Bank Bonus Pay as a Risk Sharing Contract*

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November 15, 2018

Abstract

We argue that risk sharing motivates the bank-wide structure of bonus pay. In the presence of financial frictions that make external financing costly, the optimal contract between shareholders and employees involves some degree of risk sharing whereby bonus pay partially absorbs earnings shocks. Using payroll data for 1.26 million employee-years in all functional divisions of Austrian, German, and Swiss banks, we uncover several empirical patterns in bonus pay that are difficult to rationalize with incentive theories of bonus pay—but support an important risk sharing motive. In particular, bonuses respond to performance shocks that are outside the control of employees because they originate in other bank divisions or even outside the bank.

JEL Classification: G20, G21, D22

Keywords: banker compensation, risk sharing, bonus pay, operating leverage

*We thank Jean-Edouard Colliard, Roman Goncharenko, Denis Gromb, John Thanassoulis, seminar participants at HEC Paris and the French Prudential Supervision and Resolution Authority (ACPR), and conference participants at the 17th International Conference on Credit Risk Evaluation for helpful comments. Matthias Efing acknowledges financial support from Investissements d'Avenir (ANR-11-IDEX-0003/Labex Ecodec/ANR-11-LABX-0047). This research project also benefited from a Sinergia Research Grant from the Swiss National Science Foundation (SNSF). The authors declare that they have no relevant or material financial interests that relate to the research described in this paper.

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1 Introduction

Bankers typically manage large amounts of capital and their effort is notoriously difficult to monitor (Axelson and Bond, 2015). For this reason, high bonus pay in banks is often interpreted as performance-linked compensation designed to solicit effort (Holmström, 1979). In the aftermaths of the 2008-2010 financial crisis, bonus pay has also been blamed for creating perverse incentives to take excessive risk.[1] As a consequence, various new regulations seek to curtail bankers' bonuses.[2] This paper focuses on an entirely different role of bonus pay in banks which is independent of any incentive effects. As highlighted in Thanassoulis (2012), bonus pay can contribute to optimal risk sharing between shareholders and employees and, thereby, improve bank resilience. We provide first empirical evidence in favor of this risk sharing hypothesis. Based on comprehensive payroll data for 1.26 million employee-years, we uncover several surprising findings that support the risk sharing motive of bonus pay but cannot be fully explained with theories of incentive pay.

Early contributions to the implicit contract theory see little scope for bonus pay or any other form of risk sharing between diversified shareholders and risk averse employees. Wages should be perfectly insulated from earnings shocks (Azariadis, 1975; Baily, 1974; Knight, 1921).[3] Yet, such complete wage insurance can break down in the presence of financial frictions. If external recapitalization is costly, the value of internal cash increases in times of financial distress and shareholder value becomes a concave function of cash reserves (Froot, Scharfstein, and Stein, 1993; Froot and Stein, 1998). The optimal contract between shareholders and employees then involves some degree of risk sharing: part of employee compensation is paid in the form of variable bonuses which are sensitive to firm-wide earnings.

[1] For example, US Treasury Secretary Geithner argued in his testimony to Congress on June 6, 2009: "I think that although many things caused this crisis, what happened to compensation and the incentives in creative risk taking did contribute in some institutions to the vulnerability that we saw in this financial crisis."

[2] The European Parliament proposed new EU-wide legislation on bank bonuses in 2013 (see Colonnello, Koetter, and Wagner, 2018); in the U.S. executive pay was reformed in the Say-on-Pay rule included in the 2010 Dodd-Frank Act; and for the UK debate see http://www.nortonrosefulbright.com/knowledge/technical-resources/the-uk-corporate-governance-portal/executive-pay. At the international level, the G20 has established the Financial Stability Board (FSB) which proposes principles for sound compensation practices.

[3] The provision of employment and wage insurance rests on firms' credibility to honor implicit contracts. Such commitment appears more credible in the case of family-owned firms and in firms with high employee participation in governance (Ellul, Pagano, and Schivardi, 2017; Kim, Maug, and Schneider, 2018).

Risk sharing through bonus pay is especially attractive to the financial industry which is characterized by high labor intensity, earnings volatility, and funding risk. According to the Office of the New York State Comptroller (2014), the remuneration of Wall Street employees amounts to 47% of their employers' revenues. Focusing on Austrian, German, and Swiss banks, we find that labor expenses just before the financial crisis are lower than on Wall Street but still amount to one third of gross income and to one half of total overhead costs for the median bank. Overall, labor expenses condition bank resilience unless they can be adjusted whenever external funding conditions deteriorate, internal cash flows dry up, and liquidity needs increase.

To study the risk sharing dimension of bonus pay, we analyze comprehensive remuneration data that is directly extracted from the payroll records of 324 Austrian, German, and Swiss banks. For the years 2003 to 2010, we observe the variable (bonus) and fixed (base) compensation of 1.26 million employee-year observations. Whereas previous work has mostly focused on executive compensation, our data covers all levels of the employment hierarchy and all bank divisions. Hence, the high granularity and coverage of the data allow us to exploit variation across different occupational areas inside banks. We document several new stylized facts that support the risk sharing motive of bonus pay.

First, bonus pay features significant cross-divisional earnings sensitivity for both operational and service divisions. For example, the bonus pay of loan officers covaries positively with the income generated by the traders of the same bank and *vice versa*. We emphasize that loan officers have no direct control over the trading strategies chosen in treasury/capital markets or investment banking divisions. Similarly, traders do not interfere with lending decisions taken in retail or corporate banking. The cross-divisional earnings sensitivity between trading and lending is, therefore, difficult to reconcile with theories of incentive pay. By conditioning a loan officer's bonus on trading income, the bank only makes his employment contract riskier without providing additional incentives to underwrite better loans. Cross-divisional earnings sensitivity also extends to support functions like accounting, human resources, or IT: service employees receive higher bonuses in years when traders and loan officers generate higher earnings. While these cross-divisional earnings sensitivities appear to be at odds with incentive pay theories, they are predicted by our risk sharing hypothesis. The bonus of any given employee should be contingent on bank-wide earnings and, hence, on earnings shocks that are beyond the employee's control because they

originate in other divisions of the bank.

Second, the 2008-2010 crisis triggered a general bank-wide contraction of bonuses regardless of individual performance. For example, the average bonus of traders amounted to 70% of fixed (base) remuneration in 2007. One year later this bonus-to-base ratio had declined by 36 percentage points. By the end of 2010, the average bonus share had dropped by a total of 53 percentage points relative to 2007. Importantly, these bonus cuts remain economically and statistically significant when we explicitly control for earnings generated by traders which is inconsistent with theories of pay-for-performance. Instead, these bonus cuts seem to reflect a need to preserve cash under deteriorating external funding conditions and high economic uncertainty. Consistent with this hypothesis, we find that bonus cuts conditional on performance are prevalent in all functional areas of banking including loan offices. Even the bonuses in support functions like accounting, human resources, or IT are cut in half notwithstanding their lack of involvement in any operational decisions related to the crisis. Similarly, we find that bonus cuts are not limited to the senior employees that choose the risk appetite and crisis exposure of their banks. Also the bonuses of junior employees without decision-making power are cut during the crisis. Even new recruits (without any legacy responsibilities) earned lower bonuses in their first year if they were hired after 2007. This suggests that low bonuses during the crisis were not simply deferred punishment for low pre-crisis performance. Overall, the evidence suggests that bank-wide bonus cuts during the crisis originate in industry-wide distress which is largely beyond the control of most employees.

Third, we show that bonus pay indeed reduces operating leverage. Banks that paid their employees in variable bonuses rather than in fixed salaries were able to adjust labor expenses downwards at the onset of the crisis. Total pay (bonus plus base) per employee decreased by 4% from 2007 to 2008 for every increase in pre-crisis bonus share (bonus-to-base ratio) by ten percentage points. Bank-wide labor expenses including (fixed) pension obligations decreased by 2.2% for a ten percentage points higher pre-crisis bonus share. Consistent with the idea of risk sharing, employee remuneration declined more in banks with higher crisis losses—conditional on pre-crisis bonus shares. In other words: banks do not cut bonuses homogeneously in response to a falling reservation wage (in a deteriorating labor market) regardless the banks' financial situation. Instead, banks with a more stable income during the crisis cut employee compensation less aggressively than other banks with higher crisis losses but a similar pre-crisis bonus shares.

Fourth, riskier banks chose lower operating leverage (higher bonus shares) before the crisis than safer banks. For example, service employees (e.g., accountants or IT) in risky investment banks received higher bonus pay in 2007 than their counterparts in service divisions of relatively safe commercial or retail banks. Similarly, variable pay one year before the crisis was also higher for loan officers and traders in banks with riskier business models (as proxied by banks' employment share in trading or their share of non-interest income) than for front office employees in safe banks. This result is again consistent with our theory of risk sharing on the wage bill. By contrast, this result is difficult to explain only with theories of incentive pay or with differences in employees' outside labor market options. As we are comparing employees that work in identical functional areas and, thus, in identical labor markets (but in different banks), confounding variation in reservation wages or in the need to incentivize effort should be small.

