
Δ Regulatory capital mix	-0.007	-1.122	0.620**	0.007
	(-0.64)	(-1.40)	(2.37)	(1.68)
Δ Liquidity	0.003	-0.059	-0.052	-0.001
	(0.34)	(-0.20)	(-0.76)	(-0.81)
Bank fixed effects	X	X	X	X
Country-year fixed effects	X	X	X	X
# Banks	30	30	30	17
Mean(y)	0.008	-7.275	35.893	1.020
S.D.(y)	1.031	43.716	18.329	0.739
R^2	0.784	0.794	0.855	0.977
N	173	173	173	106

Panel B: Systemic and market risk

	Systemic risk			Market risk	
Dependent variable:	SRISK%	LRMES	ΔCoVaR	Beta	Corr.
	(1)	(2)	(3)	(4)	(5)
Post × Treat. int.	0.702***	3.957**	-1.101	0.152**	0.013
	(2.76)	(2.61)	(-0.74)	(2.51)	(0.80)
Δ Tier I	0.010	0.303	-0.208	0.016	-0.000
	(0.38)	(1.01)	(-1.13)	(0.98)	(-0.02)
Δ Regulatory capital mix	-0.001	-0.078	-0.039	-0.003	-0.001
	(-0.08)	(-1.00)	(-0.82)	(-0.80)	(-0.63)
Δ Liquidity	0.000	-0.007	0.083	-0.000	0.000
	(0.05)	(-0.14)	(1.44)	(-0.19)	(0.44)
Bank fixed effects	X	X	X	X	X
Country-year fixed effects	X	X	X	X	X
# Banks	30	30	23	30	30
Mean(y)	2.493	51.470	23.157	1.458	0.479
S.D.(y)	2.544	10.167	10.121	0.413	0.107
R^2	0.976	0.848	0.913	0.832	0.876
N	173	173	138	173	173

Table A.10: Bank performance (falsification test)
This table reports estimates from difference-in-differences regressions for bank performance around the introduction of the EU bonus cap of 2013, replacing the bank's *Treatment intensity* used in Table 9 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 measures of return 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), Δ *CoVaR* (column 3), *Beta* (column 4), and *Correlation* (column 5). *Post* is an indicator variable equal to 1 from 2014 onward. Included fixed effects are indicated below. 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: Return and credit 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	-0.022	-21.253	12.809	1.056
	(-0.04)	(-0.67)	(0.69)	(1.12)
Bank fixed effects	X	X	X	X
Country-year fixed effects	X	X	X	X
# Banks	15	15	15	12
Mean(y)	-0.095	-7.336	35.840	0.992
S.D.(y)	0.960	38.711	15.107	0.760
R^2	0.784	0.847	0.847	0.972
N	98	98	98	81

Panel B: Systemic and market risk

	Systemic risk			Market risk	
Dependent variable:	SRISK%	LRMES	ΔCoVaR	Beta	Corr.
	(1)	(2)	(3)	(4)	(5)
Post × Periph. exposure	0.955	-2.925	-6.521	-0.223	-0.023
	(0.66)	(-0.42)	(-0.82)	(-0.75)	(-1.68)
Bank fixed effects	X	X	X	X	X
Country-year fixed effects	X	X	X	X	X
# Banks	15	15	14	15	15
Mean(y)	3.941	53.530	24.457	1.532	0.515
S.D.(y)	2.500	8.352	9.615	0.358	0.086
R^2	0.961	0.897	0.903	0.883	0.932
N	98	98	93	98	98

Table A.11: Excluding bailed-out banks

This table reports estimates from difference-in-differences regressions around the introduction of the EU bonus cap of 2013. The sample covers the period 2010-2016 and excludes bailed-out banks. The dependent variables are executive turnover (Panel A), measures of executive compensation structure (Panel B), bank-level measures of return of and credit risk (Panel C), and bank-level measures of systemic and market risk (Panel D). Treated executives are those 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 executives in the control group and (2) equal to the distance between ρ (maximum variable-to-fixed compensation) and 200% as of 2013 for treated executives. In Panel C and Panel D, *Treatment intensity* is the average treatment intensity of executives within a bank as of 2014 (based on those executives for whom $Post \times Treated = 1$, where *Treated* is the executive-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 6, Table 7, and Table 9. Included fixed effects are indicated below. 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)
Post × Treat. int.	0.051*	0.067**
	(1.87)	(2.42)
Bank and executive controls	X	X
Year fixed effects	X	X
Bank fixed effects	X	X
# Executives	88	88
# CEOs	22	22
# Banks	19	19
Mean(y)	0.123	0.094
S.D.(y)	0.329	0.292
R^2	0.232	0.269
N	374.000	374.000

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.	329.187***	-583.708**	-881.103***	-0.869***	71.152	-179.221
	(3.07)	(-2.65)	(-4.22)	(-6.61)	(0.41)	(-0.77)
Bank and executive 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
Executive fixed effects	X	X	X	X	X	X
# Executives	119	119	107	107	94	96
# CEOs	29	29	28	28	25	26
# Banks	26	26	25	25	21	22
Mean(y)	1,214.012	654.846	2,044.600	1.318	1,864.662	1,840.399
S.D.(y)	842.758	1,172.337	2,897.279	1.401	1,642.815	1,546.219
R^2	0.814	0.775	0.886	0.871	0.892	0.878
N	586	586	492	494	436	442

Panel C: Return and credit 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.	-0.282**	-3.893	1.488	0.131**
	(-2.73)	(-1.11)	(0.50)	(2.39)
Bank fixed effects	X	X	X	X
Country-year fixed effects	X	X	X	X
# Banks	19	19	19	12
Mean(y)	0.118	-2.564	32.859	0.811
S.D.(y)	0.995	36.018	15.186	0.738
R^2	0.813	0.817	0.839	0.982
N	119	119	119	75

Panel D: Systemic and market risk

	Systemic risk			Market risk	
Dependent variable:	SRISK%	LRMES	ΔCoVaR	Beta	Corr.
	(1)	(2)	(3)	(4)	(5)
Post × Treat. int.	0.194*	3.143	-0.236	0.116	0.032
	(1.79)	(1.70)	(-0.13)	(1.64)	(1.01)
Bank fixed effects	X	X	X	X	X
Country-year fixed effects	X	X	X	X	X
# Banks	19	19	16	19	19
Mean(y)	1.751	50.051	23.066	1.396	0.482
S.D.(y)	2.349	9.984	10.065	0.378	0.107
R^2	0.985	0.853	0.910	0.831	0.911
N	119	119	99	119	119

Table A.12: Excluding UK banks

This table reports estimates from difference-in-differences regressions around the introduction of the EU bonus cap of 2013. The sample covers the period 2010-2016 and excludes UK banks. The dependent variables are executive turnover (Panel A), measures of executive compensation structure (Panel B), bank-level measures of return of and credit risk (Panel C), and bank-level measures of systemic and market risk (Panel D). Treated executives are those 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 executives in the control group and (2) equal to the distance between ρ (maximum variable-to-fixed compensation) and 200% as of 2013 for treated executives. In Panel C and Panel D, *Treatment intensity* is the average treatment intensity of executives within a bank as of 2014 (based on those executives for whom $Post \times Treated = 1$, where *Treated* is the executive-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 6, Table 7, and Table 9. Included fixed effects are indicated below. 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)
Post × Treat. int.	0.137***	0.161***
	(4.12)	(5.93)
Bank and executive controls	X	X
Year fixed effects	X	X
Bank fixed effects	X	X
# Executives	115	115
# CEOs	31	31
# Banks	27	27
Mean(y)	0.110	0.085
S.D.(y)	0.313	0.279
R^2	0.227	0.261
N	493	493

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.	518.108***	-439.895***	-469.230	-1.109***	457.118**	-227.630**
	(3.00)	(-2.75)	(-1.48)	(-10.61)	(2.40)	(-2.08)
Bank and executive 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
Executive fixed effects	X	X	X	X	X	X
# Executives	185	185	170	170	143	148
# CEOs	47	47	46	46	39	41
# Banks	40	40	39	39	32	34
Mean(y)	974.042	366.336	1,093.340	0.922	1,418.317	1,422.447
S.D.(y)	673.606	727.518	1,676.682	0.835	1,421.163	1,322.288
R^2	0.813	0.760	0.887	0.883	0.905	0.890
N	913	913	777	779	646	661

Panel C: Return and credit 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.	-0.298**	-7.257	3.127	0.213***
	(-2.14)	(-0.86)	(0.67)	(4.35)
Bank fixed effects	X	X	X	X
Country-year fixed effects	X	X	X	X
# Banks	25	25	25	12
Mean(y)	0.041	-8.496	37.373	0.876
S.D.(y)	1.049	46.535	19.628	0.814
R^2	0.824	0.780	0.829	0.987
N	155	155	155	77

Panel D: Systemic and market risk

	Systemic risk			Market risk	
Dependent variable:	SRISK%	LRMES	ΔCoVaR	Beta	Corr.
	(1)	(2)	(3)	(4)	(5)
Post × Treat. int.	0.294***	3.399*	-0.132	0.134*	0.027
	(4.12)	(1.79)	(-0.08)	(1.88)	(1.11)
Bank fixed effects	X	X	X	X	X
Country-year fixed effects	X	X	X	X	X
# Banks	25	25	18	25	25
Mean(y)	2.057	51.377	23.092	1.459	0.469
S.D.(y)	2.491	10.729	9.939	0.435	0.121
R^2	0.987	0.852	0.913	0.835	0.892
N	155	155	109	155	155

Table A.13: 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), bank-level measures of return of and credit risk (Panel C), and bank-level measures of systemic and market risk (Panel D). Treated executives 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 executives in the control group and (2) equal to the distance between ρ (maximum variable-to-fixed compensation) and 100% as of 2013 for treated executives. In Panel C and Panel D, *Treatment intensity (100%)* is the average treatment intensity of executives within a bank as of 2014 (based on those executives for whom $Post \times Treated = 1$, where *Treated* is the executive-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 6, Table 7, and Table 9. Included fixed effects are indicated below. 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)
Post × Treat. int. (100%)	0.055**	0.056***
	(2.73)	(2.92)
Bank and executive controls	X	X
Year fixed effects	X	X
Bank fixed effects	X	X
# Executives	130	130
# CEOs	36	36
# Banks	32	32
Mean(y)	0.109	0.086
S.D.(y)	0.312	0.280
R^2	0.226	0.247
N	561	561

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 executive 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
Executive fixed effects	X	X	X	X	X	X
# Executives	200	200	185	185	158	163
# CEOs	52	52	51	51	44	46
# Banks	45	45	44	44	37	39
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: Return and credit 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. (100%)	0.045	4.022	-0.371	0.251**
	(0.43)	(0.77)	(-0.10)	(2.52)
Bank fixed effects	X	X	X	X
Country-year fixed effects	X	X	X	X
# Banks	30	30	30	17
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	0.817	0.969
N	189	189	189	111

Panel D: Systemic and market risk

	Systemic risk			Market risk	
Dependent variable:	SRISK%	LRMES	ΔCoVaR	Beta	Corr.
	(1)	(2)	(3)	(4)	(5)
Post × Treat. int. (100%)	0.405**	2.922**	0.151	0.117**	0.009
	(2.07)	(2.22)	(0.12)	(2.25)	(0.78)
Bank fixed effects	X	X	X	X	X
Country-year fixed effects	X	X	X	X	X
# Banks	30	30	23	30	30
Mean(y)	2.321	50.854	23.099	1.433	0.472
S.D.(y)	2.505	10.201	10.025	0.413	0.114
R^2	0.975	0.850	0.899	0.835	0.891
N	189	189	143	189	189

Table A.14: 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 executives of EU banks between 2010 and 2016. The dependent variables are executive turnover (Panel A), measures of executive compensation structure (Panel B), bank-level measures of return of and credit risk (Panel C), and bank-level measures of systemic and market risk (Panel D). Treated executives 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 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 executive 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 6, Table 7, and Table 9. Included fixed effects are indicated below. 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)
Post × Treated	0.166**	0.198***
	(2.35)	(3.25)
Bank and executive controls	X	X
Year fixed effects	X	X
Bank fixed effects	X	X
# Executives	130	130
# CEOs	36	36
# Banks	32	32
Mean(y)	0.109	0.086
S.D.(y)	0.312	0.280
R^2	0.224	0.249
N	561	561

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 executive 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
Executive fixed effects	X	X	X	X	X	X
# Executives	200	200	185	185	158	163
# CEOs	52	52	51	51	44	46
# Banks	45	45	44	44	37	39
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: Return and credit 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	-0.377*	-11.017	1.560	0.279***
	(-2.04)	(-1.02)	(0.27)	(4.09)
Bank fixed effects	X	X	X	X
Country-year fixed effects	X	X	X	X
# Banks	30	30	30	17
Mean(y)	0.025	-7.243	35.859	0.997
S.D.(y)	1.048	44.317	18.717	0.738
R^2	0.791	0.770	0.817	0.964
N	189	189	189	111

Panel D: Systemic and market risk

	Systemic risk			Market risk	
Dependent variable:	SRISK%	LRMES	ΔCoVaR	Beta	Corr.
	(1)	(2)	(3))	(4)	(5)
Post × Treated	0.435***	2.480	-0.284	0.078	0.051
	(6.33)	(1.19)	(-0.13)	(0.87)	(1.10)
Bank fixed effects	X	X	X	X	X
Country-year fixed effects		X	X	X	X
# Banks	30	30	23	30	30
Mean(y)	2.321	50.854	23.099	1.433	0.472
S.D.(y)	2.505	10.201	10.025	0.413	0.114
R^2	0.973	0.844	0.899	0.829	0.895
N	189	189	143	189	189

Paper 3:

Marginal Returns to Talent for Material Risk Takers in Banking

Marginal Returns to Talent for Material Risk Takers in Banking*

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Abstract

Economies of scale explain compensation differentials over time, across firms of different size, different hierarchy-levels, and different industries. Consequently, the most talented individuals match with the largest firms in industries where marginal returns to talent are greatest. We explore a new dimension of this size-pay nexus by showing that marginal returns also differ across activities within firms and industries. Using hand-collected compensation data on European banks, we find that the size-pay nexus is strongest for investment bankers and for banks with market-based business models. Thus, managerial compensation is most sensitive to size increases for activities that are easily scaled up.

JEL Classification: G21, G24, G34

Keywords: Banks, Business Models, Marginal Returns to Talent

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1 Introduction

Economies of scale are a central concept in economics. Rosen (1981) coined the term superstar economics to capture how two similarly high-skilled individuals earn vastly different fortunes, depending on the circumstances under which they put their talent to use. For a very long time, the finance literature has focused on a specific group of superstars, namely top-managers and CEOs of corporations. Intuitively, the impact of talented top managers will increase with the resources at hand. For instance, a smart financing strategy that allows for a decrease in capital costs has a larger absolute effect when implemented in a larger corporation.

Economies of scale can explain CEO compensation differentials across firms and over time. More recent evidence supports that scalability of talent also relates to cross-sector and cross-hierarchy differences in pay. The central contribution of our paper is to document that even within a sector with high returns to talent, the nature of tasks can explain compensation differences within firms and across business models.

The group of firms we chose as a laboratory for this endeavor are European banks. This group is of special interest to policymakers and scholars alike. First, it is a sector from which we know that high excess returns to talent can be attained (Philippon and Reshef, 2012). Second, several scholars have pointed out how excessive compensation could have lead to excessive risk-taking in the run-up to the financial crisis. Consequently, understanding compensation of bankers has been the focus of numerous studies (e.g. Bhagat and Bolton, 2014; Efing, Hau, Kampkötter, and Steinbrecher, 2015). We show that the compensation of material risk takers (MRTs), which is a group of managers in European banks that is much broader than just the group of executives, depends on the activities of the business unit they are located in. To that end, we use hand-collected data on MRTs' compensation across bank business units. We collected this data from reports mandated by CRD IV disclosure rules, which were implemented in 2014.

We find that total remuneration of MRTs in investment banking business units is much more sensitive to the size of the business unit than in retail banking and business units with supportive functions. On average, we find that for each percentage point increase in relative business unit size, investment bankers earn 1% more. We argue that the underlying factor explaining these differences is heterogeneity across business units in marginal returns to talent. According to Gabaix and Landier (2008), marginal returns to talent capture how strongly the effect of talent on project size translates into increasing firm profits. We hypothesize that retail banking exhibits relatively low marginal returns to talent relative to investment banking. Even the most talented retail banker has limited impact when giving out a loan and will mostly rely on standardized credit scoring models when deciding on whether or not to grant the loan. In contrast, the occasional failures of single traders causing huge losses are an example of the tremendous impact individual investment bankers can have on their banks' performance. More generally, an exceptionally talented investment banker can easily scale up the proceeds from her ingenious asset allocation, successful trading strategy, or savvy in closing M&A deals by tailoring her approach to the needs of the specific customer and the circumstances of the specific transaction.

We go on to show that these differences in marginal returns to talent across business units also matter for the prevalence of performance pay. Célérier and Vallée (2019) argue that marginal returns to talent should determine both total compensation and the degree of variable pay. We document that the ratio of variable-to-fixed compensation exhibits the same dynamics as total compensation regarding the relationship between size and pay in different business units. More specifically, we document that for each percentage point increase in relative business unit size, the ratio of variable-to-fixed compensation of investment bankers increases by 0.5% .

Our second contribution is to show that differences in marginal returns to talent do not only matter across different bank business units, but also across banks with different business models. We understand a bank's business model as the specific mix of activities a bank engages in. Our central business model measure compares the distribution of MRTs across the two opposite poles of a bank's range of activities, namely retail banking and investment banking, which represent traditional and non-traditional banking, respectively. We classify banks as market-focused if the ratio of MRTs in investment banking to retail banking is in the top quartile of the distribution. Using this approach, we show that MRTs in investment banking earn significantly more if they work in a market-focused bank. Investment bankers on average earn one third more in terms of total pay when their bank is market-focused, while the variable-to-fixed ratio is about 12% higher in such banks.

While the focus of our business model analysis is on the mix of activities, and here, especially on the specialization of banks, we also capture heterogeneity in the inner workings of a bank. To that end, we sum up all the MRTs in overhead, i.e., supportive functions, and relate them to the number of MRTs in the bank's profit centers, i.e., retail and investment banking. We classify a bank as low overhead if this ratio is below the sample median. We hypothesize that banks with low overhead tend to err on the side of growth in the trade-off between growth and safety, which is the central dichotomy in the model by Song and Thakor (2019) of bank culture. In the following, we use bank business model and bank culture synonymously since we regard them as two sides of the same coin. Indeed, we find that investment bankers earn even more in a market-focused bank if it is also characterized by low overhead. In the sense that low overhead can be regarded as a low degree of oversight and low bureaucratization, this result can be reconciled with a view of marginal returns to talent being higher in a setting, where talented bankers are less constrained in the scope of their actions.

Our third contribution can be regarded as a distilled version of the previous two tests. Presumably, marginal returns to talent play the greatest role among the high earners in a bank. The disclosure rules of CRD IV define high earners as those employees that earn more than EUR 1 mln. a year. If the type of activities are as important as we deem them to be, we expect to be able to explain variation in the number of income millionaires and their compensation with our business model classification. Indeed, we find that even after controlling for bank size, a bank's focus on market-based finance is a significant determinant of high earner compensation.

Our paper contributes to two different strands of the literature. First, it relates to the literature using economies of scale to solve two distinct but related puzzles in the literature on managerial compensation. The first puzzle is the marked increase in executive pay since the mid-1980s. The second one is why this increase has been especially pronounced in the finance industry. Building on the idea of concept of superstar economics by Rosen (1981), Gabaix and Landier (2008) point to the increase in firm size and the tight relationship between size and compensation as the central explanatory factor for the increase in CEO pay. They show how the marginal returns to talent for skilled CEOs are higher in larger firms, which leads to the most talented CEOs matching with the largest firms. This size-pay nexus can also be used to explain compensation differentials within firms, namely between employees at different hierarchy levels (Mueller, Ouimet, and Simintzi, 2017). Marginal returns to talent have also been employed to explain why top managers seem to earn a premium in the finance industry. Philippon and Reshef (2012) find that this premium has emerged only after the wave of deregulation in the mid 1980s. In the decades before, tight regulation had inhibited managers' scope of action and thus rendered differences in talent largely irrelevant. Célérier and Vallée (2019) argue that in addition to regulation, the immaterial nature of banks' input differentiates marginal returns to talent in finance from industries, where operations cannot be scaled up as easily. Our contribution is to document that marginal returns to talent do not only differ across firms, time, hierarchies, and industries but also across different types of activities as proxied by different bank business units.