Our empirical evidence for bonus pay as a risk sharing mechanism is consistent with known industry practices of bonus determination. According to a survey conducted by Kampkötter and Sliwka (2018), bonus pay in Austrian, German, and Swiss banks is usually determined in a top-down allocation process.[4] At the end of each year, the executive board of a bank determines the aggregate amount available for bonus payments. The survey confirms that bank-wide earnings and financial health are the dominant criteria for the calculation of this bank-wide bonus pool, which indirectly confirms the risk sharing motive of bonus pay. At the same time, such risk sharing is compatible with a differentiated merit-based allocation of bonus funds to lower organizational levels. Typically, a combination of divisional, team, and individual performance determines how the bonus pool is split among employees. Nevertheless, the top-down bonus pool approach clearly limits the scope for merit-based performance pay in years when financial distress prevents boards from setting aside significant bonus pools.[5]

The rest of the paper is organized as follows. Section 2 discusses our contribution relative to the existing literature. Section 3 presents a simple model of banks with financial frictions and risk sharing through bonus pay. Section 4 presents the data and Section 5 discusses institutional details of the pay-setting process in banks. Section 6 presents our empirical results and Section 7

[4] A survey by Mercer (2013) finds that the top-down bonus pool approach is also used in North America.

[5] In general, the relative participation of an employee in the available bonus pool does not equal his relative contribution to bank-wide earnings. This is true for two reasons. First, employees that generate losses and make a negative contribution to bank-wide earnings do not receive negative bonuses. Second, also employees in service functions, which generate no earnings, typically participate in the bonus pool.

concludes.

2 Literature

Different strands of literature propose alternative hypotheses why perfect wage insurance can break down in practice. Contract theory emphasizes the need to incentivize unobservable effort through performance-linked compensation (Holmström, 1979; Holmström and Milgrom, 1987). As effort appears particularly hard to monitor in the financial industry (Axelson and Bond, 2015), many papers interpret the high variable pay component in banking as incentive pay (e.g., Bijlsma, Boone, and Zwart, 2012; Biais and Landier, 2013; Cheng, Hong, and Scheinkman, 2015; Albuquerque, Cabral, and Guedes, 2018). Yet, a more comprehensive analysis of the structure of incentive pay across bank divisions and hierarchies reveals that this incentive pay perspective is incomplete. Whereas Holmström (1979) predicts that variable pay should not be tied to factors outside the employee's control, we show that (1) a banker's bonus is sensitive to earnings shocks that originate in other divisions of the bank, (2) bonuses respond to the financial crisis even when employees are not responsible for the crisis exposure of their bank, (3) and that variable pay before the crisis is higher in riskier banks even if we control for unobservability of effort by comparing employees in identical functional areas.

The risk management literature provides an alternative explanation why variable (or bonus) pay can supersede wage insurance: In the presence of financial frictions with respect to external financing, shareholders seek to share risk with third parties (Froot, Scharfstein, and Stein, 1993; Froot and Stein,1998). Most papers here focus on risk sharing with financial counterparties. Yet, financial hedging can be unavailable due to the same financial frictions that also constrain external financing (Rampini and Viswanathan, 2010, 2013; Rampini, Viswanathan, and Vuillemey, 2016). When financial hedging is too expensive, shareholders may want to share risk with employees instead. Gambler (1988) provides one of the first theoretical frameworks that describe such risk sharing through variable pay under bankruptcy constraints. Guiso, Pistaferri, and Schivardi (2005) show evidence for such risk sharing between firm owners and employees of Italian firms.[6] Caggese

[6]Financial contracting between employers and employees may even go beyond risk sharing: Guiso, Pistaferri, and Schivardi (2013) show that financially constrained firms in Italy tend to borrow from their young workers by paying initially lower wages.

and Cuñat (2008) document that financially constrained firms in Italy rely less on permanent workers and more on fixed-term workers who can be fired.[7] Colonnello, Koetter, and Wagner (2018) find that the systematic and systemic risk of banks with high executive bonuses increased after the European Union imposed bonus caps in 2014 and, thereby, limited risk sharing on the payroll. At a theoretical level, our model relates to Thanassoulis (2012) who studies risk sharing in a more comprehensive model of competition for talent. However, Thanassoulis assumes risk neutral bankers. In any case, our main contribution is empirical and based on the unique access to comprehensive payroll data covering the entire banking sector of three countries.

Part of the corporate governance literature portrays bonus pay as the result of rent-seeking by entrenched insiders (e.g., Bertrand and Mullainathan, 2001; Bebchuk and Fried, 2003). In these papers, variable pay does not arise as the outcome of optimal contracting but when executives capture the pay-setting process. We highlight that this agency perspective is less plausible for the bonus pay at lower levels of the bank hierarchy. Junior employees and recent recruits are certainly not entrenched insiders even if they experience considerable bonus variation as documented in this paper. Theoretical work by Oyer (2004) emphasizes the role of employees' participation constraints as a determinant of employee pay. The contractual choice in his model is between equity compensation and fixed pay, which is costly to adjust, whereas our paper focuses on discretionary bonus pay devoid of wage rigidity.[8] Moreover, we argue that variation in outside labor market opportunities cannot explain the heterogeneous bank-specific bonus cuts across employees in identical functional divisions.

Finally, our work contributes to a broader literature on the level of finance wages. Philippon and Reshef (2012) document a substantial increase in the compensation of US bankers over the last twenty years. Relative to their peers in other sectors, bankers earn a positive wage premium (Oyer 2008; Kaplan and Rauh 2010). Célérier and Vallée (2017) attribute this wage premium to higher returns to talent in finance. Yet, Swedish administrative data, which include detailed cognitive and non-cognitive test scores as well as performance in high-school and university, provide no

[7]Imperfect wage and employment insurance influence various corporate policies. For example, Simintzi, Vig, and Volpin (2015) show that an increase in employment protection and, therefore, in operating leverage crowds out financial leverage. Berk, Stanton, and Zechner (2010) study a model with human costs of bankruptcy in which employees require higher compensation in firms with high financial leverage.

[8]Unlike in the U.S., equity compensation is not common below the board level in Austrian, German, and Swiss banks. Moreover, the majority of banks in our sample are not market-listed, which prevents the granting of stock options. Less than 1% of employees in our data are entitled to equity-linked compensation.

evidence for any increased skill concentration in the financial profession (Böhm, Metzger, and Strömberg, 2018). Glode and Lowery (2016) develop a model that can explain the historical increase in finance wages with an increasing employment share of traders. Studying a cross-section of countries, Boustanifar, Grant, and Reshef (2016) show empirical evidence that trading-related activities account for 50% of the increase in finance wages. Our findings are consistent with this historical perspective as more trading simultaneously increases earnings risk as well as risk sharing on the wage bill. Since employees are risk averse and need to be compensated for bearing earnings risk, finance sector wages need to increase.

3 Theory

3.1 Baseline Two-Period Model without Frictions

The following section outlines the optimal risk-sharing contract between shareholders and employees in a simple two period model. There are two categories of employees (say, traders and loan officers) indexed by $k = 1, 2$ with identical utility function

$$U(c) = \frac{c^{1-\gamma}}{1-\gamma}. \tag{1}$$

At date $t = 0$, and after investment decisions, the bank disposes of an amount x_0 of cash to allocate between wages w_0^k, $k = 1, 2$, dividends δ_0, and cash reserves m , such that

$$w_0^1 + w_0^2 + \delta_0 + m = x_0. \tag{2}$$

We denote by e the (stochastic) bank earnings at date 1. Assuming that cash reserves are not remunerated, the terminal (date $t = 1$) budget constraint is

$$\delta_1(x) + w_1^1(x) + w_1^2(x) = m + e \equiv x, \tag{3}$$

where cash resources x at date 1 are allocated to dividends $\delta_1(x)$ and wages $w_1^k(x)$.

The objective of the bank is to maximize a weighted sum of shareholder value, i.e. the expected present value of dividends, and the expected discounted utilities of the two categories of employees

$$V(x_0) = \delta_0 + \frac{1}{1+r}E[\delta_1(x)] + \sum_k \alpha^k \left[U(w_0^k) + \frac{1}{1+r}E\{U(w_1^k(x))\}\right],$$

where α^k is the weight given to the utility of employees of category k.

The bank maximizes this expression under constraints (2) and (3), with one constraint for each value of x. When $\delta_0 > 0$, the problem can be simplified by solving for δ_0 in constraint (2). For convenience we denote by $\lambda(x)f(e)/(1+r)$ the Lagrange multiplier associated with constraint (3) at $x = e+m$, where $f(e)$ is the density of e. The Lagrangian of the simplified problem becomes

$$L = x_0 - m + \sum_{k=1,2} \alpha^k [U(w_0^k) - w_0^k] +$$
$$+ \frac{1}{1+r}E\left\{\delta_1(x) + \sum_{k=1,2} \alpha^k U(w_1^k(x)) - \lambda(x)[\delta_1(x) - m - \sum_{k=1,2} w_1^k(x) - e]\right\}.$$

Frictionless bank recapitalization corresponds to the assumption that shareholders can commit at date $t = 0$ to inject new capital at date $t = 1$ at no additional costs, which implies that $\delta_1(x)$ can be negative. Equating to zero the derivative of L with respect to $\delta_1(x)$ implies that $\lambda(x)$ is constant and equal to 1. Then a differentiation with respect to wages at dates $t = 0$ and $t = 1$ implies that these wages are also constant and independent of time and bank earnings

$$w_0^k = w_1^k(x) = U'^{-1}(1/\alpha^k). \tag{4}$$

Under frictionless recapitalization, the risk neutral shareholders fully insure (risk averse) employees. This corresponds to the benchmark result highlighted by Jensen and Meckling (1976) in the absence of any incentive dimension to employee remuneration. In the two period model, all earnings are distributed and the bank holds no cash reserves ($m = 0$) because cash reserves have an opportunity cost $r > 0$.