Our analysis also relates to the literature on bank business models and in particular to the literature connecting business models and compensation. Song and Thakor (2019) devise a theoretical model of bank culture and show that manager incentive contracting serves to match managers and banks with similar preferences regarding the trade-off between safety and growth. Barth and Mansouri (2018) and Hagendorff, Saunders, Steffen, and Vallascas (2018) show empirically how differences in risk taking and incentive compensation can be explained via bank culture and idiosyncratic manager effects, respectively. Beyond the papers explicitly taking into account compensation, a host of papers uses a combination of various observables to cluster banks into distinct business models: funding and trading activity (Roengpitya, Tarashev, and Tsatsaronis, 2014), sources of income, funding, and activities (ECB, 2016), retail-focus and degree of diversification (Mergaerts and Vander Vennet, 2016), balance sheet composition and performance (Farnè and Vouldis, 2017), size, complexity, activities, geographic reach, funding, and ownership structure (Lucas, Schaumburg, and Schwaab, 2019). We contribute to this literature by using a new business model characterization based on the number of MRTs employed in different business units. This way we can explain variation in managerial compensation practices below the CEO-level, likely emanating from different marginal returns to talent for different types of activities.

2 Institutional setting

Bank compensation has been under intense regulatory scrutiny in the post-crisis years, which has resulted in a stream of regulations. Implementing the recommendations of the Financial Stability Board (FSB), the EU introduced the European Capital Requirements Directive (CRD) III in 2010. It regulates, among others, the minimum deferral of variable pay of bankers to better align risk-taking incentives with long-term performance.[1] The new directive was supposed to regulate the pay of all *staff whose professional activities have a material impact on the risk profile of credit institutions*, commonly referred to as *identified staff* or *material risk takers* (MRTs).

In 2013, the EU complemented the CRD III with a new directive, the CRD IV,

[1]Directive 2010/76/EU came into effect in 2011.

and an accompanying regulation, the Capital Requirements Regulation (CRR).[2] In the CRD IV, the EU introduced the so called bonus-cap which limited the ratio of allowed variable to fixed compensation for all MRTs (Colonnello, Koetter, and Wagner, 2020). Importantly for our purposes, the new set of regulations also required banks to disclose the number of MRTs and their total, fixed, and variable compensation at the aggregate level, split by business areas. In addition, banks have to disclose the number of high earners, i.e., employees earning above EUR 1 million, by payment bands of EUR 500,000. Banks have to identify MRTs based on qualitative criteria such as an employee's position (e.g. as a member of the management body or as the head of a material business unit) or the size of the loan portfolio under management by the employee and based on quantitative criteria such as the employee's total remuneration.[3]

3 Marginal returns to talent

The impact of managerial skills increases with the resources available in the situation where skills are put to use. Consequently, more skilled CEOs match with larger firms where they earn more as their marginal returns to talent are higher (Gabaix and Landier, 2008).

To structure our discussion on how the size-pay nexus varies across different activities within the finance industry, we follow the formalization of the mechanics of the size-pay nexus as presented by Célérier and Vallée (2019). Here, the firm's target function is described as:

$$T \times S^{\alpha} - S - w(T) \ , \tag{1}$$

where S is project size and $w(T)$ is the wage for a worker of talent T. The parameter α determines marginal returns to a manager's talent. Under the assumption of perfect competition at the labor demand side, firms compete for talented workers and workers have full bargaining power. Optimizing over project size S, the resulting wage takes

[2]Directive 2013/36/EU and Regulation 575/2013 both came into effect in 2014 and are commonly referred to collectively. Henceforth, we will adopt the common practice and refer to both regulations as the CRD IV.

[3]These criteria were specified in the Commission Delegated Regulation 604/2014, which in turn implemented recommendations from a technical document by the European Banking Authority (EBA), the EBA Regulatory Technical Standards 2013/11.

the form

$$\begin{aligned} & w(T) = T \times S_T^{*\alpha} - S_T^* \ , \\ \text{or} \quad & w(T) = T^{\frac{1}{1-\alpha}} \alpha^{\frac{1}{1-\alpha}} (1-\alpha) \ . \end{aligned} \tag{2}$$

From equation (2) we can see that marginal returns to talent are positive. Consequently, more skilled workers, i.e., those with higher values of T, earn higher wages. In line with Gabaix and Landier (2008), more skilled individuals match with occupations related to larger projects, i.e., larger values of S. The match between talent and size can ultimately be traced back to scale returns to talent, i.e., more skilled individuals will match with occupations with higher values of α.

Célérier and Vallée (2019) go on to assume that α varies across industries and that it is higher in the finance industry than in non-finance industries. Consequently, working in finance is rewarded with a premium based on higher returns to talent. We hypothesize that α does not only differ across industries but also within one industry across different activities. Thus, companies will value talent more when hiring workers in business units exhibiting higher returns to talent. At the same time, we conjecture that more skilled workers will select into business units with higher returns to talent.

In the context of the industry in our focus, i.e. the banking industry, we expect marginal returns to talent to MRTs to be higher in investment banking than in retail banking or overhead functions. Retail-banking is a low-margin activity generating fixed income streams. Profits are generated not from scaling up the activities of very talented individual retail bankers but rather by scaling up low-margin products like debit cards on a national or even international level. In contrast, individual talent plays a much larger role in the deal-oriented investment banking business. Here, a small number of very talented individuals can generate much higher returns to talent. For example, the same effort by a team of very talented investment bankers in M&A can generate vastly higher profits than a less talented team because the most talented M&A advisors attract clients with larger deal volumes, i.e., higher values of S. Hence, we expect more talented investment bankers to match with banks, where the investment banking business is more important, compared to other business units. Empirically, we would expect compensation to rise more strongly with increasing relative business unit size for material risk takers in investment banking units compared to other business units. This reflects higher marginal returns to talent, i.e., higher values of α in investment banking.

4 Business models

In the previous section, we laid out why the relationship between business unit size and material risk takers' pay should be stronger in investment banking across all banks. Still, the size-pay nexus for investment banking will not be the same across all banks. We expect that marginal returns to talent for investment bankers in banks with a particular focus on investment-banking should be even higher than in a bank with a similarly sized investment banking business unit but with a business model focused more on traditional banking such as retail banking. Grouping banks into different business models will thus help us to refine our analysis of heterogeneity in the strength of the size-pay nexus across banks and business units.

We define business models along the dimension of a bank's market focus. The two opposite poles regarding a bank's activities are investment banking, i.e., capital market-focused activities, and traditional retail banking (Gorton and Metrick, 2012). We determine a bank's market focus by relating the number of material risk takers in the investment banking business unit to the number of MRTs in retail banking. We consider banks in the middle of the domain, i.e, those with a less pronounced focus on either market-based or retail-based finance, as universal banks.[4]

While a bank's activities represent an outside view on its business model, we also want to use the inside view for our business model classification. To that end, we summarize all business units that are not the actual profit centers of a bank into an aggregate overhead business unit and compare the number of MRTs in overhead to the number of MRTs in the profit centers, i.e., retail- and investment banking. We assume that the relative weight of overhead functions like compliance, HR, and risk control reflects how much a bank relies on bureaucratization and control to rein in risk takers in profit centers and thus sheds light on a bank's self-positioning in the trade-off between safety and growth as described in Song and Thakor (2019). While we think that this is a reasonable assumption, we acknowledge that the weight of overhead functions could also to some degree reflect bank complexity, e.g. the complexity of a bank's corporate structure.

[4]Note that in our empirical analysis, we concentrate on either market- or retail focused banks. We do not estimate separate coefficients for universal banks as they constitute the reference group.

5 Empirical approach

5.1 Size-pay nexus across banks

In the first step of our analysis we investigate the relation between bank-size and the pay level of MRTs. In contrast to Gabaix and Landier (2008) who only look at CEOs, we analyze the compensation of below-CEO level employees, namely the MRTs. We implement this analysis running regressions of the following form:

$$y_{ijt} = \beta_1 s_{it} + \beta_2 s_{ijt} + \beta_3 n_{ijt} + \mathbf{1}\boldsymbol{f}_{it} + \epsilon_{ijt}, \quad (3)$$

where i, j, and t denote the bank, business unit, and year, respectively. Our MRT-level compensation measure, y_{ijt}, is the logarithm of the sum of total annual pay of all MRTs in a given business unit.[5] Our main independent variables are the size measures, s_{it} and s_{ijt}. We use the logarithm of a bank's total assets s_{it} to capture firm size. We complement the aggregate bank-level measure of firm size with a new measure of relative business unit size, s_{ijt}, which relates the number of MRTs in a given business unit to the total number of MRTs in the entire bank. By incorporating this measure into the analysis, we point out that it is not just the total size of a bank that determines pay-levels of employees, but also the relative importance of a business unit within a bank in which employees work. Like this, we prepare the ground for the second step of our analysis, which entails the analysis of heterogeneity in the size-pay nexus across different types of business units.

We argue that our MRT-based relative size indicator offers several advantages relative to measures based on bank financials or simple headcounts of all employees in a business unit. Our measure does not depend on the subjective process of identifying the accounting-based measure that most adequately reflects a business unit's size and it abstracts from non-essential employees, which do not necessarily inform on the relative importance of a business unit within a bank.

Since we are using the sum of total pay as a dependent variable, it is important to control for the (logarithm of) the absolute number of MRTs in a given business unit, n_{ijt}. Furthermore, we add different sets of fixed effects, f_{it}, which include time fixed effects, bank fixed effects, and business unit fixed effects. While bank fixed effects

[5]For cases where a bank does not report any information for one or more of the eight EBA business units, we assume that this business unit does in fact not exist in the given bank. When a given business unit comprises two EBA categories we split compensation and number of MRTs evenly across relevant EBA categories.

control for a bank's culture and business model, business unit fixed effects control for business-unit-specific compensation culture, e.g., general pay differences among MRTs in investment banking relative to MRTs in retail banking. Note that bank fixed effects encompass country fixed effects and thus control for unobserved time-invariant differences in bank compensation and reporting standards across countries.

5.2 Size-pay nexus across business units

We now turn to the heterogeneity of the size-pay nexus across business units. For this analysis, we aggregate the eight EBA business units to three business units to sharpen our analysis and to avoid overfitting. As we focus on key personnel below the management board, we exclude the EBA categories *management body in its supervisory function* and *management body in its management function*. These two categories do not constitute business units in the actual sense and their compensation is not comparable to the remaining business units.[6] Moreover, we exclude the business unit *asset management* due to the low number of banks within our sample, which have an asset management unit. Lastly, we summarize the business units *corporate functions*, *independent control function*, and the residual category *all other* in a new business unit, which we call overhead. As discussed in chapter 4, these business units do not represent a profit center but rather perform support and control functions. Thus, it is a natural choice to use the overhead business unit as the reference category in our regressions looking into heterogeneity across business units. We run regressions of the following form:

$$y_{ijt} = \boldsymbol{\beta}_1 \boldsymbol{b}_j + \beta_2 s_{ijt} + \boldsymbol{\beta_3} \boldsymbol{b}_j s_{ijt} + n_{ijt} + \boldsymbol{\lambda} \boldsymbol{c}_{it} + \boldsymbol{1} \boldsymbol{f}_{it} + \epsilon_{ijt}, \tag{4}$$

where i, j, and t denote the bank, business unit, and year, respectively. In addition to the dependent variable from Equation (3), the logarithm of the total pay of all MRTs in a given business unit, we now also look at a measure of variable pay, namely the aggregate ratio of variable to fixed compensation for all MRTs in a business unit. The vector b_j comprises indicator variables for the three business units retail banking, investment banking, and overhead. Our main variable of interest is the interaction of the business unit indicators with our business-unit-specific size measure, s_{ijt}, which is defined by the ratio of MRTs in a business unit over the total number of MRTs in a

[6] For example, in some banks and jurisdictions MRTs in the *management body in it supervisory function* only receive attendance fees for supervisory meetings and no variable pay.

bank as described further above. The coefficients in $\boldsymbol{\beta}_3$ capture the heterogeneity in the size-pay nexus across business units. The strength of each coefficient provides a measure for the marginal returns to talent, γ, prevalent in the respective business unit. We hypothesize that γ will be largest for the investment banking business unit, where we except the highest marginal returns to talent as laid out in Section 3. We also expect marginal returns to talent to increase the degree of performance pay. Thus, β_3 should be also highest for investment banking when using the variable-to-fixed compensation ratio as the dependent variable.

The bank-specific size measure (the logarithm of total assets), s_{it}, from Equation (3) has been relegated to the vector of bank-control variables, $\boldsymbol{c}_{it}$, which also comprises the return on average assets and the cost-to-income ratio as measures of profitability and efficiency, respectively. Moreover, we keep on controlling for the logarithm of the number of MRTs in a each business unit, n_{ijt}, to prevent that our effects are driven by simple mechanical correlations.

5.3 Size-pay nexus across business models

We further investigate if heterogeneity in marginal returns to talent also emanates from bank business models. The degree to which a bank resorts to non-traditional banking is captured by our market focus indicator, which relates the number of MRTs in the investment banking business unit to the number of MRTs in the retail banking unit. We divide the indicator into three categories so that bank-years in the upper quartile and bank-years in the lower quartile represent a high and low degree of market focus, respectively. Banks that fall into the middle category can be thought of as universal banks, which have a more even distribution of MRTs across business units, reflecting a business model balanced between traditional and non-traditional banking.

While the market focus indicator captures the banks profit centers, we also want to analyze how a high degree of overhead affects the size-pay nexus. To that end, we relate the number of MRTs in the aggregate overhead business unit to the number of MRTs in investment banking and retail banking. We dichotomize our indicator by setting it equal to one if the overhead share is below the median within our sample. A low overhead share would reflect a low degree of bureaucratization and overhead and thus a bank that tends to prefer safety over growth. By controlling for the cost-to-income ratio we make sure that a low overhead share does not simply reflect a high degree of efficiency.

In our analysis of business models we exclude the business-unit specific size measures, s_{ijt}, to prevent collinearity with the bank-year specific business model indicators. Apart from that, we employ the control variables and fixed effects structure from Equation (4), which leads to the following regression equation:

$$y_{ijt} = \boldsymbol{\beta}_1 \boldsymbol{b}_j + \beta_2 bm_{it} + \boldsymbol{\beta}_3 \boldsymbol{b}_j bm_{it} + n_{ijt} + \boldsymbol{\lambda c}_{it} + \mathbf{1} \boldsymbol{f}_{it} + \epsilon_{ijt}, \tag{5}$$

where the bank-year level business model indicator is denoted bm_{it}. First, we run regressions with only one of two business model measures interacted with the business unit indicators and then we run combined regression, where the main variable of interest is the triple interaction of market focus, low overhead, and the respective business unit indicator, i.e., retail banking or investment banking.[7] We hypothesize that total and variable compensation is highest for banks with a high market-focus and low overhead corresponding to a situation, where marginal risk takers in the business unit with the highest marginal returns to talent, i.e., investment banking, are least restrained by bureaucracy and oversight.

5.4 Size-pay nexus and high earners

We now turn away from MRTs to the analysis of high earners, which are defined as income millionaires. While the data that is publicly available is at the bank-level and therefore does not allow us an analysis of heterogeneity across business units, the high earners provide an ideal testing ground for the relationship between the size-pay nexus and a bank's business model. We would expect that the most important determinant for the number of high earners is the degree of a bank's market focus. We therefore run regressions of the form:

$$y_{it} = \beta_1 bm_{it} + \beta_2 s_{it} + \boldsymbol{\lambda c}_{it} + \mathbf{1} \boldsymbol{f}_{it} + \epsilon_{it}, \tag{6}$$

where i and t denote bank and year, respectively. Our dependent variable is either the number of high earners or the total pay of all high earners within a bank. Given that there is less heterogeneity and a lower number of observations in a bank-level setting, we favor power over the ease of interpretation and use a continuous version of the categorical market focus indicator from the previous chapter. Our business model measure, bm_{it}, is thus simply the ratio of the number MRTs in investment banking over

[7] Recall that the aggregate overhead business unit serves as the reference category

the number of MRTs in retail banking. Our coefficient of interest is the strength of the connection between a bank's market focus and the number and pay of high earners, captured by β_1.

Note that in specification (6), we explicitly report coefficient estimates of bank size s_{it}. This allows us to directly relate the nexus between business model and pay to the size-pay nexus. We would expect that bank size has a positive impact on the number of high earners, i.e. a positive and significant coefficient estimate β_2. If the impact of a bank's business model is also meaningful for its pay policies, we would also expect a positive coefficient estimate for bank business model, i.e. a positive and significant coefficient estimate β_1.

6 Data and summary statistics

We hand-collect data on MRTs and high earners in European banks over the period 2014 to 2018. As discussed in Section 2, the beginning of our sample period is defined by the implementation of regulatory publication requirements on MRT pay in the CRR. We restrict our data collection effort to the sample of 124 banks that took part in the 2014 EBA stress test.[8]

According to EBA guidelines, banks have to split up the information on their MRTs by eight business areas: i) *the management body in its supervisory function*, ii) *the management body in its management function*, iii) *investment banking*, iv) *retail banking*, v) *asset management*, vi) *corporate functions* (such as HR and IT), vii) *independent control functions* (such as risk management, compliance and internal audit), and the residual category viii) *all others*.[9] Moreover, the EBA guidelines require banks to disclose the number of high earners according to bins of 500,000 EUR.

We find information on MRTs and high earners in a wide variety of report types, predominantly in annual reports, special reports on compensation practices, and CRR reports. Most institutions base their disclosure on MRTs and high earners on the EBA templates, as discussed in Section 2. Figure A.1 and Figure A.2 show an example of a table for disclosure on MRTs and a table for disclosure on high earners, respectively. In those cases, where the categories in the MRT-table do not perfectly match the official EBA nomenclature of the eight business units listed in Section 2, we hand-match them

[8]See https://eba.europa.eu/risk-analysis-and-data/eu-wide-stress-testing/2014 for the list of institutions included. Among this group of banks, we find at least some information on MRTs and high earners for 95 institutions.

[9]EBA guidelines EBA/GL/2014/08

to the closest EBA category.

Table 1 depicts summary statistics for a collapsed version of our main dataset, i.e., a bank-year panel. Here, each bank-year observation carries all the information of the associated business units. Balance sheet variables and MRT variables are winsorized at the 1st and 99th percentiles. Refer to Appendix Table A.1 for variable definitions. In Table 2, we split the sample of banks based on our business model measure capturing the degree of market focus. The univariate evidence points in the direction of the hypothesis developed in Section 5, i.e., banks with a high market focus exhibit higher average pay of MRTs in all business units but especially in investment banking. Moreover, we observe higher numbers of high earners in banks with a stronger market focus. However, the stark differences in total assets highlight the need for the multivariate regressions featured in the following section.

In addition to the non-parametric evidence on the role of bank business models, we provide visual evidence on the size-pay nexus across banks and business units. Figure 1 exhibits the cross-sectional size-pay nexus. Depending on the size of the bank, MRTs in all business units tend to earn more, which arguably reflects higher marginal returns to talent in larger banks in line with Gabaix and Landier (2008). Figure 2 provides visual evidence regarding our main hypothesis from Section 2. The relationship between the size of the business unit, as gauged by our MRT-based size measure, and compensation of MRTs is strongest for investment banking. Again, this arguably reflects relatively higher marginal returns to talent in business units related to investment banking.

7 Results

7.1 Size-pay nexus across banks and business units

We examine the well-established size-pay nexus by first looking at the classical measure of size, namely bank total assets. In columns 1-3 of Table 3, we document that MRTs in larger banks command a significantly higher total salary. Since our dependent variable is measured at the level of MRTs in a business unit rather than simply looking at CEO pay, our results also corroborate Mueller et al. (2017)'s result that differences in marginal returns to talent also determine compensation differences within a bank. In columns 4-6, we show that our MRT-based size measure captures variation in the size-pay nexus above and beyond total assets. For each percentage point increase in the relative size of a business unit, we find a roughly 0.6% increase in total compensation. In all columns, we control for the number of MRTs in each business unit to make sure that our results are not simply driven by the mechanical relationship between the number of MRTs and the total aggregate pay of MRTs in the respective business unit. Note that our results hold across different sets of fixed effects that either control for time-invariant compensation culture in business units, banks or for the combination of both.