3.2 Extension to Costly Recapitalization

Whenever the cash resources x of a bank are low, its recapitalization can be costly. Outside investors may doubt the solvency of the bank and provide new equity capital only at a discount relative to its nominal value. Maximization of the Lagrangian produces two different cases. In

the case of high bank earnings, total compensation is (again) maximal at $w_1^k(x) = w_0^k$ with $\lambda(x) = 1$. Total wage payments are $\overline{w} = \Sigma_k w_0^k$. Dividends payments are (strictly) positive with $\delta_1(x) = x - \overline{w} > 0$. However, in the case of low bank earnings in period 1, dividends payments are suspended ($\delta_1(x) = 0$) and the remaining cash resources $x = m + e$ are devoted to a diminished total compensation at date 1, namely $w_1(x) = x < \overline{w}$. The marginal shadow value of cash follows as $\lambda(x) = U'(x)/U'(\overline{w}) > 1$. Equating the derivative of L with respect to m to zero implicitly defines optimal bank cash reserves

$$(1 + r) = E\left[\lambda(x)\right] = \frac{E[max\left\{U'(\overline{w}), U'(m + e)\right\}]}{U'(\overline{w})}. \tag{5}$$

Next, we assume that (gross) bank earnings can be written as $e = e_{\max} - \sigma\varepsilon$, where losses are represented by the random variable $\varepsilon \in [0, 1]$, which has the unit interval as its support and $\sigma > 0$ measures earnings risk. The total compensation $w_1(x) \in [\underline{w}, \overline{w}]$ of employees can then be decomposed into a fixed and variable component as

$$w_1(x) = min(x, \overline{w}) = \underline{w} + \min(x - \underline{w}, \overline{w} - \underline{w}), \tag{6}$$

where $\underline{w} = m + e_{max} - \sigma$ is the total wage bill in the worst possible scenario where earnings are $e_{max} - \sigma$, whereas $\min(x - \underline{w}, \overline{w} - \underline{w})$ denotes total bonus pay contingent on bank earnings. Base wage $\underline{w}$ is implicitly defined by:

$$(1 + r) = \frac{E[max\left\{U'(\overline{w}), U'(\underline{w} + \sigma(1 - \epsilon))\right\}]}{U'(\overline{w})}. \tag{7}$$

Figure 1 provides a graphical illustration of the wage and dividend function, respectively.

For our empirical analysis, it is useful to define the bonus share of banker compensation as

$$Bonus\ Share = \frac{w_1(x) - \underline{w}}{\underline{w}} = \min\left(\frac{e - e_{max} + \sigma}{\underline{w}}, \frac{\overline{w} - \underline{w}}{\underline{w}}\right). \tag{8}$$

Note that, in conformity with the top-down practice of bonus pools, we first determine the total wage bill $w_1(x)$ and then allocate between the two categories of employees by maximizing $\sum_{k=1,2} \alpha^k[U(w^k)$ under the constraint $\sum_{k=1,2} w^k = w_1(x))$. Due to our assumption of CRRA

utility, the wages paid to each category of employees are proportional to the total wage bill with

$$w_1^k(x) = \frac{\overline{w^k}}{\overline{w}^1 + \overline{w}^2} w_1(x). \tag{9}$$

The following two theorems summarize our main results:

Theorem 1: Bonus Pay Across Bank Divisions

Under costly bank recapitalization, optimal contracting between bank shareholders and employees implies that the bonus share of employees in each division increases with total bank earnings.

Proof: Follows directly from Equations (6) and(9).

Theorem 2: Bonus Pay Across Banks

Optimal contracting under costly recapitalization implies that the bonus share of employee compensation increases in (i) the bank earnings e, and (ii) the bank earnings risk σ.

Proof: Part (i) follows trivially from Eq. (8). For (ii), differentiating (7) with respect to σ implies that

$$0 = E\left\{1_{e<\overline{w}-\underline{w}} \times U''(m+e)\left[\frac{d\underline{w}}{d\sigma} + (1-\varepsilon)\right]\right\}. \tag{10}$$

Since $U(.)$ is concave and $\varepsilon \leq 1$, we find

$$\frac{d\underline{w}}{d\sigma} = -\frac{E[1_{e<\overline{w}-\underline{w}} \times U''(m+e)(1-\varepsilon)]}{E[1_{e<\overline{w}-\underline{w}} \times U''(m+e)]} < 0. \tag{11}$$

Now the Bonus Share is equal to $\min\left(\frac{e-e_{max}+\sigma}{\underline{w}}, \frac{\overline{w}-\underline{w}}{\underline{w}}\right)$. Since $\underline{w}$ decreases in σ, both of the terms between brackets increase with σ, which implies the desired result.

3.3 Testable Model Implications

In this section we discuss three testable model implications driven from Theorems 1 and 2. First, banks are typically structured into several divisions and various operational divisions (like re-

tail banking, corporate banking, or investment banking) contribute independently to total bank earnings. Moreover, labor costs are generated both in operating and service divisions (human resources, IT, logistical services, etc.). Bank accounting typically reports earnings from its loan business as interest income generated by the retail and corporate banking divisions and trading income generated by the treasury management/capital market or investment banking division. Total bank earnings are the sum of both earnings sources and other earnings, that is[9]

$$e = e_{Loan\ Business} + e_{Trading\ Activity} + e_{Other}. \tag{12}$$

Our model predicts the following relationship between bank earnings and average divisional bonus share:

Implication 1: Bonus Pay Across Bank Divisions

Optimal risk sharing across bank divisions implies that (i) the bonus share in trading divisions, (ii) the bonus share in interest earning divisions, and (iii) the bonus share in service divisions all covary positively with both interest and trading income.

Institutionally, risk sharing across bank divisions is organized through so-called bonus pools which are determined at the bank level and are a function of the total bank earnings. This aggregate bonus pool is then allocated top-down to divisions and smaller organizational units. Service divisions also participate in the bonus allocation even if their pay package has no incentive component as performance of service divisions is difficult to evaluate. They nevertheless contribute to bank level income risk sharing.

During the 2007-2009 financial crisis, many banks in Austria, Germany and Switzerland faced large reductions in their gross income and soaring loan loss provisions depicted in Figure 2. At the same time, collapsing equity prices for bank stocks made external equity financing relatively costly to incumbent shareholders as shown in Figure 3. Our model of employee risk sharing implies reduced bonuses across all bank functions and bank employees.

[9]Banks further generate income from fees and commissions which we ignore because it cannot be clearly traced to one operational division. In unreported regressions, we find that our empirical findings are robust to controlling for fee and commission income, which itself is weakly correlated with average bonus pay in trading, loan, and service divisions.

Implication 2: Bonus Share Reduction in the 2007-8 Banking Crisis

Under income losses and rising costs of external equity during the financial crisis, banks reduce their bonus share for (i) employees in operational bank functions even after controlling for divisional performance, (ii) employees without influence on the risk exposure of the bank, i.e., employees in bank support functions and at the bottom of the employment hierarchy, and (iii) new employees without legacy responsibilities.

A reduction in bonus pay in a bank's operating units under low operating performance is certainly compatible with both the incentive-based motive and risk-sharing-based motive of bonus pay. Lower variable pay in operational units (where employees have accumulated industry-specific human capital) can also be motivated by worsening outside employment options as highlighted by Oyer (2004). However, evidence for lower bonuses in bank support functions and for new bank employees are better explained by our earnings risk sharing motive.

Third, banks with a higher bonus share are able to reduce their labor costs significantly under negative income shocks and adverse external funding conditions. The financial crisis can again provide evidence that this labor cost reduction option was available during the crisis to firms with a high average (pre-crisis) bonus share.

Implication 3: Labor Cost Reductions by Bonus Share

Average banker pay and bank-wide labor costs both decrease during the crisis proportional to the average pre-crisis bonus share and are larger if bank losses are bigger.

Finally, higher earnings risk provides a larger scope for risk sharing. Before the crisis, employees in any given occupation should thus earn higher bonus shares in investment banks with large trading floors than in commercial banks which generate most of their income from conservative lending.

Implication 4: Bonus Share and Bank Earnings Risk

Conditional on their profession, employees earn higher bonus shares in riskier investment banks, i.e. in banks with large trading floors and high non-interest income.

Implication 4 is not easily explained by efficiency wage models that focus on the labor market determination of banker pay. In particular, time-varying reservation wages alone cannot explain why employees in identical occupations (i.e., employees with identical outside employment options) have higher bonus shares in riskier banks. Similarly, Implication 4 is difficult to explain by theories of incentive pay because the need to incentivize unobservable effort should be very similar for employees that work in identical functional areas.

4 Data

4.1 Compensation Data

This paper draws on a large payroll data set from the financial service sectors of Austria, Germany, and Switzerland, which is documented in detail in Efing, Hau, Kampkötter, and Steinbrecher (2015) and in Kampkötter (2015). Information on individual compensation contracts were collected by the international pay consultancy firm Willis Towers Watson and is directly sourced from the banks' payroll records. The data undergo several quality checks by the pay consultants and bank representatives. In particular, every data submission is reviewed and validated by survey analysts and compensation consultants, processed by special software for data anomalies, and then double-checked by the banks' and the consultancy's pay compensation specialist.

The data sample used in this study ranges from 2003 to 2010 and includes more than 1.26 million employee-year observations from payroll records of 324 Austrian, German, and Swiss banks. Banks have to report data from at least 80% of all employees below executive level. The bank sample is representative and accounts for a large fraction of bank assets in the three countries. However, we dispose of accounting data only for an unbalanced subsample of the 82 larger banks. For example, in 2008, we only observe 5 Austrian, 35 German, and 13 Swiss banks with both matched compensation and accounting data. Yet, these 53 banks alone account for approximately 26%, 83%, and 87% of total bank assets in Austria, Germany, and Switzerland, respectively.

An important feature of the data set is its comparability across banks, functions, hierarchical levels and countries. The pay consultant uses a standardized and internationally consistent method to define a broad number of specific job positions in the financial services industry. Based on this consistent methodology, each job position is uniquely assigned to a specific function, functional

area and hierarchical level. This enables us to compare the fixed and variable components of compensation across specific functional areas or employee groups within a bank or across banks.

Pay information includes the fixed annual *Base Salary* as well as the end-of-the-year *Bonus Pay* of each employee. We define as *Total Pay* the sum of these two pay components and as *Bonus Share* the ratio of *Bonus Pay* to *Base Salary*. The latter variable captures the relative size of the variable pay component. Equity-based compensation is not included in our data, but such compensation is extremely rare among non-executive employees in the countries we consider.

The information on individual employees includes the employee age, employment tenure, bonus eligibility, bank hierarchy level (ranging from 1 to 7), the specific job position, and the assignment to one of eight bank divisions: Logistical Services (D1), Headquarter (HQ) Services (D2), Retail Banking (D3), Corporate Banking (D4), Private Banking (D5), Asset Management (D6), Investment Banking (D7), and Treasury Management/Capital Markets (D8). Logistical Services (D1) include support functions like IT, communications, and customer support whereas Headquarter Services (D2) include, for example, accounting, human resources, and marketing. To match the bank division with the available accounting data, we aggregate Logistical Services and HQ Services to Internal Services; Retail Banking and Corporate Banking to Loan Business; and Investment Banking and Treasury/Capital Markets to Trading Business. Interest income and trading income then represent the two performance measure of the Loan Business and Trading Business divisions, respectively.

The data do exclude board level employees. A second shortcoming is the "unstructured nature" of the panel, which does not track employees through time. Individual employees are assigned a new identifier each year even if sampled repeatedly. We subject the raw data to only minor modifications: We discard extremely low compensation levels with a base salary below €24,000 as these positions correspond to interns or trainees on short-term contracts. We also ignore data outliers by winsorizing the 10 smallest and largest observations for *Base Salary* and *Bonus Pay*.

Table 1, Panel A, reports summary statistics for the individual-level compensation sample based on more than 1.26 million employee-year observations pooled across the three countries. *Total Pay* amounts to an average of €70,759, with a standard deviation of roughly €49,384. Ten percent of all banking employees earn more that €110,000 in *Total Pay*, which can reach up to €3 million for employees just below the executive board level. The average Bonus Pay per bank

employee is €10,696 with a median of €3,873. The median *Bonus Share* is therefore low at only 7.7%, but increases in the level of *Base Salary*. Only for 10% of all employees does the variable component of pay amounts to more than 30% of their total compensation. Panel B provides the breakdown of the *Average Bonus Share* by bank division and employee group. We find the lowest *Average Bonus Share* in Logistical Services and HQ Services with 7.6% and 13.5%, respectively. By contrast, the variable pay component reaches and average of 43.1% and 41.2% in the Investment Banking and Treasury/Capital Markets divisions, respectively.

4.2 Bank Data

We complement the bank compensation data with bank balance sheet data from Bankscope (Bureau van Dijk).[10] The overlapping coverage comprises 82 banks for which we have compensation data and accounting data for at least one year in the period 2003–2010. The total matched sample consists of 342 bank years, but some income items are available only for a smaller subsample. The median bank has an asset size of €35.5 billion, of which 71% are deposits on the liability side and 37% are loans on the asset side. The median return on assets is only 1% for all bank-years. The median bank has only 4.4% equity relative to total assets.

We define the *Return on Loans* as the ratio of (gross) interest income and change in loan loss provisions (LLP) to loans; its median is 10% in the full sample. The *Return on Trading* is defined as the ratio of the trading income to non-loan assets on a firm's balance sheet. The median return here is zero, but 2.6% for the bank-year with the best performance. The low average *Return on Trading* of only 0.2% reflects a standardization of the return by non-loan assets which generally overstates the capital used to generate trading profits. Hence, the magnitude of any regression coefficients involving the *Returns on Trading* needs to be interpreted with caution. Unfortunately, we do not dispose of any better measure to scale trading profits as the public financial reporting of many banks is opaque and incomplete.

[10]Data from Bankscope and from Willis Towers Watson are deflated with the 2010 price level in Germany.

5 Institutional Background

German, Austrian, and Swiss banks share certain institutional features of their bonus culture. This is confirmed by survey evidence on 36 bonus plans from 25 different banks conducted in 2013 (Kampkötter and Sliwka, 2018). Within the banking sector, a top-down decision process for allocating individual bonuses, so-called bonus pools, is predominant. Such a *modus operandi* is fully compatible with a centralized sharing of bank-wide earnings risk.

Of the surveyed banks, 64% allocated bonuses through bonus pools. The total annual bonus pool is determined at the board level and the allocated funds are cascaded down to the divisional level and smaller organizational units. The survey shows that bank earnings at the top level are the dominant criterion for the calculation of these bonus pools, with operating revenue as major performance metrics used to measure bank success. The bonus pools are assigned to supervisors in the respective operational units (typically also depending on the unit's financial performance), who then have to allocate these pools to subordinates according to some combination of subjective and objective performance assessment. The institutional practice of bonus pools is also widespread in global banking outside the three countries examined in this paper. A survey by the consultancy Mercer (2013) in North America, Europe, and Emerging Markets concluded that "*the top-down pool approach is predominant in the banking industry*".

Two related types of bonus allocation systems are the so-called "additive bonus system" and "multiplicative bonus system". In additive systems, the individual bonus usually depends on a combination of individual performance, the performance of the employee's organizational unit or a team and on the earnings of the entire bank. In multiplicative bonus systems, the supervisor first assesses the performance of her subordinates, and this performance evaluation is then multiplied by a certain factor, which depends on the profitability of the whole bank and the specific unit. Around 40% of the surveyed banks use either the additive or the multiplicative bonus system in one of their plans.

Almost all of the surveyed bonus plans include individual performance assessments, which are based on qualitative or discretionary assessments (all plans) and objective performance indicators (86%). The survey evidence also reveals that the structure of bonus plans remained very stable during the time period 2004–2013. Overall, the prevalence of top-down planning of bonus pools

lends credibility to the employee risk sharing motive of bonus pay. At the same time, such a risk sharing motive is not incompatible with differentiated merit-based allocations at the individual level: it only defines its scope.

6 Evidence on Employee Risk Sharing

The empirical analysis mirrors the model implications highlighted in Section 2.3. First, we provide direct evidence on risk sharing across bank divisions in Section 5.1. Second, we document in Section 5.2 the decline of bonus pay during the 2008-10 financial crisis across all employee groups, including employees in service divisions, junior employees, and new recruits. Third, we show in Section 5.3 the relationship between pre-crisis average bonus share in 2007 and the percentage labor cost reduction during the crisis. In section 5.4, we study the nexus between bank earnings risk and bankers pay.

6.1 Risk Sharing Across Bank Divisions

The universal bank model prevalent in Austria, Germany and Switzerland implies that banks combine different operating activities under the same roof. The traditional loan business is often complemented by trading activities in financial markets and annual accounting profits are reported separately for both activities. An incentive based model of bonus pay predicts that the variable component of an employee's pay should covary with the operating performance of the division she/he is working in, but not with the operating performance of other bank divisions. More generally, high bonuses should be paid to reward individual performance and not factors outside the employee's control.

By contrast, our risk sharing hypothesis of bank bonus pay implies that, under costly external refinancing, all employees share some of the risk of lower bank-wide earnings through bonus pay reductions. The risk sharing at the bank level implies that a higher operating performance in one division has repercussions for the bonus pay in an unrelated division. For example, higher trading profits imply a higher bonus share not only for those working in treasury management/capital market (D8) and investment banking (D7), but also spill over into a larger bonus share for those employees working in the loan business (D3 and D4) or in internal service divisions (D1 and D2).

In the extreme case of complete risk sharing we predict that the performance sensitivity of bonus pay is identical across divisions and with respect to any earnings source.

Table 2 provides evidence for such risk sharing across bank divisions. We define the *Return on Trading* as the ratio of trading profits to the non-loan assets (or total assets minus loans) and the *Return on Loans* as the ratio of net interest income and changes in loan loss provisions to loan assets. The dependent variable is the *Average Bonus Share* of all employees engaged in trading activity in Columns (1) and (4), all employees involved in the loan business divisions in Columns (2) and (5), and all employees working in internal services in Columns (3) and (6). We also control for a variety of bank characteristics such as loan to asset ratio (*Loans/Assets*), the deposit to asset ratio (*Deposits/Assets*), the (book) equity share of assets (*Equity/Assets*), bank size (*Log Assets*) and in Columns (4)-(6) by a financial *Crisis Dummy* marking the three years 2008-2010. All regressions in Table 2 include bank fixed effects to account for bank heterogeneity in the level of incentive pay in any of the bank divisions.