Next, we turn to the analysis of heterogeneity across business units. To that end, we interact our MRT-specific size measure with business unit indicators for investment banking, retail banking, and the aggregate overhead business unit. In columns 1-3 of Table 4, we again look at total pay of MRTs in each business unit and find evidence for our central hypothesis regarding the importance of marginal returns to talent. MRTs in investment banking earn significantly more than MRTs in the reference category (overhead) across three specifications controlling for time-varying factors at the bank-level, the number of MRTs in a business unit, and time-invariant compensation cultures at the business-unit and bank-level. The coefficient in column 3 suggests that for each percentage point increase in the relative size of the investment banking unit, we find a roughly 1.5% increase in total compensation, while the same effect is only 0.5% for MRTs in the overhead business units (the reference category).

At the same time, we do not find an effect for retail banking, which arguably reflects lower marginal returns to talent associated with the activities conducted in that business unit. In columns 4-6 of Table 4, we look at the ratio of variable to fixed pay of MRTs in each business unit. While we do not find an effect in the specification with business unit fixed effects only, in the remaining two specifications we find a positive compensation differential for MRTs in investment banking and only a weak positive effect for MRTs in retail banking. The results in Table 4 suggest that indeed marginal returns to talent, or γ in the terminology of Equation 1, are highest in investment banking, which leads to positive compensation differentials of MRTs in investment banking business units regarding both total and variable-to-fixed compensation.

7.2 Size-pay nexus across business models

Now we turn to the analysis of bank business models and test to what extent compensation is not only determined by heterogeneity in activities across business units but also by differences in the specialization in activities and the positioning in the trade-off between growth and safety across banks.

In Table 5, we interact our first business model measure, which captures the degree of a bank's market focus by relating MRTs in investment banking to MRTs in retail banking, with the business unit indicators. In columns 1-3, we find that banks with a market focus in the top quartile of the distribution exhibit significantly higher pay for investment bankers relative to MRTs in overhead, while we do not find a similar effect for retail banking. When looking at variable-to fixed compensation, the picture becomes even starker. Here, we find a significant positive effect for MRTs in investment banking if they work in a bank with a high market focus, while the variable-to-fixed compensation ratio is significantly lower for MRTs in retail banking.

While in the previous analysis we took the outside view at a bank's specialization in activities, we now examine the inside view of a bank's business model. We compare banks with different degrees of bureaucracy and oversight, proxied by the ratio of MRTs in overhead business units to MRTs investment and retail banking. In Table 6, we show that MRTs in investment banking in banks with below median bureaucracy and oversight command higher pay. However, the results only hold for the case of total pay and in the specification with business unit fixed effects. Apparently, the inside view alone does not give us enough power to find compensation differentials.

This is why in Table 7, we combine the inside and the outside view on a bank's business model in a triple interaction regression. In columns 1-3, we find that retail bankers and to an even larger degree investment bankers earn more in terms of total pay in banks with low overhead. The effect is magnified in banks whose business model is both characterized by low overhead and a high degree of market focus. The additional effect only exists for investment bankers. This confirms our hypothesis that MRTs engaging in activities with high marginal returns to talent command even higher pay when they are less constrained by bureaucracy and oversight. This result does not extend to the case of variable-to-fixed pay in columns 3-6. We do, however, find that MRTs in retail banking earn less variable pay when a bank is market-focused. This suggests that the degree of bureaucracy and oversight does not play a large role for bonus payouts relative to the specialization of a bank.

7.3 Size-pay nexus and high earners

Our analysis of high earners can be regarded as a distillation of the tests we have conducted so far. Income millionaires are a natural choice for an examination of the relationship between marginal returns to talent and compensation. We hypothesize that the specialization in activities a bank engages in is the key factor in determining the distribution of income millionaires across banks. Specifically, we want to test whether our business model indicator capturing the degree of a bank's market focus is able to predict the number and compensation of income millionaires even after controlling for bank size. In Table 8, we use the continuous version of our market focus indicator and compare its effect on the number of high-earners and their total pay with the effect of bank size. In panel A, we look at total pay and find that our business-model indicator trumps the influence of bank size as soon as we control for both bank and time fixed effects. We find the same dynamics when looking at the total number of high earners in panel B.

8 Conclusion

Economies of scale determine compensation across firms of different size, across different hierarchy levels, and across different industries. We explore a new dimension of the interplay between marginal returns to talent, scale, and managers' compensation by documenting heterogeneity in returns to talent in one sector, i.e., the European banking industry, along the specific types of activities in which institutions engage. More specifically, we investigate if pay structure patterns are compatible with differences in marginal returns to talent across different business units and across different business models.

We make use of hand-collect data on compensation of material risk takers, which is available due to post-crisis disclosure requirements. These data comprise information on pay of managers not limited to top management, and are split by business units.

We document that within larger business units, employees receive higher pay. This effect is especially pronounced for investment bankers. Talented retail bankers have little leeway to scale up talent, as their business is highly standardized. In contrast, investment bankers regularly work in small teams handling specific investment products, trading strategies, or M&A deals. Here, a talented banker can have a much larger impact on outcomes. Consequently, the impact of a talented investment banker on a specific project is scaled up relatively more with increasing project size.

We go on to show that compensation also depends on the specialization of a bank. We classify banks into business models along two dimensions. On the one hand, we look at the degree of market focus of a bank. On the other hand, we consider the importance of supportive and controlling overhead functions. We find that investment bankers earn more in market-focused banks. Pay for investment bankers is even higher at market-focused banks when the importance of overhead functions is low and investment bankers are less restricted in their freedom of action. Furthermore, the degree of market focus is also the central determinant of the number of high earners, i.e, those with annual income of more than EUR 1 mln., at the bank-level. In summary, we show that differences in marginal returns to talent associated with different activities within the banking industry are an important driver of compensation patterns for managers below the CEO level.

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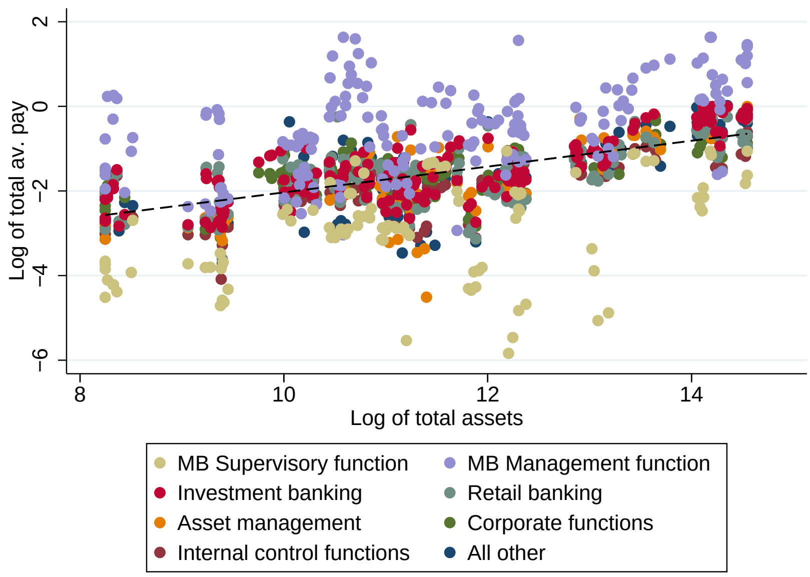

Figure 1: Size-pay nexus and bank size This figure visualizes the relationship between firm size, measured by the logarithm of total assets, and average compensation of MRTs in European banks over the period 2014 to 2018. Each dot represents the logarithm of total average pay of MRTs in a particular bank-year in one of the eight business units specified by the EBA. The black dashed line is a fitted regression line.

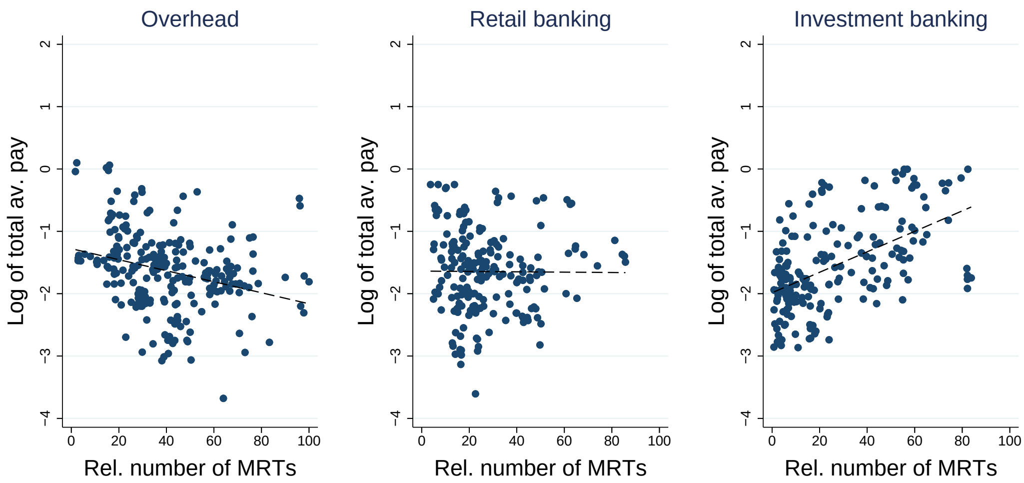

Figure 2: Size-pay nexus and business unit size This figure visualizes the relationship between business unit size and average compensation of MRTs in European banks over the period 2014 to 2018 in three different business units. Business unit size is proxied by the number of MRTs in each business unit relative to the total number of MRTs in the respective bank-year. Each dot represents the logarithm of total average pay of MRTs in a particular bank-year for the business units *overhead*, *retail banking*, and *investment banking*, respectively. The *overhead* business unit is an aggregate cateogry summarizing the business units *corporate functions*, *independent control function*, and the residual category *All Other*. The black dashed lines are fitted regression lines.

Table 1: Summary statistics

This table shows summary statistics for our European sample banks over the period 2014-2018. Both bank characteristics and business unit characteristics are reported at the bank-level. Refer to Appendix Table A.1 for variable definitions.

	N	Average	S.E.	p25	Median	p75
Bank characteristics						
Total assets (mln. EUR)	181	344,409.345	555,646.069	34,424.242	70,634.766	381,295.000
ROA (in %)	181	0.228	0.860	0.100	0.330	0.590
Cost-to-income ratio	181	0.649	0.197	0.553	0.622	0.716
Market-to-retail ratio	181	1.468	2.898	0.111	0.375	1.182
Overhead-to-profit-center ratio	181	0.358	0.177	0.229	0.332	0.467
MRT characteristics:						
Number of MRTs	181	436.729	609.121	74.000	158.000	534.000
Rel. BU size (overhead)	181	0.358	0.177	0.229	0.332	0.467
Rel. BU size (retail)	181	0.279	0.171	0.165	0.239	0.366
Rel. BU size (inv. banking)	181	0.188	0.208	0.030	0.098	0.283
Average pay of MRTs in inv. banking (mln. EUR)	181	0.248	0.253	0.083	0.167	0.305
Average pay of MRTs in retail (mln. EUR)	181	0.247	0.168	0.127	0.205	0.296
Average pay of MRTs in overhead (mln. EUR)	181	0.254	0.191	0.142	0.209	0.290
Total number of high earners	146	45.404	121.875	0.000	2.000	12.000
Total pay of high earners	146	83.176	230.153	0.000	3.750	21.500

Table 2: Summary statistics

This table shows summary statistics for our European sample banks over the period 2014-2018. Both bank characteristics and business unit characteristics are reported at the bank-level. Banks with market focus exhibit a market-to-retail ratio in the top quartile. Banks with retail focus exhibit a market-to-retail ratio in the bottom quartile. Refer to Appendix Table A.1 for variable definitions.

	Banks with market foucs				Banks with retail focus			
	N	Average	S.E.	Median	*N*	Average	S.E.	Median
Bank characteristics								
Total assets (mln. EUR)	46	911,091.430	723,478.530	545,479.000	46	73,338.307	123,253.520	37,525.342
ROA (in %)	46	0.153	0.401	0.260	46	0.228	0.706	0.360
Cost-to-income ratio	46	0.698	0.166	0.674	46	0.664	0.157	0.639
Market-to-retail ratio	46	4.857	4.187	3.315	46	0.023	0.037	0.000
Overhead-to-profit-center ratio	46	0.274	0.128	0.286	46	0.386	0.185	0.367
MRT characteristics:								
Number of MRTs	46	908.191	850.638	612.500	46	141.459	149.262	76.500
Rel. BU size (overhead)	46	0.274	0.128	0.286	46	0.386	0.185	0.367
Rel. BU size (retail)	46	0.146	0.071	0.138	46	0.377	0.224	0.295
Rel. BU size (inv. banking)	46	0.493	0.150	0.479	46	0.008	0.013	0.000
Average pay of MRTs in inv. banking (mln. EUR)	46	0.480	0.307	0.413	46	0.052	0.092	0.000
Average pay of MRTs in retail (mln. EUR)	46	0.359	0.190	0.329	46	0.194	0.078	0.192
Average pay of MRTs in overhead (mln. EUR)	46	0.351	0.224	0.275	46	0.196	0.086	0.203
Total number of high earners	43	126.349	196.723	20.000	33	2.242	3.437	0.000
Total pay of high earners (mln. EUR)	43	225.372	373.743	29.500	33	4.235	7.060	0.000

Table 3: Size-pay nexus for banks and business units
This table reports estimates from regressions of total pay of material risk takers (MRTs) on characteristics of banks and business units. The sample covers all business units for EU banks between 2014 and 2018 and has a bank-business unit-year structure. The independent variables are log(*BU size)*), which is the logarithm of the total number of MRTs by business unit, log(*Total assets*), which is the logarithm of total assets of a bank, and *Rel. BU size* (columns 4 to 6), which is the number of MRTs within a business unit over the total number of MRTs by bank. All columns include time fixed effects, columns 1, 3, 4, and 6 include business unit fixed effects and columns 3 and 6 include bank fixed effects. Robust standard errors are clustered at the level of banks and displayed in brackets below parameter estimates. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

Dependent variable:	log(Total pay)					
	(1)	(2)	(3)	(4)	(5)	(6)
log(BU size))	0.824***	0.850***	0.850***	0.764***	0.714***	0.771***
	(0.043)	(0.023)	(0.023)	(0.057)	(0.055)	(0.034)
log(Total assets)	0.356***	0.259	0.259	0.380***	0.250*	0.279*
	(0.047)	(0.157)	(0.157)	(0.053)	(0.136)	(0.147)
Rel. BU size (in %)				0.007**	0.007*	0.006***
				(0.003)	(0.004)	(0.002)
Time FE	X	X	X	X	X	X
Business unit FE	X		X	X		X
Bank FE		X	X		X	X
Mean(y)	1.592	1.592	1.592	1.592	1.592	1.592
S.D.(y)	1.732	1.732	1.732	1.732	1.732	1.732
R^2	0.872	0.936	0.936	0.876	0.849	0.938
N	1,086	1,086	1,086	1,086	1,086	1,086

Table 4: Size-pay nexus for retail vs. investment banking
This table reports estimates from regressions of total pay of material risk takers (MRTs) and the ratio of variable pay to fixed pay of MRTs on characteristics of banks and business units. The sample covers the business units overhead, retail banking, and investment banking for EU banks between 2014 and 2018 and has a bank-business unit-year structure. The independent variables are *Rel. BU size*, which is the number of MRTs within a business unit over the total number of MRTs by bank, *RB*, which is a dummy variable that takes the value of one if a business unit is related to retail banking, *IB*, which is a dummy variable that takes the value of one if a business unit is related to investment banking, and interactions of *Rel. BU size* and business unit indicators *RB* and *IB*. In all columns, we use log(*BU size)*), which is the logarithm of total number of MRTs by business unit, log(*Total assets*), which is the logarithm of total assets of a bank, *ROA* and *Cost-to-income ratio* as control variables. All columns include time fixed effects, columns 1, 3, 4, and 6 include business unit fixed effects and columns 3 and 6 include bank fixed effects. Robust standard errors are clustered at the level of banks and displayed in brackets below parameter estimates. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

Dependent variable:	log(Total pay)			log(Variable-to-fixed)		
	(1)	(2)	(3)	(4)	(5)	(6)
Rel. BU size	0.003	0.005***	0.005***	0.003	-0.000	-0.000
	(0.003)	(0.002)	(0.002)	(0.003)	(0.001)	(0.001)
RB × Rel. BU size (in %)	0.007	-0.000	-0.000	-0.001	0.002*	0.002*
	(0.005)	(0.003)	(0.003)	(0.004)	(0.001)	(0.001)
IB × Rel. BU size (in %)	0.016***	0.010***	0.010***	0.004	0.005***	0.005***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.001)	(0.001)
Time FE	X	X	X	X	X	X
Business unit FE	X		X	X		X
Bank FE		X	X		X	X
Controls	X	X	X	X	X	X
Mean(y)	2.256	2.253	2.253	0.288	0.288	0.288
S.D.(y)	1.787	1.789	1.789	0.343	0.343	0.343
R^2	0.956	0.987	0.987	0.448	0.811	0.811
N	498	496	496	498	496	496

Table 5: Size-pay nexus for high vs. low market focus
This table reports estimates from regressions of total pay of material risk takers (MRTs) and the ratio of variable pay to fixed pay of MRTs on characteristics of banks and business units. The sample covers the business units overhead, retail banking, and investment banking for EU banks between 2014 and 2018 and has a bank-business unit-year structure. The independent variables are *Market-focus*, which is an indicator variable that takes the value of minus one if a bank's market-to-retail ratio is in the bottom quartile within our sample, one if a bank's market-to-retail ratio is in the top quartile within our sample and zero otherwise, *RB*, which is a dummy variable that takes the value of one if a business unit is related to retail banking, *IB*, which is a dummy variable that takes the value of one if a business unit is related to investment banking, and interactions of *Market-focus* and business unit indicators *RB* and *IB*. In all columns, we use log(*BU size*)), which is the logarithm of the total number of MRTs by business unit, log(*Total assets*), which is the logarithm of total assets of a bank, *ROA*, and *Cost-to-income ratio* as control variables. All columns include time fixed effects, columns 1, 3, 4, and 6 include business unit fixed effects and columns 3 and 6 include bank fixed effects. Robust standard errors are clustered at the level of banks and displayed in brackets below parameter estimates. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

Dependent variable:	log(Total pay)			log(Variable-to-fixed)		
	(1)	(2)	(3)	(4)	(5)	(6)
Market-focus	-0.106	-0.101*	-0.101*	-0.017	0.019	0.019
	(0.089)	(0.054)	(0.054)	(0.045)	(0.058)	(0.058)
RB		-0.041			0.005	
		(0.034)			(0.010)	
IB		-0.018			0.069***	
		(0.054)			(0.025)	
Market-focus × RB	-0.031	-0.024	-0.024	-0.015	-0.031**	-0.031**
	(0.051)	(0.041)	(0.041)	(0.018)	(0.014)	(0.014)
Market-focus × IB	0.610***	0.331***	0.331***	0.203***	0.118***	0.118***
	(0.128)	(0.069)	(0.069)	(0.056)	(0.034)	(0.034)
Time FE	X	X	X	X	X	X
Business unit FE	X		X	X		X
Bank FE		X	X		X	X
Controls	X	X	X	X	X	X
Mean(y)	2.234	2.234	2.234	0.281	0.281	0.281
S.D.(y)	1.830	1.830	1.830	0.337	0.337	0.337
R^2	0.952	0.986	0.986	0.474	0.792	0.792
N	442	442	442	442	442	442

Table 6: Size-pay nexus for low vs high overhead
This table reports estimates from regressions of total pay of material risk takers (MRTs) and the ratio of variable pay to fixed pay of MRTs on characteristics of banks and business units. The sample covers the business units overhead, retail banking, and investment banking for EU banks between 2014 and 2018 and has a bank-business unit-year structure. The independent variables are *Low overhead*, which is a dummy variable taking the value of one if a bank's overhead-to-profit-center ratio is below the median within our sample, *RB*, which is a dummy variable that takes the value of one if a business unit is related to retail banking, *IB*, which is a dummy variable that takes the value of one if a business unit is related to investment banking, and interactions of *Low overhead* and business unit indicators *RB* and *IB*. In all columns, we use log(*BU size)*), which is the logarithm of total number of MRTs by business unit, log(*Total assets*), which is the logarithm of total assets of a bank, *ROA*, and *Cost-to-income ratio* as control variables. All columns include time fixed effects, columns 1, 3, 4, and 6 include business unit fixed effects and columns 3 and 6 include bank fixed effects. Robust standard errors are clustered at the level of banks and displayed in brackets below parameter estimates. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