Column (1) shows that employees in the trading divisions (D7 and D8) enjoy bonus pay strongly correlated not only with *Return on Trading*, but also with *Return on Loans*. Variations by one standard deviation in trading returns change the *Average Bonus Share* by 7 percentage points ($= 14.008 \times 0.005$), whereas a one standard deviation change in loan returns moves the *Average Bonus Share* by 22 percentage points ($= 1.369 \times 0.160$). The comparison seems to suggest that even in the capital market division, bonus pay depends more on the performance variation in the loan business than in trading operations. This higher bonus sensitivity to net interest income can be explained by the greater importance of this source of bank earnings for the overall bank performance of most banks. But it could also reflect the fact that standardization of trading profits by non-loan assets introduces considerable measurement error which biases the bonus sensitivity to trading performance downwards.

We explore the bonus share variation for employees in the loan business in Column (2). Again, operating performance in both the trading division and the loan business matters for the bonus share. In particular, even loan officers benefit considerably from a better operating performance in trading as indicated by the statistically significant coefficient of 2.438. Their bonus sensitivity to trading outcomes is still 17.4% ($= 2.438/14.008$) of that of employees working directly in the trading divisions.

The *Average Bonus Share* of employees in internal services covaries with the operating performance in both Trading Activity and the Loan Business as shown in Column (3). Their bonus share sensitivity to trading profits is slightly lower that of employees in the Loan Business with a coefficient of 2.312. And employees in Headquarter Services (D1) and Logistical Services (D2) benefit also from better loan business performance similar to those in the trading division. The sensitivity of bonus pay in the service divisions to both types of operating income provides direct evidence for our risk sharing hypothesis formulated as Theorem 1 and Implication 1.

Inclusion of the *Crisis Dummy* in Columns (4)-(6) generally attenuates the estimated performance sensitivity. This is not surprising as this dummy captures crisis-related underperformance common to all banks. In particular, the performance in trading divisions appears highly correlated across banks and, hence, the coefficients of the *Return on Trading* become statistically insignificant. Evidently, the crisis shock to trading income is largely exogenous to the individual bank—a stylized fact which we will exploit for identification in the next section.

6.2 Crisis-Related Bonus Share Reductions by Employee Group

The 2008-10 financial crisis represents a common negative shock to banking sectors in Germany, Austria, and Switzerland. Losses accumulated due to exposure to both the US subprime crisis and to the European sovereign debt crisis as shown in Figure 2. Changes to loan loss provisions peek at the end of 2008 and the average net trading income profits reach a loss of €300 million. Even banks with stable earnings during the crisis were affected by the spike in economic uncertainty and worsening external funding conditions. Figure 3 depicts the sharp drop of bank equity prices for German banks in the second half of 2007 (Panel A) along with a general increase in credit default swap rates (Panel B). The risk sharing hypothesis predicts that banks should respond to the crisis with bonus cuts for all employees independently of their individual performance. Moreover, the bonuses of employees in service divisions, junior employees, and new recruits should decline even though these employee groups carry little or no responsibility for the crisis exposure of their employers.

Table 3 documents the dynamics of the bonus share for various employee groups before and during the crisis. Columns (1) and (2) report regressions for the *Average Bonus Share* of employees in the trading business; Columns (3) and (4) for those in the loan business; and Columns (5) and

(6) focus on the *Average Bonus Share* of employees in internal services. We also report similar regression results for junior employees in the two lowest hierarchy levels in Columns (7) and (8); and new employees recruited less than a year ago in Columns (9) and (10). The first regression for each group [Columns (1), (3), (5), (7) and (9)] includes only year fixed effects and bank fixed effects (not reported). The reference year is 2007 so that each year dummy measures the *Average Bonus Share* shortfall relative to 2007 for each employee group. Figure 4 plots these year fixed effects showing a gradual increase of bonus shares during boom years and a strong decline after 2007 in all different employee groups.

For example, employees in the trading business benefit from an *Average Bonus Share* equal to 70% of fixed pay at the end of 2007. This share of bonus pay declines by 36 percentage points at the end of 2008, by 35 percentage points at the end of 2009, and drops even further at the end of 2010 by a total of 53 percentage points relative to 2007 (Column (1)). In principle, these large bonus cuts in trading divisions are consistent with both the risk sharing as well as the performance-pay theory. Yet, when we explicitly control for the income generated by traders in Column (2), the year fixed effects remain negative and highly significant for all crisis years which seems consistent only with risk sharing.[11] Our observations for employees in the loan business seem to corroborate this interpretation. Again, we observe a strong drop in the *Average Bonus Share* between 2007 and 2010, which remains negative and significant after controlling for income generated in the loan business.[12]

To interpret the crisis effect on bonus shares in operating divisions as evidence for risk sharing, we need to assume that *Return on Trading* and *Return on Loans* are appropriate performance measures and that functional relationships are indeed linear. The analysis of service employees in columns (5) and (6) does not rely on these assumptions. Specifically, there is little reason to believe that performance in accounting, IT, HR, etc. is pro-cyclical or that employees in these divisions are directly responsible for the crisis exposure of their employer. Hence, the strong bonus share decline in service divisions by seven percentage points until 2010 (approximately 50% relative to bonus shares in 2007) is best explained by the risk sharing hypothesis. Similarly, bonus cuts during the crisis are hard to justify as performance pay in the case of junior employees who

[11] Note that missing Bankscope data for control variables reduces the bank sample to 72 banks and also loses year 2003 in column (2).

[12] The peak bonus share of loan officers in 2007 equals 23%.

are rarely material risk takers as defined in the Principles for Sound Compensation Practices of the Financial Stability Board (FSB).[13] Finally, bonus share declines are also hard to explain as deferred punishment for low pre-crisis performance as even new recruits are granted a 16% lower bonus share in 2010 than in 2007 (Column (9)).[14]

Overall, the evidence suggests that banks respond to worsening sector-wide profitability, spiking economic uncertainty, and tightening of external funding conditions with a bank-wide suspension of bonuses—irrespective of employees' individual performance or contribution to their employers' crisis exposure.

6.3 Ex-Ante Bonus Share and Labor Cost Reduction in the Crisis

The risk sharing hypothesis of bonus pay views a higher bonus share as an option to reduce labor costs in times of high external funding costs and funding needs. It is therefore instructive to explore to what extent this option was exercised to effectively reduce labor costs. Banks with a larger *Average Bonus Share* at the outset of the crisis in 2007 should also be those that reduce the bonus share and thereby labor costs most dramatically.

Table 4 shows cross-sectional regressions for the percentage labor cost change from 2007 to 2008 for various salary measures. The dependent variable is the percentage change in the *Average Bonus Pay* of all bank employees in Column (1), the *Average Base Pay* in Column (2), the *Average Total Pay* (=*Bonus*+*Base*) in Column (3), and the *Bank-wide Labor Expenses* (sourced from Bankscope) in Column (4).[15] The specifications in Columns (1) to (4) use the pre-crisis *Average Bonus Share in 2007* as the regressor of interest. Columns (5) and (6) also include the interaction term of the *Average Bonus Share in 2007* and the percentage *Income Change* from 2007 to 2008 as an additional regressor. The bank income definition here includes the sum of interest income, trading income, and net changes in loan loss provisions. As control variables we include the same balance sheet variables already used in Tables 2 and 3.

[13]The FSB defines material risk takers as employees with "the potential to expose the firm to significant risk" (Financial Stability Board 2017, p.24). The FSB explicitly mentions sufficient seniority as one characteristic of material risk takers. We call employees "junior" if they are employed at the lowest two hierarchy levels. At the peak in 2007, their *Average Bonus Share* equals 10%.

[14]The *Average Bonus Share* of new recruits equals 24% in 2007.

[15]*Bank-wide Labor Expenses* are not computed as the average labor cost per employee but as the total wage bill of the bank comprising, for example, fixed base salaries and bonuses but also pension obligations.

The regression result in Column (3) shows that banks with a 10 percentage points higher *Average Bonus Share* before the crisis are able to reduce the average total pay per employee by approximately 4% in 2008. The *Bank-wide Labor Expenses* in Column (4) decrease by (only) 2.2% for every increase of the pre-crisis bank bonus share by 10 percentage points. This difference in cost sensitivity is mostly accounted for by fixed social security charges (paid by the employer) and related to the base salary.

A higher *Average Bonus Share* prior to the crisis, therefore, reduces the downward rigidity in labor costs, i.e. the operating leverage, during the crisis. As expected, the *Average Base Pay* in Column (2) cannot be compressed and stays constant. This is in line with results by Knoppik and Beissinger (2003) and Bauer, Bonin, Goette, and Sunde (2007) who show that the degree of downward real and nominal wage rigidity is substantial in Germany. The extent of wage rigidity depends on macroeconomic factors such as collective bargaining, labor market conditions or inflation. In a recent survey among European firms, Du Caju, Kosma, Lawless, Messina, and Rõõm (2015) further show that only 2% of firms reported that they had cut nominal base wages even when faced by negative economic shocks, with institutional restrictions being named as one of the main reasons.

Figure 5 provides a graphical illustration of the regression results. The four Panels plot the percentage change from 2007 to 2008 of the various pay measures as functions of the pre-crisis (log) *Average Bonus Share in 2007.*

Finally, the statistically significant interaction term in Columns (5) and (6) of Table 4 shows that the labor cost reduction is more pronounced for the same change in bank income for banks with a higher pre-crisis *Average Bonus Share* in 2007. In other words, banks that experience a larger drop in income in 2008 are more likely to exercise the option to reduce labor expenses.

6.4 Earnings Risk and Bonus Share Variation

Banks vary in their business models and risk cultures. Investment banks with large trading floors and international activities derive a large fraction of their income from volatile non-interest income. By contrast, commercial and retail banks typically exhibit a more conservative risk culture and derive most of their income from traditional lending. Fahlenbrach, Prilmeier, and Stulz (2012) show that these differences in risk cultures or business models are highly persistence, in particular,

with respect to banks' crisis-performance. In line with Theorem 2, we conjecture that the scope for risk sharing between shareholders and employees should be higher in risky investment banks than in relatively safe commercial banks (Implication 4).

To proxy for the risk culture of banks' different business models, we compute the *Employment Share of Trading* and the *Non-Interest Income Share in 2003*. Both variables arguably capture bank risk better than any empirical measure of earnings volatility that is subject to a short sample and potential issues of earnings management. In Table 5, we use both proxies of bank risk to explain employees' *Average Bonus Share* one year before the crisis (i.e., in 2007). We estimate this regression separately for bank employees in the Trading Business, Column (1)-(2), the Loan Business, Columns (3)-(4), and Internal Services, Columns (5)-(6). In other words, we compare pre-crisis bonus shares of employees that work in identical functional areas but in different banks. Across all three bank divisions, we find that risky investment banks pay higher pre-crisis bonus shares than relatively safe commercial banks with little or no trading business. The cross-sectional dependence on bank risk is largest in the Trading Business, but still economically strong even in Internal Services. In other words: human resource or accounting employees contribute more to bank-wide risk sharing if they work in a bank with a larger share of trading business and (risky) non-interest income. We stress that this result is difficult to explain with a flexible wage model or a theory of incentive pay. As we are comparing employees in identical functional areas (but different banks), confounding variation in outside employment opportunities or in the need to incentivize effort should be small.

7 Conclusion

Based on new payroll data for employees in all functional areas of Austrian, German, and Swiss banks, we conduct a comprehensive analysis of bonus pay below the executive level. We show that the dominant interpretation of banker bonuses as incentive pay is incomplete and cannot explain several novel findings uncovered in our analysis. In particular, we find that (i) bonus pay is prevalent at all hierarchy levels and in all occupations including support functions without any discernible direct contribution to operating performance; (ii) before the crisis, bonus pay is higher if employees with a given job function work for banks with riskier business models; (iii)

the bonus pay of a given bank employee is sensitive to earnings shocks beyond his control — i.e. to earnings shocks that originate in other bank divisions; and (iv) the financial crisis triggered a considerable bank-wide reduction in bonus pay even for employees that are not responsible for the crisis exposure of their bank.

In light of these stylized facts, we propose a complementary interpretation of banker bonuses as a risk sharing contract between shareholders and employees. Central to our argument is the observation that perfect wage insurance by diversified shareholders only emerges as the optimal contract in the knife-edge case in which equity refinancing is frictionless. In a world of costly bank recapitalization (in the case of bank distress), shareholder value becomes concave in internal cash and the wage bill exhibits some degree of optimal risk sharing between employees and shareholders. In other words: bonus pay is a mechanism to reduce operating leverage, limiting the need to raise costly capital in distress, and thus procures financial benefits which can be shared between employees and shareholders. From a regulatory perspective, a very restrictive policy on bonus pay can jeopardize such risk sharing and effectively impose higher operating leverage on banks.

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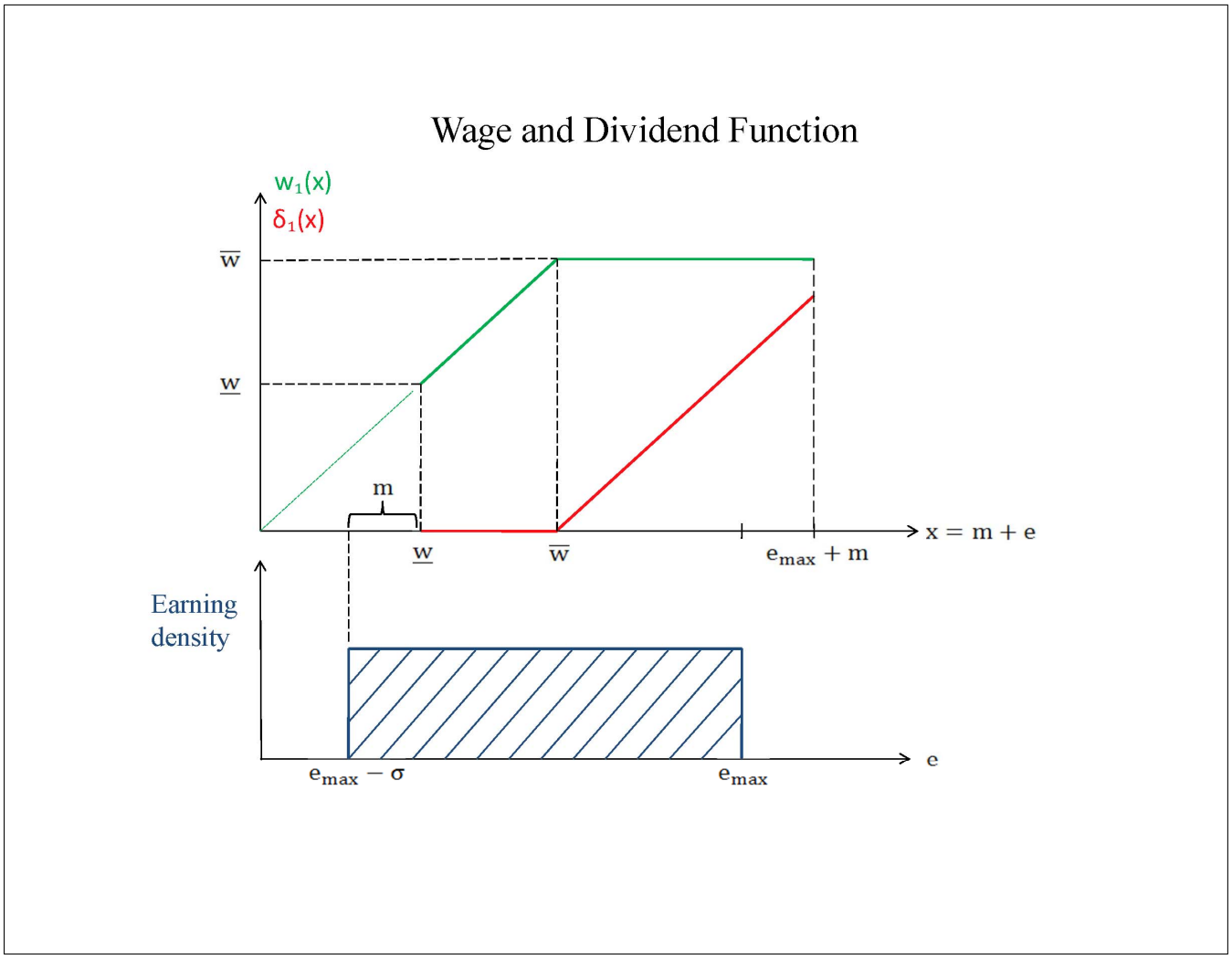

Figure 1: For the static model with a single employee type, we illustrate the uniform distribution of bank earnings over the interval $[e_{\max} - \sigma, e_{\max}]$, as well as the wage and dividend functions $w_1(x)$ and $\delta_1(x)$, respectively. Both functions depend on the state variable $x = m + e$, where m are the bank's cash reserves and e the stochastic bank earnings.