Dependent variable:	log(Total pay)			log(Variable-to-fixed)		
	(1)	(2)	(3)	(4)	(5)	(6)
Low overhead	0.123	-0.031	-0.031	0.026	0.050	0.050
	(0.122)	(0.083)	(0.083)	(0.059)	(0.037)	(0.037)
RB		-0.026			0.023	
		(0.047)			(0.014)	
IB		0.019			0.108***	
		(0.056)			(0.038)	
Low overhead × RB	0.088	0.031	0.031	-0.006	-0.010	-0.010
	(0.062)	(0.052)	(0.052)	(0.026)	(0.021)	(0.021)
Low overhead × IB	0.353**	0.149	0.149	0.048	0.010	0.010
	(0.138)	(0.099)	(0.099)	(0.060)	(0.047)	(0.047)
Time FE	X	X	X	X	X	X
Business unit FE	X		X	X		X
Bank FE		X	X		X	X
Controls	X	X	X	X	X	X
Mean(y)	2.219	2.219	2.219	0.286	0.286	0.286
S.D.(y)	1.789	1.789	1.789	0.330	0.330	0.330
R^2	0.947	0.984	0.984	0.426	0.787	0.787
N	478	478	478	478	478	478

Table 7: Size-pay nexus along market-focus and overhead dimensions
This table reports estimates from regressions of total pay of material risk takers (MRTs) and the ratio of variable pay to fixed pay of MRTs on characteristics of banks and business units. The sample covers the business units overhead, retail banking, and investment banking for EU banks between 2014 and 2018 and has a bank-business unit-year structure. from 2014 to 2018. The independent variables are *Market-focus*, which is and indicator variable that takes the value minus one if a bank's market-to-retail ratio is in the bottom quartile within our sample, one if a bank's market-to-retail ratio is in the top quartile within our sample, and zero otherwise, *Low overhead*, which is a dummy variable taking the value of one if a bank's overhead-to-profit-center ratio is below the median within our sample, *RB*, which is a dummy variable that takes the value of one if a business unit is related to retail banking, *IB*, which is a dummy variable that takes the value of one if a business unit is related to investment banking, and interactions of *Market-focus*, *Low overhead*, and business unit indicators *RB* and *IB*. In all columns, we use log(*BU size*)), which is the logarithm of total number of MRTs by business unit, log(*Total assets*), which is the logarithm of total assets of a bank, *ROA*, and *Cost-to-income ratio* as control variables. All columns include time fixed effects, columns 1, 3, 4, and 6 include business unit fixed effects and columns 3 and 6 include bank fixed effects. Robust standard errors are clustered at the level of banks and displayed in brackets below parameter estimates. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

Dependent variable:	log(Total pay)			log(Variable-to-fixed)		
	(1)	(2)	(3)	(4)	(5)	(6)
Low overhead	0.089	-0.110	-0.110	0.026	0.046	0.046
	(0.129)	(0.079)	(0.079)	(0.065)	(0.038)	(0.038)
RB		-0.147***			-0.019	
		(0.052)			(0.020)	
IB		-0.190**			0.041	
		(0.072)			(0.045)	
Low overhead × Market focus	0.084	-0.060	-0.060	0.121	-0.083	-0.083
	(0.145)	(0.070)	(0.070)	(0.076)	(0.064)	(0.064)
RB × Low overhead	0.245***	0.168***	0.168***	0.037	0.040	0.040
	(0.076)	(0.058)	(0.058)	(0.026)	(0.030)	(0.030)
IB × Low overhead	0.282**	0.214**	0.214**	-0.016	0.025	0.025
	(0.108)	(0.084)	(0.084)	(0.056)	(0.050)	(0.050)
Market focus	-0.126	-0.052	-0.052	-0.074	0.075	0.075
	(0.107)	(0.067)	(0.067)	(0.044)	(0.083)	(0.083)
RB × Market-focus	-0.126*	-0.104	-0.104	-0.041***	-0.044***	-0.044***
	(0.075)	(0.064)	(0.064)	(0.014)	(0.015)	(0.015)
IB × Market-focus	0.394***	0.172**	0.172**	0.100	0.079*	0.079*
	(0.121)	(0.072)	(0.072)	(0.061)	(0.042)	(0.042)
RB × Market-focus × Low overhead	0.048	0.063	0.063	0.027	0.004	0.004
	(0.078)	(0.067)	(0.067)	(0.021)	(0.020)	(0.020)
IB × Market-focus × Low overhead	0.244*	0.274***	0.274***	0.119	0.074	0.074
	(0.136)	(0.094)	(0.094)	(0.079)	(0.045)	(0.045)
Time FE	X	X	X	X	X	X
Business unit FE	X		X	X		X
Bank FE		X	X		X	X
Controls	X	X	X	X	X	X
Mean(y)	2.234	2.234	2.234	0.281	0.281	0.281
S.D.(y)	1.830	1.830	1.830	0.337	0.337	0.337
R^2	0.958	0.987	0.987	0.500	0.796	0.796
N	442	442	442	442	442	442

Table 8: High-earners and relative importance of investment banking
This table reports estimates from regressions of outcomes at the level of high earners on firm size and business model characteristics. The sample covers all EU banks between 2014 and 2018 and has a bank-year structure. High earners is defined by regulation as staff earning more than one mln. EUR a year. In Panel A, the dependent variable is *Total pay of high earners* and in Panel B the dependent variable is *Total number of high earners.* The independent variables are log(*Total assets*), which is the logarithm of total assets of a bank, and *Market-to-retail ratio*, which is the ratio of material risk takers (MRTs) in investment banking over MRTs in retail banking. In all columns we use *ROA*, and *Cost-to-income ratio* as control variables. All columns include time fixed effects and all even columns include bank fixed effects. Robust standard errors are clustered at the level of banks and displayed in brackets below parameter estimates. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

Panel A: Total pay of high earners

Dependent variable:	Total pay of high-earners					
	(1)	(2)	(3)	(4)	(5)	(6)
log(Total assets)	66.518**	-12.603	52.076***	-65.748		
	(24.940)	(36.767)	(17.959)	(93.542)		
Market-to-retail ratio			21.769	11.868***	30.935*	11.197***
			(14.968)	(3.181)	(17.488)	(2.307)
Time FE	X	X	X	X	X	X
Bank FE		X		X		X
Controls	X	X	X	X	X	X
Mean(y)	79.626	84.450	79.626	84.450	79.626	84.450
S.D.(y)	225.383	231.504	225.383	231.504	225.383	231.504
R^2	0.305	0.948	0.395	0.953	0.259	0.952
N	153	144	153	144	153	144

Panel B: Total number of high earners

Dependent variable:	Total number of high earners					
	(1)	(2)	(3)	(4)	(5)	(6)
log(Total assets)	36.466***	-9.481	28.631***	-32.940		
	(13.043)	(20.172)	(9.383)	(45.399)		
Market-to-retail ratio			11.810	5.239***	16.849*	4.903***
			(7.509)	(1.434)	(8.937)	(1.008)
Time FE	X	X	X	X	X	X
Bank FE		X		X		X
Controls	X	X	X	X	X	X
Mean(y)	43.497	46.132	43.497	46.132	43.497	46.132
S.D.(y)	119.358	122.571	119.358	122.571	119.358	122.571
R^2	0.326	0.958	0.420	0.962	0.273	0.961
N	153	144	153	144	153	144

Appendix for
“Marginal Returns to Talent for Material Risk Takers in Banking”

	Managers and Board of Directors	Investment banking	Retail banking	Asset management	Support functions	Control function	Others	Total
Number of personnel identified	*23*	*328*	*232*	*23*	*92*	*80*	*4*	*782*
Of which number of personnel identified and deferred	*2*	*265*	*67*	*12*	*36*	*18*	*4*	*404*
Total remuneration	4.9	173.4	69.8	11.5	27.6	18.5	2.2	308.0
Of which fixed amount	3.2	87.6	45.4	6.0	18.1	12.7	1.2	174.1
Of which variable amount	1.8	85.9	24.5	5.5	9.5	5.8	1.0	133.9

Figure A.1: MRT-table from remuneration report, Crédit Agricole 2018 This figure shows an exemplary excerpt from a remuneration report complying with CRD IV disclosure rules on MRT-level compensation. Banks are required to report fixed and variable compensation and the total number of MRTs across different business units at yearly frequency.

Total remuneration	France	Europe (excluding France)	Rest of the world
Between €1,000,000 and €1,500,000	5	6	4
Between €1,500,000 and €2,000,000	1	1	1
Between €2,000,000 and €2,500,000	1	1	1
Between €2,500,000 and €3,000,000	1	-	1

Figure A.2: High-earners-table from remuneration report, Crédit Agricole 2018 This figure shows an exemplary excerpt from a remuneration report complying with CRD IV disclosure rules on the number of income millionaires or *high earners*. Banks are required to report the number of income millionaires within bins of 500,000 EUR.

Table A.1: Definition of variables

Variable	Databases	Definition
Bank-level		
Cost-to-income ratio	Bankscope and Bankfocus	Non-interest expenses over the sum of net interest income and other operating income.
Low overhead	Hand-collected	Indicator equal to one if a bank's overhead-to-profit-center ratio is below the median within our sample.
Market focus	Hand-collected	Indicator equal to minus one if a banks' market-to-retail ratio is in the bottom quartile in our sample, equal to one if a bank's market-to-retail ratio is in the top quartile and zero otherwise.
Market-to-retail ratio	Hand-collected	Ratio of a bank's total number of MRTs related to investment banking over total number of MRTs related to retail banking.
Overhead-to-profit-center ratio	Hand-collected	Ratio of a bank's overhead staff over total number of MRTs from investment banking and retail banking.
ROA	Bankscope and Bankfocus	Return on average assets.
Total assets	Bankscope and Bankfocus	Total assets.
Total number of high earners	Hand-collected	Total number of high earners, which are defined as staff that earning at least EUR 1 mln. a year.
Total pay of high earners	Hand-collected	Total pay of all high earners within a bank, which are defined as staff that earns at least EUR 1 mln. a year.
Business unit-level		
BU size	Hand-collected	Total number of MRTs in a business unit.
IB	Hand-collected	Indicator equal to one if a business unit is related to investment banking.
Rel. BU size	Hand-collected	Total number of MRTs in a business unit over total number of MRTs in a bank.
RB	Hand-collected	Indicator equal to one if a business unit is related to retail banking.
Total pay	Hand-collected	Total pay of material risk takers within a business unit.
Variable-to-fixed	Hand-collected	Ratio of total variable pay over total fixed pay within a business unit.

Paper 4:

Reverse Revolving Doors in the Supervision of European Banks

Reverse Revolving Doors in the Supervision of European Banks*

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Abstract

We show that the presence of executive directors with prior experience in the finance industry is pervasive on the boards of European national banking supervisors. Up to one executive out of three has previously held positions in the industry he/she supervises. Appointments of such executives impacts more favorably bank valuations than those of executives without a finance background. The proximity to supervised banks—rather than superior financial expertise or intrinsic skills—appears to drive the positive differential effect of finance-related executives.

JEL Classification: G14, G21, G28

Keywords: Revolving Doors, Banking Supervision, Conflicts of Interest

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1 Introduction

A remarkable flow of workers between banks and their supervisory authorities exists at all hierarchical levels, a phenomenon known as the *revolving door* (e.g., Lucca, Seru, and Trebbi, 2014; Shive and Forster, 2016). Several studies explore, theoretically and empirically, its implications for supervisory activity (e.g., Agarwal, Lucca, Seru, and Trebbi, 2014; Bond and Glode, 2014), but focus almost invariably on regulators seeking employment in the banking sector, possibly because of the media and regulatory attention (through, for instance, *cooling-off periods*) these moves attract. We make one step back and look at the opposite job flow, from supervised banks to their supervisors: the *reverse revolving door*.[1]

This phenomenon, just like the possibility for regulators to secure a position in the banking industry in the future, may alter regulation design and the effectiveness of supervision. On the one hand, former bankers may bring to the table their industry expertise, helping design better rules and enforce them more effectively. On the other, their lingering relationships with former colleagues may be conducive to cronyism and regulatory capture.

The trade-off posed by the reverse revolving door is scarcely scrutinized by the public and relatively underexplored in academic research. It is peculiar, for instance, that in the Federal Reserve System of the United States (US), the presence of bankers at the very top of supervisory institutions is enshrined in bylaws (e.g., Adams, 2017). The phenomenon is even less understood, both in its magnitude and implications, within the European Union (EU). We fill this gap by collecting curriculum vitae (CV) data on executive directors of banking supervisory authorities from selected EU countries, which offer a useful laboratory in which supranational and national institutions interact. After quantifying the pervasiveness of former bankers' presence at the top of such institutions, we assess their impact on supervised banks' value by means of an event study, which points to their friendliness towards the industry relative to supervisors with a civil-servant or an academic background.

More specifically, our manually-collected dataset features detailed information on the careers of the 190 executive directors serving on the boards of 14 national supervisors from the ten largest EU economies over the period 2002-2019. Levering such a dataset, we assess the magnitude of the reverse revolving door across Europe. Using

[1] Though uncommon, we are not the first to use this expression (e.g., Fang, 2013; Castellani and Dulitzky, 2018).

a broad definition of what constitutes a significant experience in the finance sector, the phenomenon involves up to 37.2% of the executives. Even restricting the definition to those individuals that previously held a managerial position in finance, the phenomenon appears to be important in most countries' institutions, although with notable cross-country and time variation. This is not the only facet in which national supervisors' executive hires display heterogeneity: we observe a divide between a group of countries (like France and Italy), where civil-servant profiles largely prevail, and others (like the United Kingdom and Sweden), where a more balanced mix in terms of public and private sector backgrounds is pursued.

To infer how personal links to the banking industry shape supervisory activity, we carry out an event study on bank stock returns around announcements of executive appointments. The average appointment is met with a significantly negative return in the range of -0.46% to -0.37% on the announcement day. The value-decreasing effect, however, is driven by executives without prior experience in the finance industry. Appointees with a finance background trigger no significant market reaction. Provided that both groups of executives inform supervisory activity with valuable (though different) technical know-how, we argue that proximity to supervised entities of former bankers underlies the result. We corroborate this conjecture by separately examining direct bank-executive links, where the proximity aspect is particularly pronounced. Consistently, appointments of this type are associated with positive stock price responses. In other words, based on investors' expectations, executives' industry proximity matters and leads to a differential valuation effect of finance- and non-finance-related appointments.

We narrow down the role of industry proximity by ruling out two important alternative explanations for our findings. First, investors may react more positively to finance-related appointments because these executives are intrinsically more skilled than the other ones. Whereas intrinsic skills are unobservable, existing theory and evidence suggests that the quality of the applicant pool of supervisors varies countercyclically, as banking becomes less attractive for talented individuals during downturns (Bond and Glode, 2014; Lucca et al., 2014). Put differently, after controlling for market-wide fluctuations, bank stocks should react more favorably to appointments made in recessions. We find no evidence of such a pattern. To the contrary, reactions are even more negative in bad times, possibly because of the anticipation of new executives' support of tougher enforcement actions during a crisis.

Second, most of the national supervisors in our sample are central banks, which are charged with numerous tasks. Out of the ten EU countries analyzed, only two do not belong to the eurozone, so, upon executive appointments, bank stock prices are unlikely to impound expected changes in monetary policy, which is in the hands of the European Central Bank (ECB). But it is still possible that appointments convey information about tasks other than banking supervision. To verify that we are indeed capturing investors' views about future supervisory activity, we exploit the introduction of the Single Supervisory Mechanism (SSM), which transferred supervisory powers over important banks (such as the ones in our sample) from national supervisors to the ECB. Consistently, the average market reaction to national supervisors' executive appointments turns insignificant in the post-SSM period.

All in all, our results suggest that the reverse revolving door in the boards of banking supervisory authorities is prevalent. Moreover, based on investors' expectations, former bankers differ from other executives by introducing a positive bias towards supervised banks. Detecting the presence (or absence) of such a bias in actual supervisory actions, though it exceeds the scope of this paper, is key to substantiate the consequences of the reverse revolving door.

This study contributes to the literature studying the relationship between banking supervisory authorities and supervised entities through the revolving door.[2] Lucca et al. (2014) characterize the trade-off posed by the flow of workers from the regulatory to the banking sector. This can lead to suboptimal outcomes if regulators soften their standards to enhance their future employability in the private sector ("quid-pro-quo hypothesis"). However, if regulators become more employable in banks by virtue of the expertise they acquire while in supervision, the revolving door may provide benefits for the financial system stability ("regulatory schooling hypothesis"). Lucca et al. (2014) provide evidence supportive of this second view for the US context. Shive and Forster (2016) show that US bank CEOs with a background in supervision are paid more and implement safer policies, also in line with the regulatory schooling hypothesis.

Whereas there is a substantial body of work on the effects of workers flowing from the regulatory to the banking sector, the consequences of the reverse revolving door are

[2] The revolving door is a pervasive phenomenon even outside banking, and specifically in any highly regulated industry. For instance, Cornaggia, Cornaggia, and Xia (2016) and Kempf (2020) analyze the revolving door among credit rating agencies, their client firms, and underwriting banks. Blanes i Vidal, Draca, and Fons-Rosen (2012) look at the flow of US federal government employees into lobbying, documenting that they can lever their personal connections in government to generate revenues. Luechinger and Moser (2020) illustrate that firms benefit from hiring former EU commissioners, especially if they recruit them shortly after they left office, in line with the intuition that what matters is their personal connections.

much less studied.[3] With regards to the US, the structure of Federal Reserve Banks' boards, in which one-third of the directors are nominated by member banks, is a useful setting to evaluate such consequences. Adams (2017) and Black and Dlugosz (2018) find that the appointment of a connected director benefits banks through supervisory forbearance and information advantage. Lim, Hagendorff, and Armitage (2019) find that, ceteris paribus, connected banks are less capitalized than non-connected ones, in line with a regulatory capture story. We add to the literature by documenting the existence of the reverse revolving door in EU national supervisors and by studying its valuation impact on supervised banks.

2 (Reverse) revolving doors and bank value

Our analysis evaluates the consequences for bank value of the previous work experience of appointees at the top level of supervisory authorities. More specifically, we study the appointments of individuals with a banking background against those of individuals with no such experience (e.g., academics, civil servants, etc.), where the former contribute to the reverse revolving door. To inform the empirical analysis, here we elaborate on the possible forces driving the market reaction to news about appointments to the executive board of supervisory bodies.

Before characterizing such forces, it is worth briefly sketching the rules governing the appointment of executive board members of national supervisors in Europe. The 2019 Bank Regulation and Supervision Survey maintained by the World Bank (see, e.g., Cihak, Demirgüç-Kunt, Peria, and Mohseni-Cheraghlou, 2013) provides a useful overview. Although heterogeneity in the specifics is present, the involvement of political authorities (e.g., the Head of State, Parliament) is observed across the board, justified by the legal responsibility of these supervisors towards public bodies. The procedures are invariably highly formalized and aimed at ensuring independence from political contingencies. In some instances, like Germany or the United Kingdom, appointments are made after hearing the recommendation of external experts. Term length (in years) generally ranges between five and seven years (except for Germany, where no maximum duration is defined), and in most countries only one or two terms are allowed. The

[3] However, a large literature investigates the value for financial firms of having personal relationships with the public administration. For instance, Acemoglu, Johnson, Kermani, Kwak, and Mitton (2016) shows that financial firms connected with Timothy Geithner experienced positive abnormal returns around the announcement of his nominee as Treasury Secretary. Lambert (2019) finds that lobbying banks are less likely to become subject to enforcement actions by their supervisors.

power to dismiss executive board members—though severely restricted to particular causes—lies with political authorities as well. Numerous supervisory authorities prevent executives from seeking employment in supervised banks after the end of their term through cooling-off periods, which effectively limits the revolving door.[4] By contrast, restrictions on the reverse revolving door, i.e., on the appointment of executives with a banking industry background, are hardly found.

Against this backdrop and abstracting from intrinsic skill differences driven by self-selection into regulation or banking, the effect of the appointment of an individual crucially hinges on his/her proximity to supervised entities (*bias*, for brevity) as well as on his/her technical knowledge about the banking sector and its regulation (*competency*, for brevity).

The personal and institutional connections established by an individual during his/her career could interfere with his/her supervisory "style". Although not necessarily representing cronyism, these connections may be conducive to regulatory capture, i.e., to decisions biased in favor of incumbents institutions (e.g., provision of private information, preferential treatment, etc.). Appointment of supervisors with close ties to the banking sector should be met with a positive reaction by bank investors.