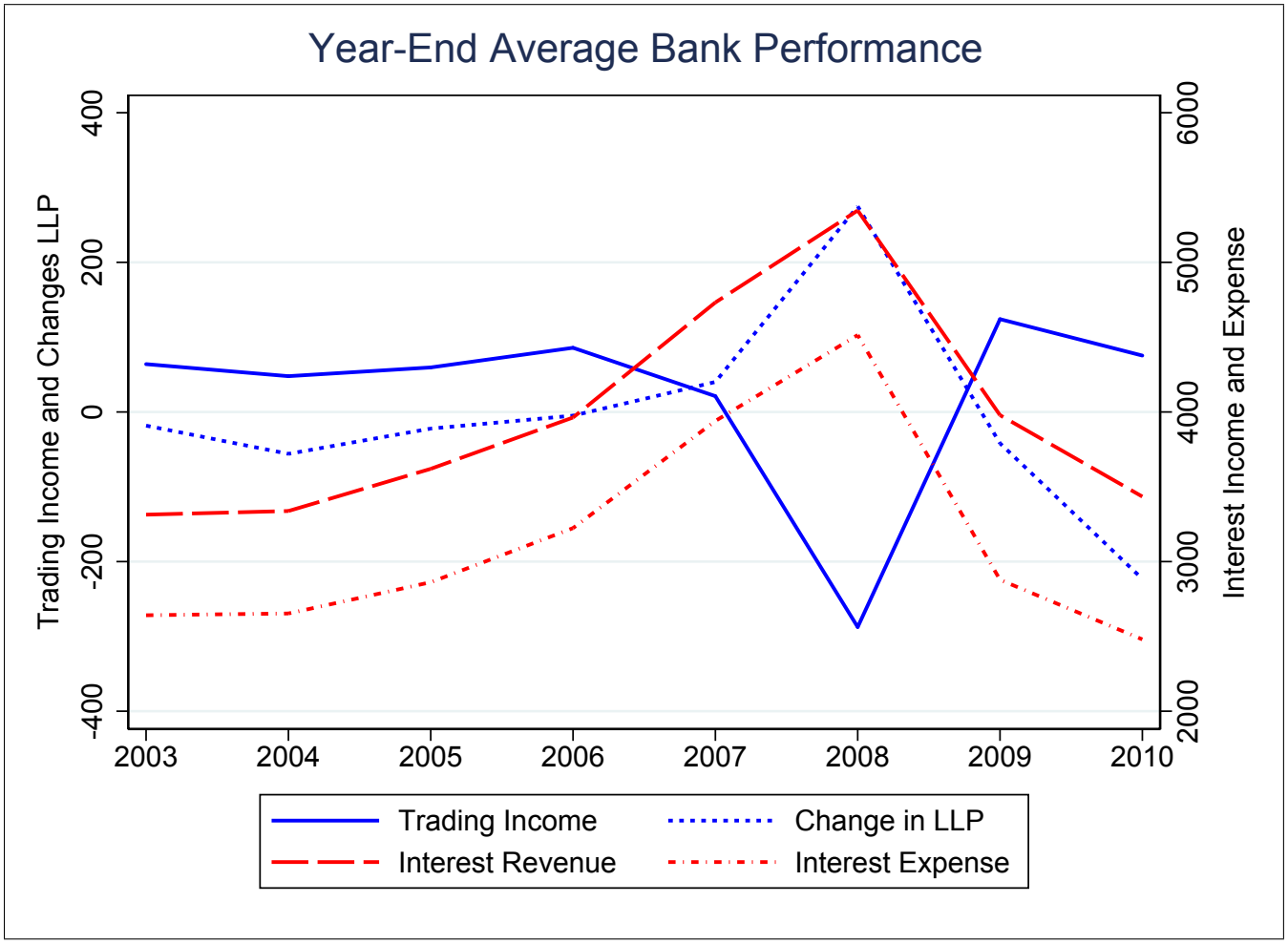

Figure 2: We show the evolution of different performance measures averaged across banks in Austria, Germany, and Switzerland. The sample is restricted to banks with data throughout all years 2003 to 2010.

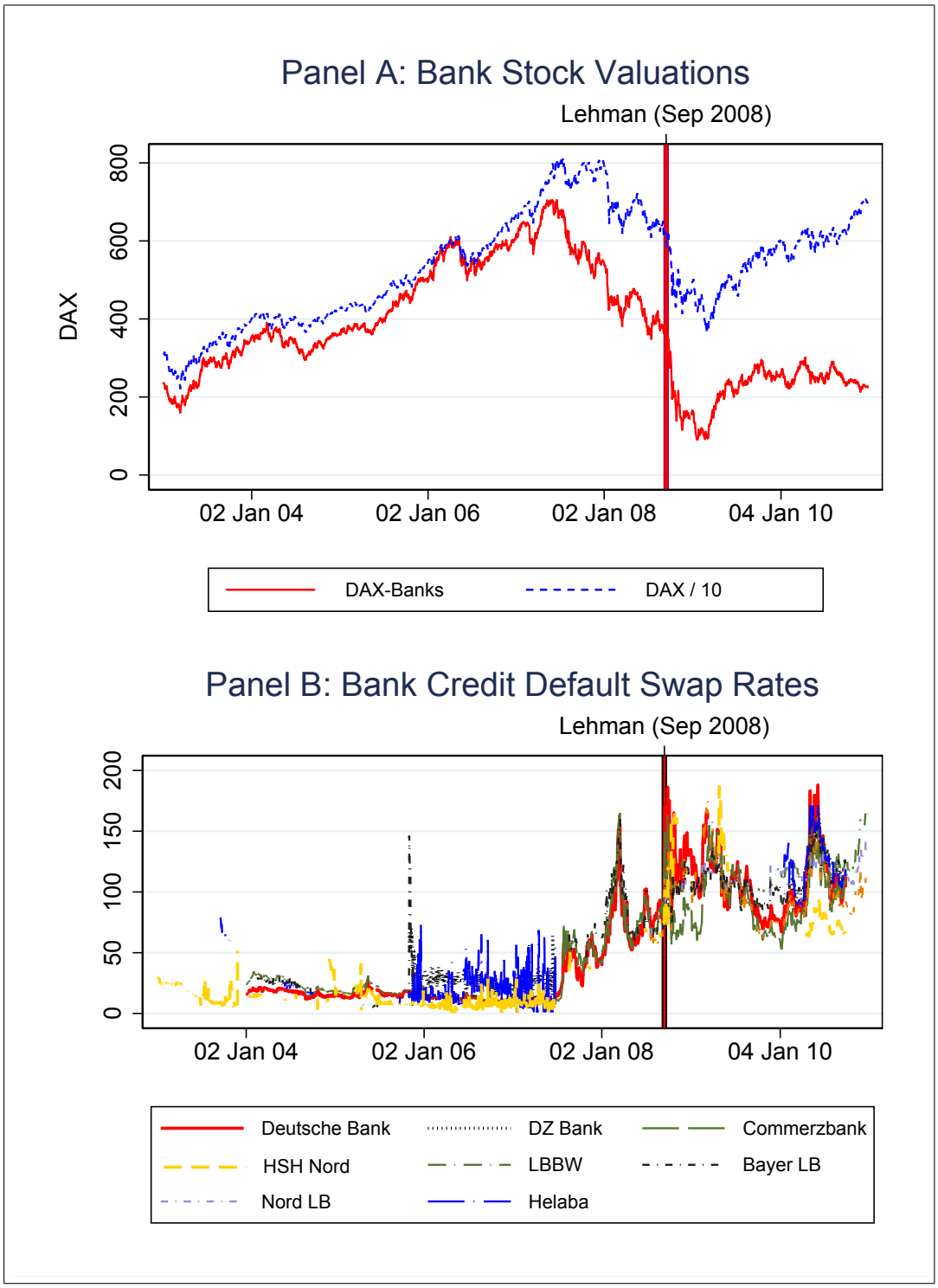

Figure 3: Panel A shows the average stock price of banks in the stock index (DAX-Banks) relative to the index of all German Stocks (DAX) (scaled by 10^{-1}). Panel B reports the spreads of credit default swaps (in basis points) for the eight German banks with five-year single-name CDS contracts.