Supervisors' competency helps effectively design and enforce rules on inherently complex matters. However, such knowledge may also translate into more timely detection and sanctioning of bank misbehavior. Put differently, the impact of supervisors' competency cannot be evaluated ex ante in isolation, but it crucially depends on the characteristics of the banking market. If it is highly competitive, one can expect that supervisors' competency will ceteris paribus overall benefit incumbent banks by preserving the efficiency of the system. By contrast, if the incumbent banks enjoy substantial (quasi-)rents, a regulator favoring competition and transparency will impose costs on such institutions (at least in the short-run), leading to a negative sector-level market reaction.

The interaction of supervisors' bias and competency determines the net effect on bank value of an appointment, as measured by investors' expectations. The mix of bias and competency, on average, is likely to vary with the background of the appointed professional. We are interested in teasing out such differences from investors' expectations concerning bankers that turn to the regulatory sector as opposed to other supervisory staff members, a residual category typically comprising civil servants who

[4]See Frisell, Roszbach, and Spagnolo (2009), who also provide a comprehensive on the governance of central banks, which in most countries hold banking supervisory powers.

rose through the ranks of the institution (or of the public administration) or academics. We hypothesize that former bankers are more likely than other regulators to entertain personal relations with employees of supervised banks.

It is instead difficult to form a prior on the competency distribution of the two groups of appointees. Whereas former bankers probably have a better knowledge of supervised entities, regulators without banking experience may better understand regulatory issues if their background is in the public administration. Former academics might have a better view of the system as a whole.

We thus expect the bias channel to be largely muted for supervisors without a banking background. At the same time, the sign of the difference in average competency (whose effect is ex ante ambiguous, as argued above) across the two groups of supervisors is unclear. To sum up, we conjecture that the market will react more positively to the appointment of former bankers.

Going back to differences in skills across the candidate pools of banks and regulators, the state of the economy is an important factor (Bond and Glode, 2014; Lucca et al., 2014). Most skilled individuals may prefer the higher compensation generally offered by the banking sector, especially during boom periods. Yet, these dynamics are plausibly more relevant for positions below the ones we consider. Executive board seats are highly prestigious roles, for which power considerations may matter just as much as—or even more than—mere monetary rewards. Thus, it is possible that bankers with rich careers might even decide to move on to the regulator, in order to obtain a prestigious executive role at the supervisor. In other words, unlike for entry- or middle-level positions in supervision, "brain drain" towards banks may not play a major role at the very top level. Nonetheless, in the analysis below we inspect the role of the business cycle to insulate the effect of across-group differences in bias and competency from self-selection effects.

3 Data

We collect data on the characteristics and career paths of executive board members of National Central Banks (NCBs) and National Central Authorities (NCAs) in charge of banking supervision in Europe starting from 2002 until 2019. We focus on competent authorities from the ten largest economies that were part of the European Union as of 2002: Austria (AT), Belgium (BE), Germany (DE), Spain (ES), France (FR), United Kingdom (GB), Ireland (IE), Italy (IT), Netherlands (NL), and Sweden (SE). Appendix

Table A.1 provides the list of national supervisory institutions included in our sample. For most countries (e.g., Italy and France), only one institution supervises the banking sector, but in others the duty is shared between two institutions (Austria, Germany, and the United Kingdom). We construct a comprehensive dataset on all the executive directors serving on the board of the covered supervisory institutions by manually collecting their career paths from CVs. The final sample features 190 directorships at 14 institutions, resulting in 1,255 director-year observations.

For each director, we retrieve information on the appointment by using the Bloomberg Professional Service (BPS) news search function, which includes news from different sources, such as newspapers, official press releases from central banks, and a proprietary news service. In this way, we are able to precisely determine the date (and the time of the day) when each appointment was announced to the market. Importantly, executive appointments are usually disclosed well in advance relative to the effective starting date, and in some cases on non-trading dates. Therefore, we check if a given announcement took place before or after market closing and/or during non-trading days.

As a result, we are able to identify the announcement dates of 124 appointments. Of these, 29 relate to the head of the executive body and 95 relate to other executive board members. In several instances, supervisory institutions appoint more than one executive at the same time. We exclude such multiple appointments from the analysis, because market reaction to them will reflect the heterogeneity in the background of the new directors, making it impossible to disentangle the impact of a specific type of career path (e.g., if one the same day a former banker and an academic are appointed). After this sample restriction, we are left with 74 announcements in our baseline specification (Table 4, columns 4 to 7): 33 appointments of directors with previous experience in the finance industry, and 41 without such experience. Among the former, we are able to identify 13 announcements in which the director has a direct link to one of the listed banks included in our sample.

To construct the bank sample, we start from the list of supervised entities under SSM as of year 2019 and the list of other systemically important institutions (O-SIIs) maintained by the European Banking Authority as of year 2019. Because the empirical analysis revolves around an event study around the relevant director appointment dates, we then select listed banks among them.[5] We then restrict the sample to those banks for

[5]This admittedly introduces a sample bias, because only few and generally large banks are public in Europe (with the partial exception of the United Kingdom). We thus typically estimate the effect

which we could find information on the board of directors in BoardEx, bank accounting data in Bureau van Dijk Bankscope and Bankfocus, and stock market data in BPS. We also collect bank credit default swap (CDS) market data from BPS (complemented with Thomson Reuters Datastream). The final sample consists of 44 banks.

Country-level data on local sovereign credit spreads and macroeconomic conditions are from BPS and Thomson Reuters Datastream, respectively.

To conduct the event study, we merge our unique sample on announcement dates of executive directors with bank-level data. Any executive appointment event at any national supervisor is relevant for the banks that it supervises. For example: executive appointments at the Bank of Italy are relevant for Italian banks but not for other countries' banks.

3.1 Summary statistics

Specific rules—as defined in bylaws and laws—and institutional culture govern and inform the operations of each supervisory authority, with ramifications on the selection of executive directors as well as on their activity. Before estimating the impact of director appointment on the value of supervised entities, we explore their prior experience and demographic traits across institutions and throughout time. For each individual, we observe his/her prior experience, education background, age, and gender.[6] Moreover, we examine how these characteristics change with the state of the business cycle. In this way, we obtain a prima facie assessment of the regulatory sector attractiveness relative to banking and get a sense of the across-sector differences in directors' intrinsic skills.

By means of simple summary statistics, in Table 1 we draw a comparison of executive directors at supervisory authorities (Panel A) as opposed to those at supervised banks (Panel B). Most executive directors of supervisory authorities have prior public sector experience, but only 40.3% have experience in the private sector, while only 29.2% have prior management experience in the finance industry. The opposite holds for bank directors. Conditional on having private sector experience, 92.3% (= 37.2%/40.3%) of supervisors held positions in the finance sector, similarly to bank directors. The average director in regulation has held 3.3 positions before being ap-

of top regulators' appointments on value from the perspective of dominant players in their economies. Therefore, based on the discussion in Section 2, it is plausible that highly competent regulators oriented towards introducing more competition in the banking system affect negatively these banks.

[6]Note that for bank directors we do not observe several traits (e.g., the subject of university studies) because they are not provided by BoardEx.

pointed executive director or president of a national supervisor, a number considerably lower than the 15.2 spells of bank directors. The lower number of previous spells of regulators is not only a mechanical consequence of their more limited private sector experience, but it is likely to capture their lower inherent job mobility, which has been already documented by Lucca et al. (2014) in the US context. Indeed, the internal career path is frequent in the regulatory sector: 40.6% of directors in our sample held previous management positions below the board-level in the same institution. This is consistent with the intuition that a career in regulation requires accumulating highly specific human capital, which makes switching occupation particularly costly. A second factor favoring internal progressions (and low mobility) may relate to the risk preferences of professionals choosing to begin their career in regulation: these are arguably risk-averse individuals who highly value the job and income security offered by supervisory authorities.

Aggregate summary statistics may mask substantial variation across supervisory institutions and throughout time. Figure 1 visualizes such heterogeneity for management experience. Rising though the ranks is frequent among boards of supervisors from Austria, Belgium, Germany, Spain, Italy and Netherlands. This is especially striking for Banca d'Italia, where all but one of the executives had prior internal experience before appointment. With regards to prior private sector experience, this is more frequent in Austria, Germany, Spain, Great Britain, Netherlands and Sweden. In these countries, we observe that at least one executive had prior experience in the private sector. All in all, there appear to be relevant differences in director selection among countries: some—like France and Italy—show a strong bias towards public sector appointments, others—like Great Britain—exhibit more balanced boards in terms of prior experience. Nontrivial variation in the background of appointees is also present within institutions through time, but no clear pattern emerges in this case.

These statistics also provide an assessment of the reverse revolving door. Across all national supervisors, as noted above, 37.2% of executives have a background in the finance industry, which we can interpret as as an upper bound for the magnitude of the phenomenon. Indeed, an earlier job in the finance industry could matter little if, for instance, it was an entry-level position held at very beginning of the executive's career or it was in a non-bank financial institution (e.g., in asset management or insurance) not subject to the same supervisor. Thus, 29.2% of executives at supervisors that have prior management experience in the finance industry can be considered as a lower bound for the magnitude of the phenomenon. Managerial positions, instead, usually come with a dense network of personal connections likely to influence the executive's supervisory conduct. We thus take the fraction of executives with prior managerial experience in the finance industry as a lower bound of the magnitude of the reverse revolving door. Figure 1 displays a prominent degree of heterogeneity across national supervisors. Executives with such an experience are almost invariably present in German, Spanish, British, Dutch, and Swedish institutions, constituting between a fifth and half of those boards. And even for other countries' institutions, executives with managerial experience in the finance industry are observed for relatively long periods, with the exception of the Central Bank of Ireland. Despite its simplicity, this analysis points to the importance of reverse revolving door at the top of banking supervision institutions.

Among executive directors at supervisory institutions, the most common education background is in economics or related subjects (69.6%), with a sizable minority whose highest degree is in law (29.4%). The highest degree is a Ph.D. for 52.2% of the individuals in supervision, as opposed to 14.5% of bankers. Cross-country differences in terms of education and academic background exist. For each country, Figure 2 visualizes the fraction of executive directors with an academic background (as proxied by holding a Ph.D. title) and of those with a finance background (as proxied by presence at least one spell in the finance industry in the CV) in supervisory institutions. In most countries, the former group exceeds the latter, with France being the notable exception.[7]. Moving to the subject of university studies, Figure 3 documents that executives with an economics background outnumber those that studied law in all covered institututions, except for France (Banque de France) and Germany (Deutsche Bundesbank and Bundesanstalt für Finanzdienstleistungsaufsicht).

With regards to demographic traits, executive directors are on average older (58.6 vs. 54.1 years) and more likely to be female (18.3% vs. 6.9%) in supervision than in banking. As shown in Figure 4, executives are oldest at Banca d'Italia and Banco de España, whereas most institutions exhibit an increasing trend in term of female board representation.

The state of the economy may influence the inflow of top officers at the institutions in our sample. Table 2 compares the characteristics of newly appointed executives at national supervisors (Panel A) and supervised banks (Panel B), distinguishing between non-recession (columns 1-4) and recession years (columns 5-8). New hires' traits are

[7] None of the executives at Banque de France in our sample holds a Ph.D. title, but most of them are from so-called *grandes écoles*, i.e., elite schools. See, for instance, Célérier and Vallée (2019) for further details on the French education system in relation with the finance industry.

remarkably stable throughout the cycle in banks. Differences are more marked in the case of national supervisors. Two observations are especially noteworthy: recession hires are more likely to be internal (61.3% vs. 32.7%) and less likely to have private sector experience (29.0% vs. 48.7%). This naïve evidence corroborates the conjecture that business cycle dynamics matter less for positions at the very top of supervisory and supervised institutions than for below-executive level positions like those studied by Lucca et al. (2014). National supervisors do not appear to face more severe retention issues during boom periods, as an intake of less experienced directors would witness. If anything, and acknowledging the limits of a comparison based on few observable traits, the quality of the intake seems to worsen in recessions, when banking sector ought to be less appealing. In other words, the labor market dynamics theorized by Bond and Glode (2014) do not seem to extend to top executives, positions whose attractiveness is largely determined by the power and prestige they come with. This reduces concerns that any heterogeneity observed in market reactions to the appointment of executives of national supervisory institutions is purely the byproduct of unobservable time-variation in the skills of the candidate pool.

Finally, Table 3 reports summary statistics for the sample of supervised banks. Included banks are listed and generally large. We are able to observe CDS spreads for around 60% of the observations.

4 Results

We investigate how bank shareholders value the announcement of executive director appointments to the board of national supervisors by estimating pooled event study regressions of this form:

$$r_{i,t} = \alpha + \sum_{\tau=-k}^{k} \beta_\tau \cdot \mathbb{1}_{\{c_i,t-\tau\}} + \gamma \cdot r_{ES50,t} + \eta_i + \eta_m + \epsilon_{i,t}, \tag{1}$$

where r_{it} is the stock market return of bank i on trading day t (calendar time). $\mathbb{1}_{\{c_i,t-\tau\}}$ is an indicator variable equal to one if on trading day $t-\tau$ an executive appointment is made by a supervisory authority of country c_i, where bank i is based. k defines the width of the event window over which we estimate abnormal returns (ARs). In our preferred specification we set $k = 5$, but we also assess the sensitivity of estimates to narrower and wider windows. In complementary tests, we define indicators for more specific appointment events by conditioning on the work background of incoming executives.

To filter out the effect of market-wide fluctuations, we control for $r_{ES50,t}$, the daily return on the Stoxx Europe 600 index. We then progressively saturate specification (1) with bank (η_i) and month-year (η_m) fixed effects, which account for time-invariant, unobservable differences across banks and for time-variation in macroeconomic conditions, respectively. We cluster standard errors at the bank level.

We are interested in estimating the set of parameters β_τ, where $\tau = [-k, k]$. Each parameter estimate $\hat{\beta}_\tau$ measures the average AR across all events for day τ around the executive appointment: $\overline{\text{AR}}[\tau]$. We can compute the average cumulative AR (CAR) between day τ_1 and day τ_2 as $\overline{\text{CAR}}[\tau_1, \tau_2] = \sum_{\tau=\tau_1}^{\tau_2} \beta_\tau$. Note that ARs are defined relative to all periods outside of event windows between 2002 and 2019, which constitute the estimation window. In additional tests, we verify the robustness of our results to using a more restrictive definition of the the estimation window.

It is worth noting that, except for the United Kingdom and Sweden, our sample comprises national supervisors from the eurozone between 2002 and 2019. Therefore, even if many of the covered national supervisors are NCBs, these are part of the Eurosystem and not directly in charge of monetary policy, whose responsibility is with the ECB. Bank stocks' reactions to executive board appointments by such NCBs are unlikely to reflect concerns about future interest rate setting (or other levers of monetary policy), providing a credible measure of investors' expectations about supervisory activities.[8] To support this conjecture, we explore how market reactions to new executives change around the introduction of the SSM, which transferred supervisory powers from national supervisors to the ECB.

Table 4 shows coefficient estimates for equation (1), considering the whole sample of executive appointments. In columns 1 to 3, irrespective of the width of the event window, results suggest that executive appointments are met with significant negative event-day ARs averaging at around -0.46%. A similar effect is observed on the subsequent trading day, with an estimated $\overline{\text{AR}}[+1]$ ranging between -0.38% and -0.44%. However, once we control for the Stoxx Europe 600 return in column 4, only the finding on the event-day is confirmed, and with a slightly smaller magnitude of around -0.38%. This result remains robust even after including bank and month-year fixed

[8]NCBs generally have other functions, besides monetary policy and banking supervision (e.g., operating the payment system, providing banking services to public administration, etc.). However, we argue that bank stocks are most likely to react to information about supervision upon the appointment of a new executive, because other NCBs' powers are either of limited relevance for supervised banks or come with relatively little discretion.

effects in columns 5 and 6. In none of the specifications, $\overline{\text{AR}}[-1]$ is statistically or economically significant, pointing to a lack of anticipation effects about the appointments, which corroborates the validity of our empirical setting. Moreover, $\overline{\text{CAR}}[-1,+1]$ is negative and statistically significant in each case, with a magnitude between -0.90% and -0.54%.

The negative value impact of national supervisors' executive appointments—though possibly just reflecting market participants' increased uncertainty about the national supervisor's future course of action—is hard to interpret. Pooling together all appointment events, indeed, is useful to confirm that this is relevant news for the market, but conflates the effects of executives' bias and competency.

4.1 The reverse revolving door

To gain insights about the importance of the economic forces at play, we proceed by distinguishing appointments based on the background of the designated executive. Contrasting market reactions to appointments of individuals with a finance background against the others supplies an indication on the bank valuation effects of the reverse revolving door.

In Table 5, we separately re-estimate specification (1) for specific types of appointment. In columns 1 and 2, we only consider executives without prior experience in the finance sector (41 events). No matter the fixed effects structure included, the average event-day AR is negative and statistically significant at the 1%, and—though mitigated—the effect persists in the subsequent trading day. Similarly, Adams (2017) documents a negative market reaction to appointments of non-banker directors to the boards of Federal Reserve Banks in the US. $\overline{\text{CAR}}[-1,+1]$ ranges between -0.80% and -0.90%, and is also statistically significant at the 1% level. By contrast, in columns 3 and 4 we do not find any significant effect when we concentrate on executives with a finance background (33 events).

We further shed light on the economic magnitude of the revolving door phenomenon by investigating its overall impact on market capitalization. In this back-of-the-envelope exercise, we focus on the banks in our sample representing the French banking sector—BNP Paribas, Crédit Agricole, and Société Générale. For these three banks, the levels of cumulative abnormal returns imply a total loss in market capitalization of on average EUR 1 bln. per event over our sample period.

As argued in Section 2, the different market reaction to these two groups of executives likely reflects their different degrees of proximity towards supervised institutions (bias), as both groups bring to the table useful technical knowledge (competency). Hence, this is evidence consistent with the intuition that finance-related executives disgruntle less bank shareholders because they are expected to be more friendly. And it is even more remarkable, because, by looking at all executives with a significant finance background, we have considered a very broad definition of reverse revolving door. Put differently, many of these individuals could be "false positives": for instance, they may have held only a low rank banking position at the very beginning of their career, with very limited repercussions on the supervisory style relative to peer executives without such an experience.

To better quantify the role of supervisory bias, in columns 5 and 6 we restrict the analysis to 13 appointments of executives who held a position in at least one the supervised bank in our sample. To ensure that we flesh out bias in the cleanest way, we impose that announcement days of those appointments are an event only for the 15 banks with a direct CV link, i.e., all other banks are assumed not to be affected. We uncover a positive and statistically reaction, with an estimated $\overline{\text{AR}}[0]$ of around 0.47%. $\overline{\text{CAR}}[-1,+1]$ is instead insignificant, suggesting that information is fully impounded into stock prices at disclosure. The reaction we find, while indicative of bias, is weaker than the one observed by Adams (2017) and Black and Dlugosz (2018) for appointments of banker directors to Federal Reserve Banks' boards. This discrepancy in magnitude could relate to the different board structure and appointment rules of European and US supervisory authorities. The presence of bankers is ingrained in Federal Reserve Banks' boards: three out of nine directors (Class A directors) are directly elected by member banks and represent their interest. In Europe, executive directors are usually nominated through a political process and not directly by the supervised banks, which could limit the ability of former bankers to influence supervisory decisions once designated.

4.2 The role of the business cycle

Abstracting from the possible existence of a competency differential between finance-related and other executives,[9] the more negative value effect of the former may be

[9] Above we conjecture that on average this is probably not the case, because both types of executives contribute useful (yet different) know-how. Executives with a finance background have a better understanding of the inner working of supervised entities, whereas executives with a civil servant profile are more knowledgeable about the intricacies of the supervisory process.

explained by factors other than bias. The most prominent alternative explanation is that executives without a finance background have lower intrinsic skills, over and above their competency and bias. Oftentimes, as seen above, these are individuals that rose through the ranks of the national supervisors, so the skill differential may be traced back to the different quality of the candidate pools for junior positions in supervision as opposed to banking.

This story relates to inherently unobservable traits of executives. Therefore, we test it indirectly by building on the intuition that the candidate pool quality for jobs at national supervisors is countercyclical: in bad times, the attractiveness/availability of supervisory positions relative to banking ones increases. In other words, were our findings driven by lower intrinsic skills of executives with a civil servant career track, we would expect market reactions to appointments to be less negative in recession than in other periods, due to the inflow of more skilled bankers.

In Table 6, we augment specification (1) with interaction terms of *Appointment* (τ) indicators with a recession indicator defined at the country-year level. In each specification both event-day ARs and CARs are significantly lower in recessions, when the human capital flowing into the regulatory sector should be of higher quality. Such a recession effect is robust to controlling for stock market conditions as well as to bank and month-year fixed effects. Hence, this is at odds with the idea that the negative market reaction to non-finance-related executive appointments is driven by their lower intrinsic skills. Note that we see a higher share of internal hires and lower shares of hires with industry experience in recessions in Table 2. One explanation for this result could be that the negative returns that are associated with hires outside of people without a finance background are more pronounced because of an altered hiring policy in economically challenging times.

However, two caveats about this indirect analysis are in order. First, based on observable traits, we do not find evidence of an increased flow of finance specialists or, more generally, of professionals with diverse job experiences into executive boards of national supervisors, possibly because we only look at top jobs in supervision (see Table 2). In other words, the countercyclical pattern in hiring quality hypothesized by Bond and Glode (2014) is not clear in our dataset. But this does not necessarily invalidate our business cycle test, because the unobservable skills of new executives may well vary countercyclically. Second, the size of the sample of appointments made during recessions is limited. As a consequence, in Table 6 we do not distinguish directors based on their background, because that would greatly limit the statistical power of our tests and make them highly sensitive to single observations. Hence, we are not directly testing how the value of finance-related directors varies through the business cycle.

Despite these shortcomings, the more negative reaction to executives nominated during recessions provides support to the role of bias as a driver of the value differential between finance-related appointees and the others.

4.3 The role of the SSM

In Fall 2012, the Economic and Financial Affairs Council (ECOFIN) reached a landmark agreement that established the SSM. Under the agreement, banking supervision for significant banks—like all the banks in our sample except for the ones from Great Britain and Sweden—came under the direct supervision of the ECB, whereas national supervisory authorities maintained direct supervision, in collaboration with the ECB, over the remaining banks.[10] The launch of the SSM provides us with a useful testing ground. A comparison of market reactions to executive appointments before and after the introduction of the SSM is informative about the extent to which our main results actually relate to the supervisory activity of the executives, or to other activities of which the institutions in our sample (mostly NCBs) are in charge. If market participants are concerned about banking supervision, our results should be driven by the pre-SSM period.

Table 7 reports coefficient estimates for specification (1) for the pre- (columns 1 and 2) and the post-SSM period (columns 3 and 4). To discriminate between the pre- and post-SSM period, we use two events: (i) the agreement on June 29, 2012 by Eurozone leaders on the establishment of the SSM (odd columns) or the (ii) the enforcement of the SSM on November 3, 2014 (even columns). We observe significantly negative $\overline{\text{AR}}[0]$ as well as $\overline{\text{CAR}}[-1,+1]$ for appointment made during the pre-SSM period. By contrast, the effect of appointments is generally insignificant in the post-SSM period. This findings corroborate the idea that, upon executive appointments by national supervisors, the market reactions pertain to expectations about about supervisory stance rather than about other areas of activity of the executive board.

Moreover, the SSM can provide insights into supervisory bias and competency of executives, as it arguably constitutes a negative shock to the former, and a positive shock to the latter. Carletti, Dell'Ariccia, and Marquez (2020) theoretically show that

[10]Significant banks are those with total assets above of EUR 30bln or above 20% of national GDP.

central supervisors (like the ECB) are less reluctant to intervene because of lower intervention cost. There are at least two channels through which intervention costs are reduced and thus supervision would became stricter when shifting from national supervisors to a central supervisor. First, the central supervisor has more resources to allocate to supervision and a higher ability to attract and retain talented regulators. Second, regulatory capture and ability of supervised banks to influence the supervisor is impaired.[11] Extant evidence on banking supervision supports the prediction that switching from local to central supervisors implies stricter supervision. More specifically, Agarwal et al. (2014) uncover differences in supervisory intensity between local and central supervision in the US, illustrating that geographic proximity to the bank is associated with more lenient supervision. With regards to the European context, Fiordelisi, Ricci, and Stentella Lopes (2017) find that, anticipating stricter supervision under the SSM, significant banks shrank their balance sheets through deleveraging and decreased lending to a greater extent than less significant banks.

Executive appointments to the boards of national supervisors are of little use to tease out the value effect of the SSM and disentangle the role of bias and competency in supervision. To this end, we conduct a comprehensive event study of announcements related to SSM implementation. As in any regulatory event study, the major challenge is to insulate the effect of the regulatory shock of interest from that of other news disseminated around the same date (see, e.g., Schäfer, Schnabel, and Weder di Mauro, 2015; Bruno, Onali, and Schaeck, 2018). By means of an in-depth news search on BPS, we identify the 18 most relevant SSM-related announcements, starting from June 29, 2012, when the EU leaders agreed on the establishment of the SSM.[12] The process ended when the SSM came into force on November 4, 2014.

Table 8 reports estimated bank stock market reactions for the identified events. Because the significance of $\overline{\text{AR}}[-1]$ for several events signals the presence of non-trivial anticipation and post-event effects, we focus on $\overline{\text{CAR}}[-1,+1]$ for the interpretation of the overall reception by investors. We start by looking at announcements related

[11]The ECB supervisory board is composed by a Chair, a Vice-Chair and other four ECB representatives, plus one representative for each national supervisor of a member state. Within this board composition, a national supervisor has a limited ability to influence supervisory decisions. Moreover, according to Carletti et al. (2020), the internal governance of a central supervisor that coordinates local supervisors that implement its standards can create frictions in the information collection process. If central supervision is stricter for supervised banks, the local supervisor has less incentives to collect information under centralization because it fears that the information collected can be used to take an action that it dislikes.

[12]We carefully check whether each of these announcement took place before or after the market close, and assign it to the relevant trading day accordingly.

to the institutional architecture and procedures of the SSM. We detect positive and statistically CARs for the Vice President speech on the banking union (September 7, 2012), the landmark agreement on the establishment of the SSM (December 13, 2012), and the disclosure of the criteria adopted to identify significant banks (December 14, 2012). Negative and statistically significant CARs are obtained for the start of the ECB comprehensive assessment (October 23, 2013), the disclosure of the SSM regulatory framework (April 25, 2014), and the start of the SSM (November 4, 2014). The CARs suggest that at the beginning the stock market rewarded the implementation of a common architecture for banking supervision. The sentiment turned negative when the market perceived that regulation and supervision was going to be more intrusive under the ECB, thus entailing a cost for supervised banks. Such a shift in sentiment is broadly consistent with the intuition that a central supervisor tends to be less friendly towards banks.

With regards to the three events related to director appointments at the SSM (December 16, 2013; January 9, 2014; January 22, 2014), we find a positive and statistically significant $\overline{\text{CAR}}[-1,+1]$ only for the appointment of four directors in the new Directorates General for supervision (January 9, 2014). Of these four directors, two had prior experience in the finance industry, which again is suggestive of a positive valuation effect of the reverse revolving door.

4.4 The consequences for debtholders

Bank debtholders are likely to be affected by composition of the national supervisor's board, especially when that has an impact on bailout probabilities. To verify debtholders' reaction to executive appointments, we look at bank-level credit risk, as measured by spreads on CDS spreads on senior unsecured debt (available for 34 banks). Provided that these CDS contracts are written on arm's length, unsecured debt claims not protected by deposit insurance schemes, we expect to observe similar effects as those observed for bank stock returns.

Table 9 re-estimates equation (1) using daily change in CDS spreads as the dependent variable. To filter out market-wide fluctuations, besides including the Stoxx Europe 600 return in the specification, we also control for the credit spread paid by the sovereign issuer of the country where the bank is based. Anticipation and post-announcement effects in CDS spreads appear to be present, therefore we concentrate on the $\overline{\text{CAR}}[-1,+1]$ to interpret market reactions. Columns 1 and 2 consider the whole sample of events. In line with the results of Table 4, $\overline{\text{CAR}}[-1,+1]$ is statistically significant and ranges between 1.20% and 1.29%.

We then distinguish appointment events by the background of the executive. Evidence is supportive of the baseline findings in Table 5: $\overline{\text{CAR}}[-1,+1]$ is significantly positive for appointments of executives without finance industry experience (columns 3 and 4), but marginally significant (or insignificant after the inclusion of month-year fixed effects) and economically small for finance-related executives (columns 5 and 6). The results on the appointments of executives that previously held a position in at least one of our supervised banks are also overall consistent with the stock return analysis (columns 7 and 8)

4.5 Further tests

To further verify the robustness of our main results, we re-estimate the baseline regressions using two alternative approaches.

First, we repeat the analysis of Tables 4 and 5 by performing an event study in event time. More specifically, we restrict the estimation window to 50 trading days before and after each announcement, which significantly reduces the number of no-news trading days in the sample. Results in Appendix Table A.3 are supportive of the main findings. The only relevant difference with respect to the baseline is that $\overline{\text{CAR}}[-1,+1]$ turns insignificant when considering the whole sample of appointment announcements.

Second, we perform tests akin to those of Table 5, but including in the same specification two sets of appointment indicators: (i) for finance-related appointments, and (ii) for all other appointments. In this way, we can conveniently evaluate if the effects differ in a statistically significant way between the two types of appointments. Table A.4 reports the estimation results, which confirm that a negative and significant $\overline{\text{AR}}[0]$ is exclusively related to the designation of executives without a background in the finance industry. The average difference in CARs between finance-related and other appointments ($\overline{\Delta\text{CAR}}[-1,+1]$) is statistically significant and ranges between 0.53% to 0.79%.

5 Conclusion

The flow of workers between banks and their supervisory authorities has ramifications on the effectiveness of regulation design and enforcement, posing a trade-off between the cross-sector transfer of knowledge it favors, and the risk of regulatory capture personal connections may create. Available evidence is mostly US-based and focused on the (adverse) incentives induced by individuals moving from the supervisory sector to supervised banks. We contribute by shedding light on the opposite flow in Europe: bankers securing positions in supervisory institutions.

We assemble a comprehensive dataset on the careers of executive directors of national banking supervisory authorities from selected EU countries. We show that the reverse revolving door is prevalent for such top positions: around one executive out of three has prior experience in the finance industry, and many of them at managerial level.

We go on to infer the consequences of such a phenomenon for supervisory activity. To this end, we perform an event study on bank stock returns around appointments of executives to the board of the competent supervisory agency. The average market response is negative, but significantly more favorable when the selected executive has a finance background. Further tests confirm that the force driving the positive differential effect of an industry connection is the proximity to supervised banks of those executives, rather than their financial know-how or intrinsic skills.

To sum up, former bankers are present across the board at the top of EU national banking supervisors. And market participants perceive their presence (and background) as a non-negligible determinant of supervisory activity. This evidence calls for further research on the impact of the reverse revolving door on *actual* supervisory actions and financial stability.

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Figure 1: Management experience in the boards of national banking supervisors
This figure shows what fraction of executive directors of national banking supervisors from selected EU countries has prior management experience between 2002 and 2019. The positive domain of the y-axis visualizes a decomposition of prior management experience into internal positions (light blue), public sector positions (dark blue), and any other position (grey). The positive domain of the y-axis visualizes a decomposition of prior management experience into finance sector positions (light red), private sector positions (light green), and any other position (grey). Both in the positive and negative domain of the y-axis positions are grouped in progressively more restrictive sets, so that, for instance, finance sector background is a subset of private sector experience, which in turn is a subset of management experience.

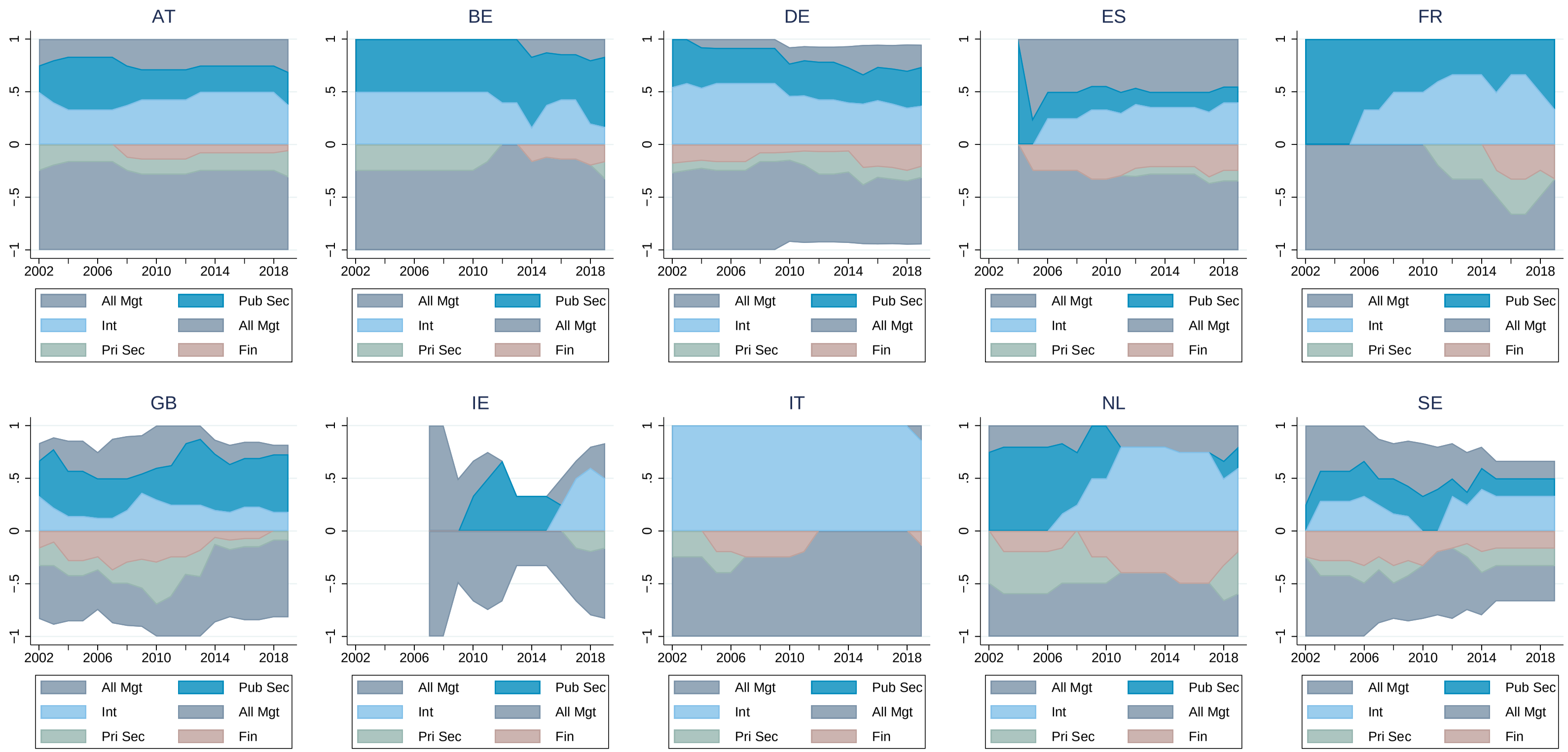

Figure 2: Academic background and finance industry background in executive boards of national banking supervisors

This figure shows what fraction of executive directors of national banking supervisors from selected EU countries has an academic (positive domain of the y-axis, in green) or a finance sector background (negative domain of the y-axis, in grey) between 2002 and 2019. A board member is categorized as having an academic background if he/she holds at least a Ph.D. title, whereas he/she is categorized as having a finance sector background if he/she had at least a position in a financial institution (also below management level).

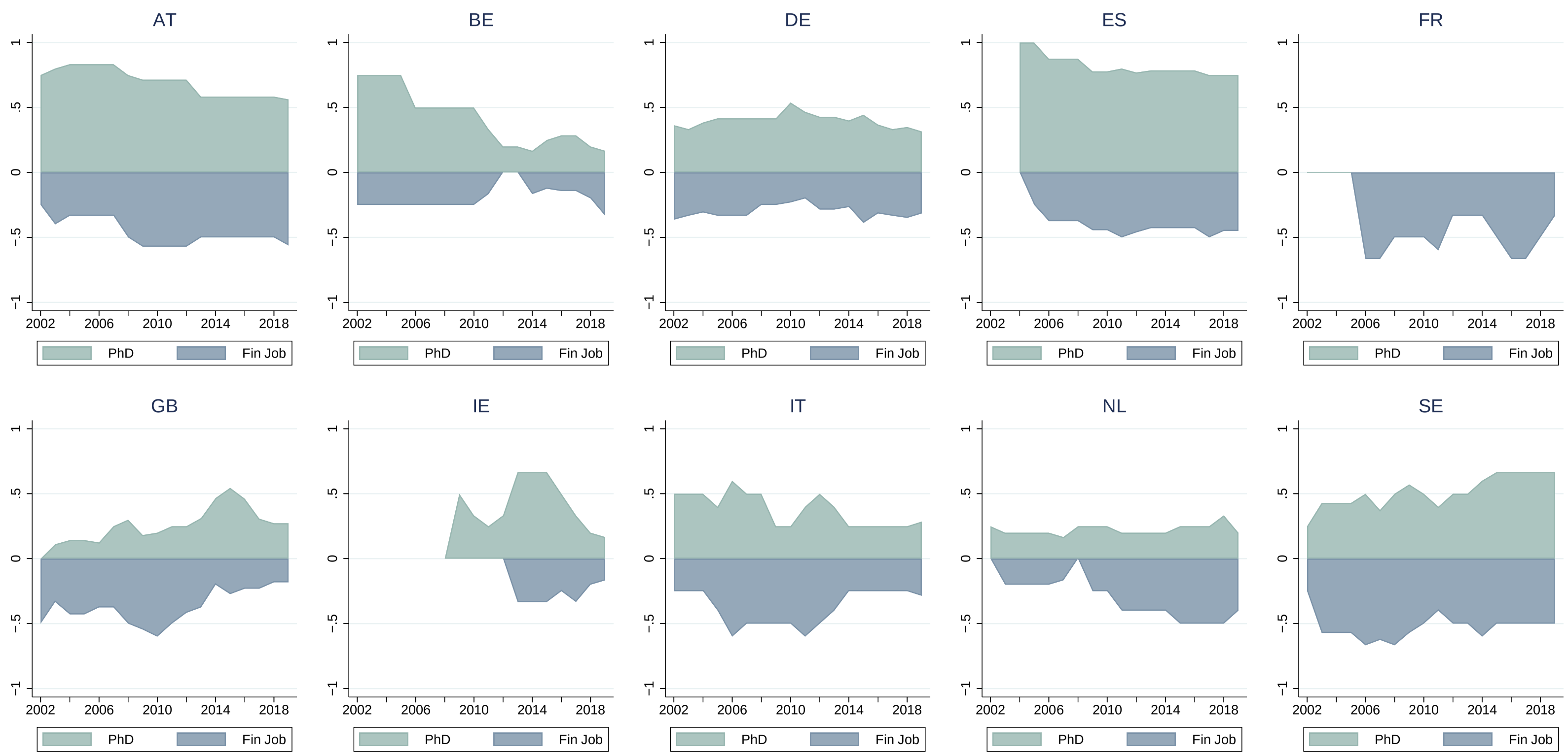

Figure 3: Education background in executive boards of national banking supervisors
This figure shows what fraction of executive directors of national banking supervisors from selected EU countries has an education background in economics (positive domain of the y-axis, in brown) or law (negative domain of the y-axis, in green) between 2002 and 2019. A board member is categorized as having an education background in economics if he/she studied economics, finance, business, or completed an MBA program.

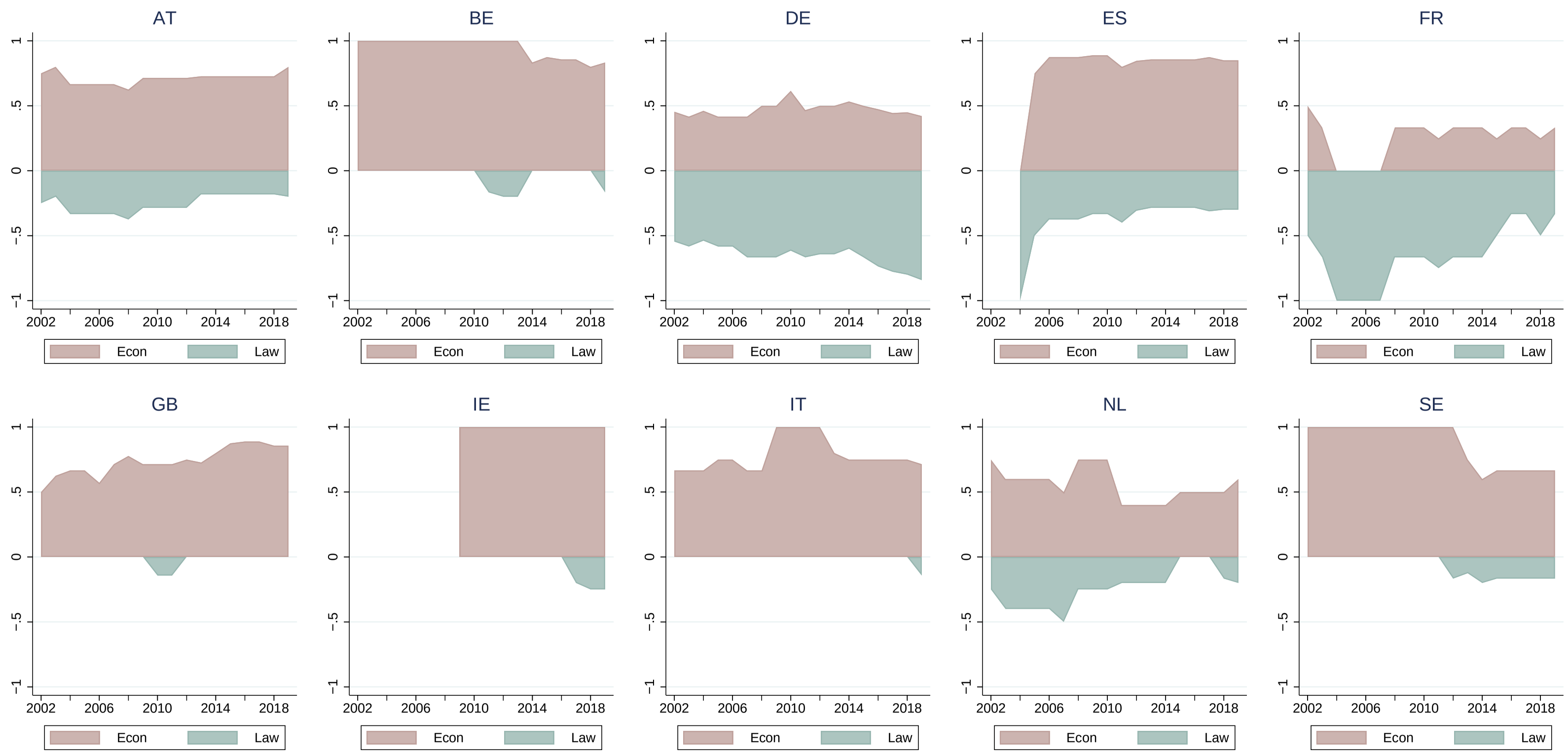

Figure 4: Demographic characteristics in executive boards of national banking supervisors
This figure shows the dynamics of selected demographic traits of executive directors of national banking supervisors from selected EU countries between 2002 and 2019. The red line indicates the share of female directors. The green line indicates the average age of newly appointed executive directors.

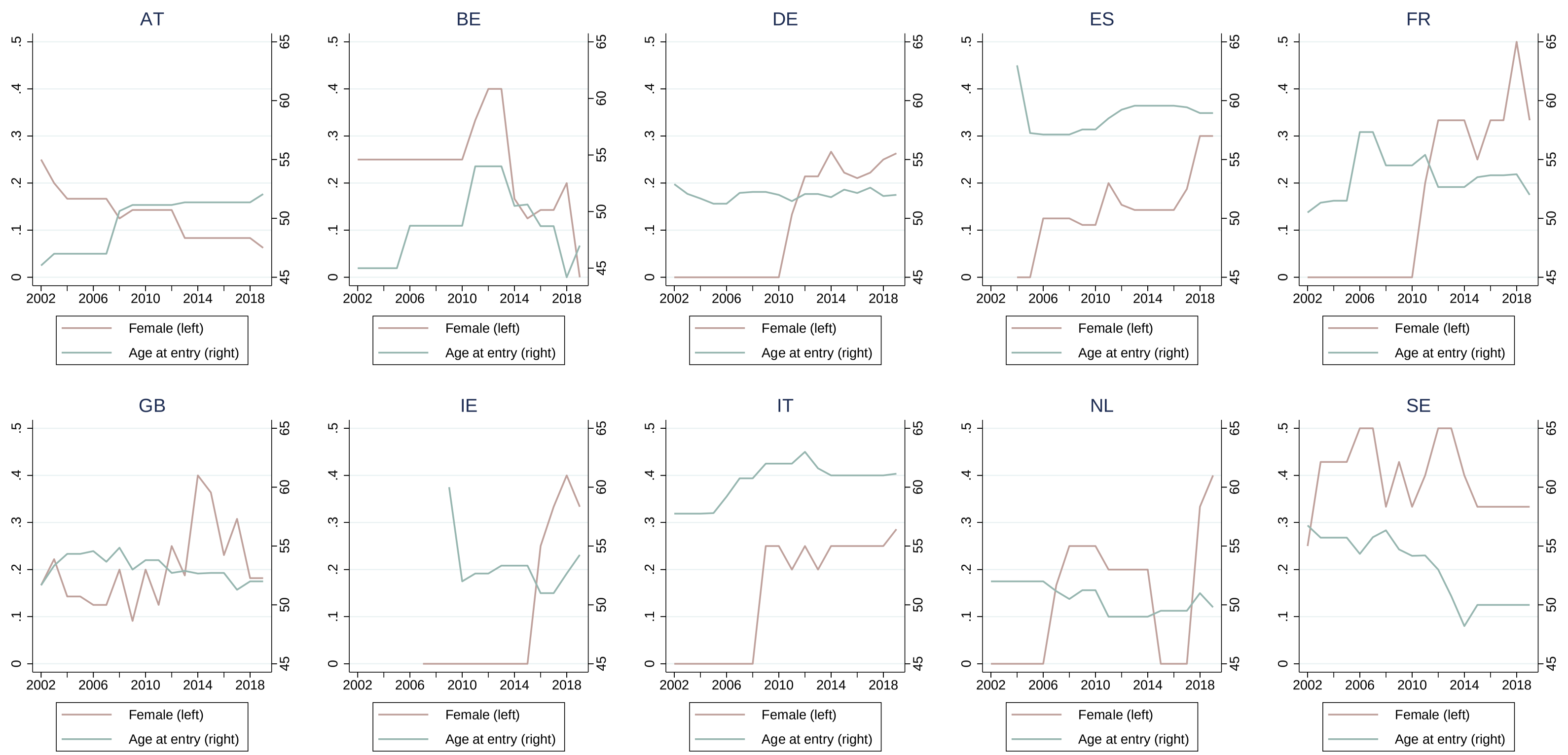

Table 1: Characteristics of executive directors
This table reports summary statistics on work experience, education, and demographic traits for a sample of executive directors serving on the board of national banking supervisors (Panel A) or supervised banks (Panel B) from selected EU countries between 2002 and 2019. Information on career paths refers to the positions held by each individual as of the time of appointment to the executive board. Refer to Appendix Table A.2 for variable definitions.

Panel A: National supervisors

	N (1)	Mean (2)	S.D. (3)	p25 (4)	Median (5)	p75 (6)
Management experience						
Prior management position	1,255	0.947	0.223	1.000	1.000	1.000
Prior management position in finance industry	1,255	0.239	0.427	0.000	0.000	0.000
Prior management position in the same institution	1,255	0.406	0.491	0.000	0.000	1.000
Public sector experience						
Prior employment in the public sector	1,255	0.912	0.284	1.000	1.000	1.000
Prior management position in the public sector	1,255	0.722	0.448	0.000	1.000	1.000
Private sector experience						
Prior employment in the private sector	1,255	0.403	0.491	0.000	0.000	1.000
No. prior spells in the private sector	1,255	3.253	5.678	0.000	0.000	5.000
Prior employment in the finance industry	1,255	0.372	0.484	0.000	0.000	1.000
No. prior spells in the finance industry	1,255	0.917	1.565	0.000	0.000	1.000
Education						
Economics	1,162	0.696	0.460	0.000	1.000	1.000
Law	1,162	0.294	0.456	0.000	0.000	1.000
Holds a Ph.D.	1,255	0.522	0.500	0.000	1.000	1.000
Demographics						
Age	1,170	58.563	7.679	53.000	59.000	64.000
Female	1,255	0.183	0.387	0.000	0.000	0.000

Panel B: Banks

	N (1)	Mean (2)	S.D. (3)	p25 (4)	Median (5)	p75 (6)
Management experience						
Prior management position	4,861	0.985	0.120	1.000	1.000	1.000
Prior management position in finance industry	4,861	0.983	0.131	1.000	1.000	1.000
Prior management position in the same institution	.	.	.	.	.	.
Public sector experience						
Prior employment in the public sector	4,861	0.215	0.411	0.000	0.000	0.000
Prior management position in the public sector	4,861	0.011	0.104	0.000	0.000	0.000
Private sector experience						
Prior employment in the private sector	4,861	1.000	0.000	1.000	1.000	1.000
No. prior spells in the private sector	4,861	15.295	9.777	8.000	13.000	20.000
Prior employment in the finance industry	4,861	0.997	0.054	1.000	1.000	1.000
No. prior spells in the finance industry	4,861	13.283	8.383	7.000	12.000	18.000
Education						
Economics	.	.	.	.	.	.
Law	.	.	.	.	.	.
Holds a Ph.D.	4,861	0.144	0.352	0.000	0.000	0.000
Demographics						
Age	4,713	54.110	8.149	48.000	53.000	59.000
Female	4,855	0.069	0.254	0.000	0.000	0.000

Table 2: Characteristics of newly appointed executive directors across the business cycle
This table reports summary statistics on work experience, education, and demographic traits for newly appointed executive directors (i.e., in the first year of their mandate) to the board of national banking supervisors (Panel A) or supervised banks (Panel B) from selected EU countries between 2002 and 2019, distinguishing appointments made in recession and non-recession times. Information on career paths refers to the positions held by each individual as of the time of appointment to the executive board. Recession times are identified at the country-year level, where a given country-year is classified as in recession if at least two quarters over the year displayed a negative growth of real GDP. Refer to Appendix Table A.2 for variable definitions.

Panel A: National supervisors

	Non-recession years				Recession years			
	N	Mean	S.D.	Median	*N*	Mean	S.D.	Median
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Management experience								
Prior manag. pos.	113	0.929	0.258	1.000	31	0.968	0.180	1.000
Prior manag. pos. in fin. industry	113	0.292	0.457	0.000	31	0.161	0.374	0.000
Prior manag. pos. in same institution	113	0.327	0.471	0.000	31	0.613	0.495	1.000
Public sector experience								
Prior employment in the public sector	113	0.903	0.298	1.000	31	0.903	0.301	1.000
Prior manag. pos. in the public sector	113	0.664	0.475	1.000	31	0.710	0.461	1.000
Private sector experience								
Prior employment in the private sector	113	0.487	0.502	0.000	31	0.290	0.461	0.000
No. prior spells in the private sector	113	3.743	5.907	0.000	31	2.581	4.911	0.000
Prior employment in the finance industry	113	0.425	0.497	0.000	31	0.387	0.495	0.000
No. prior spells in the finance industry	113	1.150	1.764	0.000	31	0.677	1.045	0.000
Education								
Economics	104	0.702	0.460	1.000	25	0.800	0.408	1.000
Law	104	0.317	0.468	0.000	25	0.160	0.374	0.000
Holds a Ph.D.	113	0.487	0.502	0.000	31	0.355	0.486	0.000
Demographics								
Age	100	54.110	6.831	55.000	27	55.037	7.684	54.000
Female	113	0.265	0.444	0.000	31	0.226	0.425	0.000

Panel B: Banks

	Non-recession years				Recession years			
	N	Mean	S.D.	Median	*N*	Mean	S.D.	Median
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Management experience								
Prior manag. pos.	664	0.985	0.122	1.000	134	0.963	0.190	1.000
Prior manag. pos. in fin. industry	664	0.989	0.102	1.000	134	0.955	0.208	1.000
Prior manag. pos. in same institution	.	.	.	.	.	.	.	.
Public sector experience								
Prior employment in the public sector	664	0.190	0.392	0.000	134	0.239	0.428	0.000
Prior manag. pos. in the public sector	664	0.009	0.095	0.000	134	0.015	0.122	0.000
Private sector experience								
Prior employment in the private sector	664	1.000	0.000	1.000	134	1.000	0.000	1.000
No. prior spells in the private sector	664	14.708	9.361	13.000	134	14.299	8.118	13.000
Prior employment in the finance industry	664	1.000	0.000	1.000	134	0.993	0.086	1.000
No. prior spells in the finance industry	664	12.944	8.189	11.000	134	12.507	7.355	12.000
Education								
Economics	.	.	.	.	.	.	.	.
Law	.	.	.	.	.	.	.	.
Holds a Ph.D.	664	0.133	0.339	0.000	134	0.119	0.325	0.000
Demographics								
Age	644	50.995	7.551	50.000	129	52.946	9.662	51.000
Female	664	0.105	0.307	0.000	134	0.030	0.171	0.000

Table 3: Characteristics of supervised banks
This table reports summary statistics for a sample of listed banks from selected EU countries between 2002 and 2019. Refer to Appendix Table A.2 for variable definitions.

	N (1)	Mean (2)	S.D. (3)	p25 (4)	Median (5)	p75 (6)
Bank-level accounting information						
Total assets (bln. EUR)	553	520.920	580.544	104.022	259.198	787.721
ROA (in %)	553	0.386	0.686	0.190	0.470	0.730
Regulatory Tier 1 ratio	553	11.194	3.796	8.000	10.790	13.300
Cost-to-income ratio	553	63.081	15.336	54.580	61.540	68.740
Impaired loans over total loans	553	0.051	0.055	0.016	0.034	0.064
Bank-level market information						
Stock return (in %)	132,784	0.008	2.256	-1.107	0.003	1.090
Stock returns volatility (30 day, in %)	132,351	34.777	23.316	20.765	28.867	41.127
Stock returns volatility (90 day, in %)	131,971	35.753	22.128	21.978	30.294	42.450
CDS spread	83,724	124.553	115.903	54.450	93.497	161.243
Aggregate market information						
Stoxx Europe 600 return (in %)	4,603	0.027	1.292	-0.561	0.054	0.656
Sovereign credit spread	35,669	1.464	1.228	0.601	1.249	2.119

Table 4: Bank value and national supervisors' executive appointments
This table reports estimates regressions of bank stock returns on an indicator for days in which the national supervisor appoints an executive director. The dependent variable is the bank's daily stock return. *Appointment* (+0) is an indicator variable equal to 1 if on a given the bank's national supervisor appoints an executive director, and 0 otherwise. The number of leads and lags of *Appointment* (+0), control variables, and fixed effects included in each specification are indicated below. Robust standard errors (in parentheses) are clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. $\overline{\text{CAR}}[-1,+1]$ is the average cumulative abnormal return between day -1 and day $+1$, computed as the sum of the coefficient estimates for *Appointment* (-1), *Appointment* (+0), and *Appointment* (+1). The p-value of the F-test of the null hypothesis that such a sum is equal to 0 is reported below. Refer to Appendix Table A.2 for variable definitions.

Dependent variable:	Stock return (in %)					
	(1)	(2)	(3)	(4)	(5)	(6)
Appointment (-1)	0.008	0.019	-0.005	-0.049	-0.050	-0.047
	(0.10)	(0.10)	(0.12)	(0.10)	(0.10)	(0.10)
Appointment (+0)	-0.463***	-0.467***	-0.461***	-0.385***	-0.387***	-0.377***
	(0.10)	(0.12)	(0.13)	(0.09)	(0.10)	(0.10)
Appointment (+1)	-0.388***	-0.413***	-0.436***	-0.105	-0.123	-0.118
	(0.13)	(0.14)	(0.14)	(0.10)	(0.10)	(0.10)
Lags/leads	-1/+1	-5/+5	-10/+10	-5/+5	-5/+5	-5/+5
Stoxx Europe 600 return				X	X	X
Bank FE					X	X
Month-year FE						X
$\overline{\text{CAR}}[-1,+1]$	-0.843	-0.861	-0.902	-0.540	-0.560	-0.542
H_0: $\overline{\text{CAR}}[-1,+1]=0$ (p-value)	0.001	0.004	0.005	0.015	0.012	0.014
No. appointments	77	75	72	74	74	74
No. bank-level events	298	259	229	258	258	258
Mean(y)	0.007	0.008	0.005	0.008	0.008	0.008
S.D.(y)	2.241	2.255	2.276	2.256	2.256	2.256
R^2	0.000	0.000	0.000	0.377	0.380	0.386
N	152,949	132,990	115,463	132,784	132,784	132,784

Table 5: Bank value, national supervisors' executive appointments, and their background
This table reports estimates regressions of bank stock returns on indicators for days in which the national supervisor appoints an executive director with a certain work experience. The dependent variable is the bank's daily stock return. *Appointment, w/o fin. background* (+0) is an indicator variable equal to 1 if on a given day the bank's national supervisor appoints an executive director with no prior finance experience, and 0 otherwise. *Appointment, with fin. background* (+0) is an indicator variable equal to 1 if on a given day the bank's national supervisor appoints an executive director with prior finance experience, and 0 otherwise. *Appointment, with link to bank)* (+0 is an indicator variable equal to 1 if on a given day the bank's national supervisor appoints an executive director who previously held a position at the bank, and 0 otherwise. The number of leads and lags of the appointment indicator variables, control variables, and fixed effects included in each specification are indicated below. Robust standard errors (in parentheses) are clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. $\overline{\text{CAR}}[-1,+1]$ is the average cumulative abnormal return between day -1 and day $+1$ around the event, computed as the sum of the coefficient estimates for the appointment indicator variable on days -1, $+0$, and $+1$. The p-value of the F-test of the null hypothesis that such a sum is equal to 0 is reported below. Refer to Appendix Table A.2 for variable definitions.

Dependent variable:	Stock return (in %)					
	(1)	(2)	(3)	(4)	(5)	(6)
Appointment, w/o fin. background (-1)	0.091	0.057				
	(0.15)	(0.16)				
Appointment, w/o fin. background ($+0$)	-0.633***	-0.669***				
	(0.15)	(0.16)				
Appointment, w/o fin. background ($+1$)	-0.261*	-0.296*				
	(0.16)	(0.15)				
Appointment, with fin. background (-1)			-0.189	-0.147		
			(0.12)	(0.12)		
Appointment, with fin. background ($+0$)			-0.116	-0.058		
			(0.11)	(0.11)		
Appointment, with fin. background ($+1$)			0.034	0.085		
			(0.09)	(0.09)		
Appointment, with link to bank (-1)					-0.196	-0.207
					(0.19)	(0.21)
Appointment, with link to bank ($+0$)					0.465**	0.481**
					(0.23)	(0.22)
Appointment, with link to bank ($+1$)					-0.231	-0.203
					(0.25)	(0.28)
Lags/leads	-5/+5	-5/+5	-5/+5	-5/+5	-5/+5	-5/+5
Stoxx Europe 600 return	X	X	X	X	X	X
Bank FE	X	X	X	X	X	X
Month-year FE		X		X		X
$\overline{\text{CAR}}[-1,+1]$	-0.803	-0.908	-0.271	-0.119	0.038	0.072
H_0: $\overline{\text{CAR}}[-1,+1]=0$ (p-value)	0.010	0.005	0.200	0.552	0.931	0.886
No. appointments	41	41	33	33	13	13
No. bank-level events	133	133	125	125	15	15
Mean(y)	0.008	0.008	0.008	0.008	0.008	0.008
S.D.(y)	2.256	2.256	2.256	2.256	2.256	2.256
R^2	0.380	0.386	0.379	0.386	0.379	0.386
N	132,784	132,784	132,784	132,784	132,784	132,784

Table 6: Bank value and national supervisors' executive appointments across the business cycle
This table reports estimates regressions of bank stock returns on indicators for days in which the national supervisor appoints an executive director, distinguishing between recession and non-recession periods. *Appointment* (+0) is an indicator variable equal to 1 if on a given the bank's national supervisor appoints an executive director, and 0 otherwise. Such an variable is interacted with *Recession*, an indicator variable equal to 1 if real GDP growth is negative for at least two quarters in a given year for the country where the bank is based. The number of leads and lags of *Appointment* (+0), control variables, and fixed effects included in each specification are indicated below. The number of leads and lags of *Appointment* (+0) indicator variables, control variables, and fixed effects included in each specification are indicated below. Robust standard errors (in parentheses) are clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. $\Delta\overline{\text{CAR}}[-1,+1]$ is the difference between appointments made in recession and those made in non-recession times in terms of average cumulative abnormal return between day −1 and day +1 around the event, computed as the sum of the coefficient estimates for the interaction term on days −1, +0, and +1. The p-value of the F-test of the null hypothesis that such a difference is equal to 0 is reported below. Refer to Appendix Table A.2 for variable definitions.

Dependent variable:	Stock return (in %)					
	(1)	(2)	(3)	(4)	(5)	(6)
Appointment (−1)	0.124	0.111	0.040	-0.135*	-0.136*	-0.122
	(0.07)	(0.08)	(0.09)	(0.08)	(0.08)	(0.08)
Appointment (+0)	0.059	0.028	-0.006	-0.086	-0.087	-0.062
	(0.11)	(0.13)	(0.13)	(0.10)	(0.10)	(0.10)
Appointment (+1)	-0.267**	-0.296**	-0.369***	0.066	0.043	0.060
	(0.11)	(0.12)	(0.11)	(0.09)	(0.08)	(0.08)
Appointment (−1) × Recession	-0.518	-0.378	-0.129	0.510	0.503	0.455
	(0.33)	(0.40)	(0.45)	(0.37)	(0.37)	(0.35)
Appointment (+0) × Recession	-2.289***	-2.346***	-2.312***	-1.352***	-1.356***	-1.416***
	(0.33)	(0.33)	(0.39)	(0.27)	(0.27)	(0.28)
Appointment (+1) × Recession	-0.529	-0.553	-0.313	-0.846**	-0.828**	-0.868**
	(0.41)	(0.43)	(0.46)	(0.37)	(0.37)	(0.35)
Lags/leads	-1/+1	-5/+5	-10/+10	-5/+5	-5/+5	-5/+5
Recession	X	X	X	X	X	X
Stoxx Europe 600 return				X	X	X
Bank FE					X	X
Month-year FE						X
$\Delta\overline{\text{CAR}}[-1,+1]$	-3.336	-3.277	-2.754	-1.687	-1.680	-1.829
H_0: $\Delta\overline{\text{CAR}}[-1,+1] = 0$ (p-value)	0.000	0.000	0.003	0.020	0.021	0.006
No. appointments	77	75	72	74	74	74
No. bank-level events	298	259	229	258	258	258
Mean(y)	0.007	0.008	0.005	0.008	0.008	0.008
S.D.(y)	2.241	2.255	2.276	2.256	2.256	2.256
R^2	0.001	0.001	0.001	0.378	0.380	0.386
N	152,949	132,990	115,463	132,784	132,784	132,784

Table 7: Bank value and national supervisors' executive appointments around the SSM introduction
This table reports estimates regressions of bank stock returns on an indicator for days in which the national supervisor appoints an executive director before and after the introduction of the SSM. The dependent variable is the bank's daily stock return. *Appointment* (+0) is an indicator variable equal to 1 if on a given the bank's national supervisor appoints an executive director, and 0 otherwise. The number of leads and lags of *Appointment* (+0), control variables, and fixed effects included in each specification are indicated below. Columns 1-2 (3-4) restrict the analysis to the pre-SSM (post-SSM) period. Odd columns identify the pre- and post-SSM period based on the date of the SSM agreement (June 29, 2012), whereas even columns refer to the date in which the SSM first came into force (November 3, 2014). Robust standard errors (in parentheses) are clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. $\overline{\text{CAR}}[-1,+1]$ is the average cumulative abnormal return between day -1 and day $+1$, computed as the sum of the coefficient estimates for *Appointment* (-1), *Appointment* ($+0$), and *Appointment* ($+1$). The p-value of the F-test of the null hypothesis that such a sum is equal to 0 is reported below. Refer to Appendix Table A.2 for variable definitions.

Dependent variable:	Stock return (in %)			
	Pre-SSM		Post-SSM	
	(1)	(2)	(3)	(4)
Appointment (-1)	0.012	0.082	-0.148	-0.328***
	(0.16)	(0.15)	(0.10)	(0.09)
Appointment ($+0$)	-0.453***	-0.561***	-0.288	-0.016
	(0.12)	(0.10)	(0.19)	(0.19)
Appointment ($+1$)	-0.236	-0.164	0.053	-0.031
	(0.15)	(0.13)	(0.15)	(0.15)
Lags/leads	-5/+5	-5/+5	-5/+5	-5/+5
Stoxx Europe 600 return	X	X	X	X
Bank FE	X	X	X	X
Sample split around:				
SSM agreement	X		X	
SSM enforcement		X		X
$\overline{\text{CAR}}[-1,+1]$	-0.677	-0.643	-0.383	-0.375
H_0: $\overline{\text{CAR}}[-1,+1]=0$ (p-value)	0.037	0.028	0.058	0.110
No. appointments	43	47	31	27
No. bank-level events	160	177	98	81
Mean(y)	-0.014	0.007	0.035	0.008
S.D.(y)	2.427	2.411	2.026	1.968
R^2	0.406	0.401	0.337	0.327
N	73,273	83,347	59,511	49,437

Table 8: Bank value and SSM-related events

This table reports estimates of bank stock market reaction to the most salient events that led to the introduction of the SSM. For each event, average abnormal returns at days −1, 0, and +1 ($\overline{AR}[-1]$, $\overline{AR}[+0]$, and $\overline{AR}[+1]$) around the announcement date, as well as the average cumulative abnormal return between days −1, 0, and +1 ($\overline{CAR}[-1,+1]$) are reported. To obtain such estimates, separate event studies on bank daily stock returns have been conducted in the style of the event study baseline specification (Column 4 of Table 4). In each regression, we limit the sample to the two years around the respective event date. Robust standard errors (in parentheses) are clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. Refer to Appendix Table A.2 for variable definitions.

Date	Event	$\overline{AR}[-1]$ (1)	$\overline{AR}[+0]$ (2)	$\overline{AR}[+1]$ (3)	$\overline{CAR}[-1,+1]$ (4)
June 29, 2012	Eurozone leaders agree on the establishment of the SSM.	-0.408	0.32	0.004	-0.083
		(0.341)	(0.608)	(0.994)	(0.924)
September 7, 2012	ECB Vice President speech at the Duisenberg School of Finance titled "Toward	1.447***	2.034***	1.017**	4.498***
	a European Banking Union"	(0.000)	(0.001)	(0.027)	(0.000)
September 12, 2012	European Commission adopts two proposals for the establishment of the SSM.	1.307***	-0.728***	0.149	0.729
		(0.002)	(0.004)	(0.749)	(0.200)
December 13, 2012	ECOFIN reaches a landmark agreement on the establishment of the SSM.	1.048***	0.954**	-0.045	1.957***
		(0.000)	(0.030)	(0.852)	(0.010)
December 14, 2012	Disclosure of the criteria adopted by the ECB to identify significant banks.	0.956**	-0.044	0.815*	1.728**
		(0.030)	(0.858)	(0.074)	(0.041)
February 12, 2013	ECB Vice President speech at the Warwick Economics Summit titled	0.602	-1.364***	0.143	-0.619
	"Financial Stability Risks, Monetary Policy and the Need for Macro-Prudential Policy".	(0.167)	(0.002)	(0.760)	(0.393)
September 12, 2013	EU parliament approves the EU bank supervision system.	1.248***	-0.322	-0.758**	0.168
		(0.010)	(0.131)	(0.034)	(0.749)
October 23, 2013	ECB starts comprehensive assessment in advance of its supervisory role.	-0.872**	-1.617***	1.075***	-1.413***
		(0.035)	(0.001)	(0.003)	(0.006)
December 16, 2013	Danièle Nouy appointed as Chair of the supervisory board.	0.279	0.019	-0.513	-0.215
		(0.293)	(0.950)	(0.401)	(0.722)
January 9, 2014	Four directors appointed in the new Directorate General for supervision.	1.346***	0.555	-0.723**	1.179**
		(0.000)	(0.163)	(0.017)	(0.021)
January 22, 2014	Sabine Lautenschläger appointed as Vice-Chair of the supervisory board.	-0.133	-0.625*	0.74	-0.017
		(0.626)	(0.098)	(0.105)	(0.978)
February 3, 2014	ECB makes progress with the Asset Quality Review (AQR) and confirms stress-test.	0.003	-1.296***	1.52***	0.227
	parameters for comprehensive assessment.	(0.99)	(0.000)	(0.000)	(0.623)
March 7, 2014	ECB appoints three representatives to the bank supervisory board.	0.136	-0.22	0.609*	0.525
		(0.726)	(0.345)	(0.057)	(0.376)
April 25, 2014	ECB publishes framework for SSM regulation.	-0.352	-0.892***	-0.328*	-1.572***
		(0.299)	(0.000)	(0.094)	(0.001)
April 29, 2014	ECB says that capital gaps from AQR must be covered with CET1 instruments.	-0.329*	0.793**	-0.68**	-0.215
		(0.094)	(0.039)	(0.022)	(0.652)
July 17, 2014	ECB Vice President says strictness of ECB test not just about results.	0.975***	-0.692***	0.087	0.369
		(0.007)	(0.001)	(0.736)	(0.392)
October 27, 2014	ECB discloses results of the AQR exercise and identifies banks that need further actions.	1.712***	-0.766*	-0.144	0.803
		(0.000)	(0.069)	(0.555)	(0.113)
November 4, 2014	SSM starts.	-0.246	0.187	-1.778***	-1.836***
		(0.654)	(0.605)	(0.000)	(0.028)

Table 9: Bank debt value and national supervisors' executive appointments

This table reports estimates regressions of changes in CDS spreads on an indicator for days in which the national supervisor appoints an executive director. The dependent variable is the bank's daily change in spreads on 5-year CDS contracts written on senior unsecured debt. *Appointment* (+0) is an indicator variable equal to 1 if on a given the bank's national supervisor appoints an executive director, and 0 otherwise. *Appointment, w/o fin. background* (+0) is an indicator variable equal to 1 if on a given day the bank's national supervisor appoints an executive director with no prior finance experience, and 0 otherwise. *Appointment, with fin. background* (+0) is an indicator variable equal to 1 if on a given day the bank's national supervisor appoints an executive director with prior finance experience, and 0 otherwise. *Appointment, with link to bank)* (+0 is an indicator variable equal to 1 if on a given day the bank's national supervisor appoints an executive director who previously held a position at the bank, and 0 otherwise. The number of leads and lags of the appointment indicator variables, control variables, and fixed effects included in each specification are indicated below. Robust standard errors (in parentheses) are clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. $\overline{\text{CAR}}[-1,+1]$ is the average cumulative abnormal CDS spread change between day -1 and day $+1$ around the event, computed as the sum of the coefficient estimates for the appointment indicator variable on days -1, $+0$, and $+1$. The p-value of the F-test of the null hypothesis that such a sum is equal to 0 is reported below. Refer to Appendix Table A.2 for variable definitions.

Dependent variable:	ΔCDS spread							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Appointment (−1)	0.473**	0.438*						
	(2.23)	(1.96)						
Appointment (+0)	0.549*	0.514*						
	(1.83)	(1.70)						
Appointment (+1)	0.264	0.250						
	(1.09)	(0.95)						
Appointment, w/o fin. background (−1)			0.687	0.730*				
			(1.65)	(1.73)				
Appointment, w/o fin. background (+0)			0.633	0.747				
			(1.19)	(1.36)				
Appointment, w/o fin. background (+1)			0.394*	0.509**				
			(1.89)	(2.08)				
Appointment, with fin. background (−1)					0.227	0.104		
					(1.06)	(0.54)		
Appointment, with fin. background (+0)					0.448	0.243		
					(1.54)	(0.90)		
Appointment, with fin. background (+1)					0.126	-0.035		
					(0.26)	(-0.06)		
Appointment of a director with link to bank (−1)							1.334***	1.389**
							(3.01)	(2.72)
Appointment of a director with link to bank (+0)							-0.363	-0.299
							(-0.90)	(-0.88)
Appointment of a director with link to bank (+1)							-0.185	-0.027
							(-0.38)	(-0.07)
Lags/leads	-5/+5	-5/+5	-5/+5	-5/+5	-5/+5	-5/+5	-5/+5	-5/+5
Stoxx Europe 600 return	X	X	X	X	X	X	X	X
Sovereign credit spread	X	X	X	X	X	X	X	X
Bank FE	X	X	X	X	X	X	X	X
Month-year FE		X		X		X		X
$\overline{\text{CAR}}[-1,+1]$	1.286	1.202	1.714	1.986	0.801	0.312	0.786	1.062
H_0: CAR$[-1,+1] = 0$ (p-value)	0.001	0.006	0.028	0.022	0.056	0.539	0.177	0.015
No. appointments	69	69	38	38	31	31	10	10
No. bank-level events	167	167	87	87	80	80	12	12
Mean(y)	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
S.D.(y)	6.963	6.963	6.963	6.963	6.963	6.963	6.963	6.963
R^2	0.088	0.106	0.088	0.106	0.089	0.106	0.088	0.106
N	83,724	83,724	83,724	83,724	83,724	83,724	83,724	83,724

Appendix for
"Reverse Revolving Doors in the Supervision of European Banks"

Table A.1: List of national supervisors
This table lists the national supervisors included in the sample, together with the time span, the number of distinct executive directors, and the number of executive-years available for each of them.

Country	Institution	First year	Last year	No. executives	No. executive -years
AT	Österreichische Nationalbank	2002	2019	13	120
AT	Financial Market Authority	2002	2019	4	37
BE	Nationale Bank van België	2002	2019	14	91
DE	Deutsche Bundesbank	2002	2019	20	135
DE	Bundesanstalt für Finanzdienstleistungsaufsicht	2002	2019	14	126
ES	Banco de España	2004	2019	20	182
GB	Bank of England	2002	2019	16	77
GB	Prudential Regulation Authority	2012	2019	13	52
GB	Financial Services Authority	2002	2013	14	57
FR	Banque de France	2002	2019	9	58
IE	Central Bank of Ireland	2007	2019	9	44
IT	Banca d'Italia	2002	2019	15	79
NL	De Nederlandsche Bank	2002	2019	13	85
SE	Sveriges Riksbank	2002	2019	16	112

Table A.2: Definition of variables

Variable	Databases	Definition
Bank data		
Cost-to-income ratio	Bankscope and Orbis Bank Focus	Non-interest expenses over the sum of net interest income and other operating income
Impaired loans over total loans	Bankscope and Orbis Bank Focus	Ratio of impaired loans over total loans
Regulatory Tier 1 ratio	Bankscope and Orbis Bank Focus	Ratio of tier 1 regulatory capital over risk weighted assets
ROA	Bankscope and Orbis Bank Focus	Return on average assets
Total assets	Bankscope and Orbis Bank Focus	Book value of total assets
Event study data		
Appointment	Bloomberg	Indicator equal to one on the day of an announcement of a new executive director appointment at a supervisory institution in the home country of the bank
Appointment, w/o fin. background	Bloomberg and manually collected	Indicator equal to one on the day of an announcement of a new executive director appointment at a supervisory institution in the home country of the bank, whereas the new executive director has no prior finance industry experience
Appointment, with fin. background	Bloomberg and manually collected	Indicator equal to one on the day of an announcement of a new executive director appointment at a supervisory institution in the home country of the bank, whereas the new executive director has prior finance industry experience
Appointment, with link to bank	Bloomberg and manually collected	Indicator equal to one on the day of an announcement of a new executive director appointment at a supervisory institution in the home country of the bank, whereas the new executive director has a link through her CV to a the bank in the same country
CDS spread	Bloomberg and Datastream	Bank CDS spread
Stoxx Europe 600 return	Bloomberg	Return of Stoxx Europe 600 stock market index
Recession	Own calculations	Indicator equal to one if an economy experienced two quarters of negative growth in GDP
Sovereign credit spread	Bloomberg	Difference between sovereign yield and reference rate
Stock return	Bloomberg	Stock return
Stock returns volatility	Bloomberg	Standard deviation of stock returns

Table A.3: Bank value and national supervisors' executive appointments (in event time)
This table reports estimates event-time regressions of bank stock returns on an indicator for days in which the national supervisor appoints an executive director. The dependent variable is the bank's daily stock return. *Appointment* (+0) is an indicator variable equal to 1 if on a given the bank's national supervisor appoints an executive director, and 0 otherwise. *Appointment, w/o fin. background* (+0) is an indicator variable equal to 1 if on a given day the bank's national supervisor appoints an executive director with no prior finance experience, and 0 otherwise. *Appointment, with fin. background* (+0) is an indicator variable equal to 1 if on a given day the bank's national supervisor appoints an executive director with prior finance experience, and 0 otherwise. *Appointment, with link to bank)* (+0 is an indicator variable equal to 1 if on a given day the bank's national supervisor appoints an executive director who previously held a position at the bank, and 0 otherwise. The number of leads and lags of the appointment indicator variables, control variables, and fixed effects included in each specification are indicated below. The estimation sample is restricted to the window of $[-50, +50]$ days around each appointment event, and excludes events exhibiting overlapping windows. Robust standard errors (in parentheses) are clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. $\overline{\text{CAR}}[-1, +1]$ is the average cumulative abnormal stock return of the null hypothesis that such a sum is equal to 0 is reported below. Refer to Appendix Table A.2 for variable definitions.

Dependent variable:	Stock return (in %)			
	(1)	(2)	(3)	(4)
Appointment (+0)	-0.306***			
	(-3.55)			
Appointment, w/o fin. background (+0)		-0.660***		
		(-4.79)		
Appointment, with fin. background (+0)			0.024	
			(0.23)	
Appointment of a director with link to bank (+0)				0.511**
				(2.49)
Lags/leads	-10/+10	-10/+10	-10/+10	-10/+10
Stoxx Europe 600 return	X	X	X	X
Bank FE	X	X	X	X
$\overline{\text{CAR}}[-1, +1]$	-0.329	-0.613	-0.126	0.743
H_0: $\overline{\text{CAR}}[-1, +1] = 0$ (p-value)	0.182	0.058	0.837	0.897
No. appointments	67	38	33	14
No. bank-level events	263	146	140	16
Mean(y)	-0.003	-0.026	0.029	-0.035
S.D.(y)	2.279	2.352	2.354	2.405
R^2	0.363	0.344	0.402	0.545
N	23,536	13,378	13,495	1,556

Table A.4: Bank value, national supervisors' executive appointments, and their background (joint estimation)
This table reports estimates regressions of bank stock returns on indicators for days in which the national supervisor appoints an executive director with a certain work experience. The dependent variable is the bank's daily stock return. *Appointment, with fin. background* (+0) is an indicator variable equal to 1 if on a given day the bank's national supervisor appoints an executive director with prior finance experience, and 0 otherwise. *Any other appointment* (+0) is an indicator variable equal to 1 if on a given day the bank's national supervisor appoints an executive director and *Appointment, with fin. background* (+0)= 0, and 0 otherwise. The number of leads and lags of the appointment indicator variables, control variables, and fixed effects included in each specification are indicated below. Robust standard errors (in parentheses) are clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively. $\Delta\overline{\text{CAR}}[-1,+1]$ is the difference between finance-related and other appointments in terms of average cumulative abnormal return between day −1 and day +1 around the event. The p-value of the F-test of the null hypothesis that such a difference is equal to 0 is reported below. Refer to Appendix Table A.2 for variable definitions.

Dependent variable:	Stock return (in %)	
	(1)	(2)
Appointment, with fin. background (−1)	-0.190	-0.148
	(0.12)	(0.12)
Appointment, with fin. background (+0)	-0.118	-0.059
	(0.11)	(0.11)
Appointment, with fin. background (+1)	0.032	0.084
	(0.09)	(0.09)
Any other appointment (−1)	0.091	0.057
	(0.15)	(0.16)
Any other appointment (+0)	-0.634***	-0.669***
	(0.15)	(0.16)
Any other appointment (+1)	-0.262*	-0.296*
	(0.16)	(0.15)
Lags/leads	-5/+5	-5/+5
Stoxx Europe 600 return	X	X
Bank FE	X	X
Month-year FE		X
$\Delta\overline{\text{CAR}}[-1,+1]$	0.529	0.785
H_0: $\Delta\overline{\text{CAR}}[-1,+1]=0$ (p-value)	0.073	0.012
No. appointments	74	74
No. bank-level events	258	258
Mean(y)	0.008	0.008
S.D.(y)	2.256	2.256
R^2	0.380	0.386
N	132,784	132,784