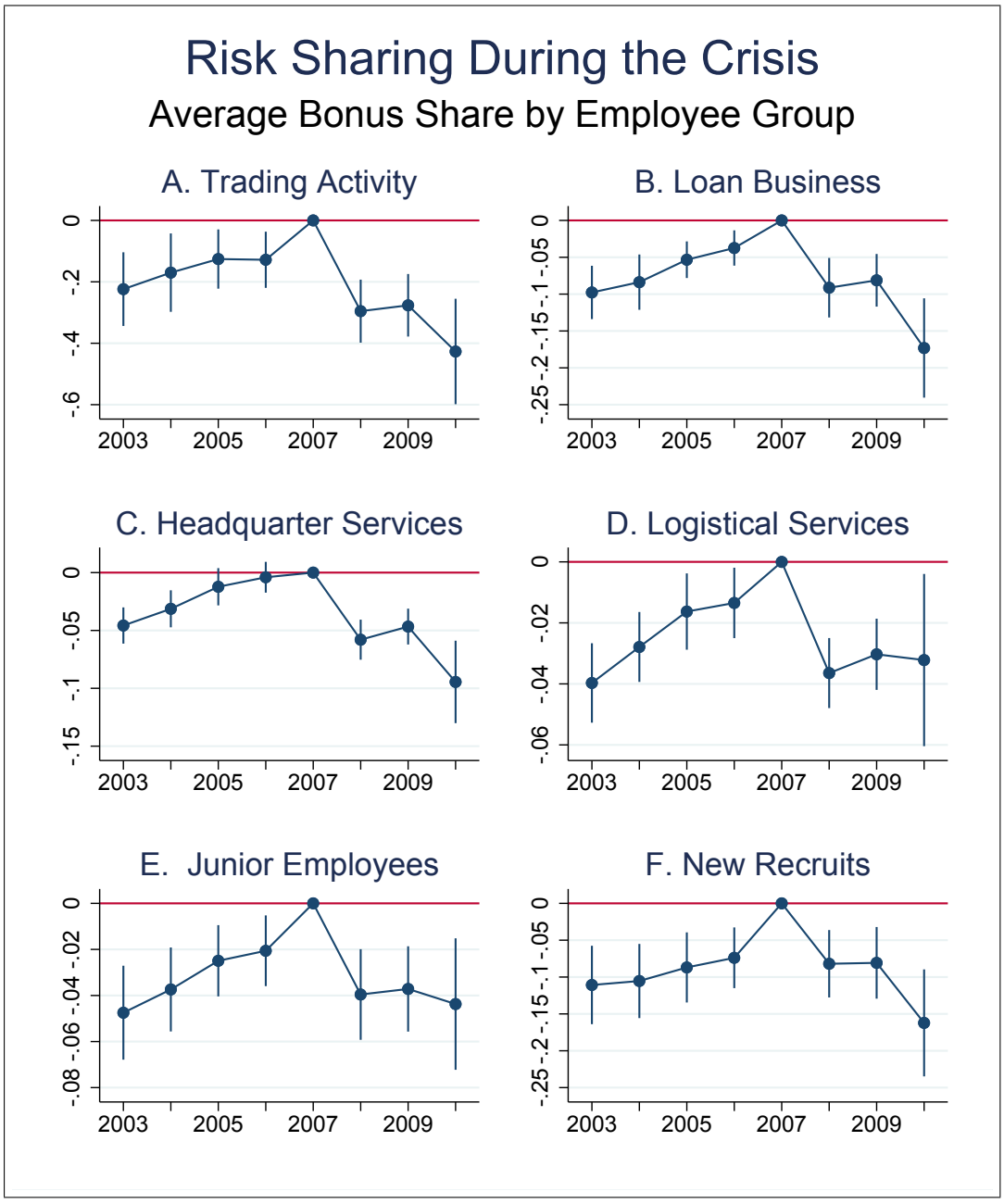

Figure 4: We show the effect of the 2007-9 financial crisis on the *Average Bonus Share* in a given employee group. Panel A shows the crisis effect for bank employees in Trading Activity (Panel A). Panels B to F show similar figures for employees in Loan Business (Panel B); in Headquarter Services (Panel C); and in Logistical Services (Panel D). Junior Employees (Panel E) are all employees working at the two lowest hierarchy levels and New Recruits (Panel F) are all employees hired at most one year earlier. The year fixed effects are estimated in panel regressions with additional bank fixed effects. We report robust standard errors (clustered by bank) and draw confidence intervals at the 5% level.

Figure 5: The percentage labor cost change in the first crisis year is plotted against the pre-crisis *Log Average Bonus Share* measured in Austrian, German, and Swiss banks in 2007. The percentage labor cost changes are depicted for the *Average Bonus* of a bank's employees in Panel A, their *Average Base Salary* in Panel B, their *Average Total Pay* (= Bonus + Base) in Panel C, and total *Bank-Wide Labor Expenses* reported by Bankscope in Panel D. Only residual variation not explained by differences in banks' *Loans/Assets* , *Deposits/Assets*, (Book) *Equity/Assets*, and *Log Assets* is plotted. The confidence intervals of a fitted regression lines are drawn for the 5% level.

Table 1: Summary Statistics

Panel A reports summary statistics at the employee-year level drawn from payroll records of 324 Austrian, German, and Swiss banks over the period 2003-2010. *Total Pay* is the sum of the annual fixed *Base Salary* and the year-end *Bonus Pay* (in EUR). The *Bonus Share* is defined as the ratio of *Bonus Pay* to *Base Salary*. Panel B reports summary statistics at the employee group-year level of 82 Austrian, German and Swiss banks reported in Bankscope over the period 2003-2010. The *Average Bonus Share* is calculated as the equally weighted average of the *Bonus Share* for all employees in the respective group or bank division. We distinguish eight functional bank divisions (D1-D8). We aggregate Logistical Services and HQ Services to Internal Services, Retail Banking and Corporate Banking to Loan Business and Investment Banking and Treasury Management/Capital Markets to Trading Business. The group of junior employees comprises all employees at the two lowest hierarchy levels. Newly recruited employees are defined as employees that arrived at most one year before the start of the current reporting year. The bank-year statistics in Panel C are sourced from Bankscope. The *Return on Loans* is defined as the (gross) interest income and changes in loan loss provisions (LLP) standardized by loans; *Returns to Trading* is calculated as the trading income standardized by non-loan assets (assets minus loans).

		Obs. (1)	Mean (2)	STD (3)	Min (4)	10th (5)	50th (6)	90th (7)	Max (8)
Panel A: Employee-year statistics									
Total Pay		1,261,693	70,759	49,384	24,000	38,751	59,196	110,849	3,065,640
Base Salary		1,262,994	60,014	23,639	24,000	37,068	54,648	89,195	485,757
Bonus Pay		1,269,208	10,696	33,120	0	0	3,873	23,478	2,662,500
Bonus Share		1,262,145	0.133	0.248	0	0	0.077	0.302	20.475
Panel B: Bank-year statistics by employee group									
Average Bonus Share									
Logistical Services	D1	268	0.076	0.054	0.000	0.007	0.068	0.150	0.324
HQ Services	D2	271	0.135	0.098	0.000	0.022	0.125	0.255	0.856
Retail Banking	D3	166	0.095	0.090	0.000	0.003	0.072	0.192	0.509
Corp. Banking	D4	192	0.199	0.164	0.000	0.021	0.185	0.380	1.139
Private Banking	D5	169	0.204	0.151	0.000	0.025	0.185	0.408	0.978
Asset Mgmt.	D6	162	0.257	0.201	0.000	0.043	0.227	0.486	1.174
Invest. Banking	D7	186	0.431	0.488	0.000	0.021	0.286	1.031	3.169
Treasury/Markets	D8	230	0.412	0.400	0.000	0.020	0.291	0.937	2.246
Internal Services	D1+D2	273	0.106	0.068	0.000	0.024	0.095	0.194	0.449
Loan Business	D3+D4	226	0.142	0.126	0.000	0.008	0.108	0.317	0.745
Trading Business	D7+D8	237	0.394	0.356	0.000	0.062	0.310	0.899	2.142
All juniors		260	0.057	0.050	0.000	0.000	0.052	0.105	0.408
All new recruits		263	0.119	0.125	0.000	0.021	0.090	0.239	0.929
Average Base Salary									
Internal Services	D1+D2	273	63,722	11,680	43,935	50,179	62,203	79,771	104,248
Loan Business	D3+D4	226	68,537	20,594	37,127	47,695	61,891	97,246	130,600
Trading Activity	D7+D8	237	90,660	22,619	50,019	66,785	88,438	119,483	175,692
All juniors		260	45,697	7,509	28,984	37,537	44,624	57,455	68,084
All new recruits		263	66,289	17,633	39,688	46,548	64,891	90,596	127,657
Panel C: Bank-year statistics									
Return on Assets		275	0.011	0.008	−0.010	0.002	0.010	0.021	0.046
Return on Loans		273	0.158	0.160	0.026	0.051	0.100	0.337	0.822
Return on Trading		305	0.002	0.005	−0.009	−0.001	0.000	0.010	0.026
Loans/Assets		336	0.392	0.237	0.028	0.070	0.367	0.746	0.911
Deposits/Assets		342	0.684	0.204	0.135	0.401	0.710	0.910	0.950
Equity/Assets		342	0.069	0.073	0.011	0.018	0.044	0.144	0.478
Assets (in EUR million)		342	92,411	118,027	701	1,974	35,450	313,943	378,271
Log Assets		342	10.189	1.859	6.553	7.588	10.476	12.657	12.843

Table 2: Risk Sharing Across Bank Divisions

We compute the *Average Bonus Share* for all employees in a particular employee group and bank-year. The *Avg. Bonus Share* in a particular employee group is then regressed on the *Return on Trading* and on the *Return on Loans*. We define *Return on Trading* as trading income standardized by non-loan asset (total assets minus loans) and the *Return on Loans* as interest income and changes in loan loss provisions standardized by total loans. In all columns, we control for *Loans/Assets*, *Deposits/Assets*, *(Book) Equity/Assets*, *Log Assets*, and bank fixed effects. In Columns (4) to (6), we also include a *Crisis Dummy* which equals one for the crisis years 2008 to 2010 and zero otherwise. We regroup under (i) Trading Business all employees in Investment Banking (D7), and Treasury Management/Capital Markets (D8); (ii) Loan Business all employees in Retail Banking (D3), and Corporate Banking (D4), and (iii) Internal Services all employees in Headquarter Services (D1) and Logistical Services (D2). The sample contains bank year-observations for the years 2003 to 2010. Robust standard errors (reported in parentheses) are clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, ***, respectively.

Dep. variable:	*Average Bonus Share* (by Employee Group)					
Divisions:	Trading Business D7+D8 (1)	Loan Business D3+D4 (2)	Internal Services D1+D2 (3)	Trading Activity D7+D8 (4)	Loan Business D3+D4 (5)	Internal Services D1+D2 (6)
Return on Trading	14.008**	2.438*	2.312**	7.914	0.900	1.284
	(6.895)	(1.401)	(0.976)	(7.311)	(1.309)	(0.913)
Return on Loans	1.369***	0.414***	0.148***	1.056***	0.340**	0.083**
	(0.280)	(0.119)	(0.036)	(0.280)	(0.132)	(0.041)
Controls:						
Loans/Assets	0.080	−0.110	0.052	0.025	−0.129	0.036
	(0.321)	(0.110)	(0.046)	(0.303)	(0.113)	(0.049)
Deposits/Assets	0.434*	0.090	0.070**	0.188	0.039	0.025
	(0.238)	(0.064)	(0.034)	(0.235)	(0.067)	(0.037)
Equity/Assets	1.458	0.488	0.465**	1.361	0.447	0.428**
	(1.220)	(0.399)	(0.200)	(1.211)	(0.389)	(0.195)
Log Assets	0.020	−0.061	0.020	0.103	−0.039	0.039*
	(0.120)	(0.054)	(0.018)	(0.131)	(0.063)	(0.021)
Crisis Dummy (2008-10)				−0.168***	−0.041**	−0.033***
				(0.051)	(0.019)	(0.009)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.24	0.20	0.13	0.30	0.24	0.22
Number of banks	72	66	82	72	66	82
Observations	237	226	273	237	226	273

Table 3: Bonus Share Dynamics by Employee Group

We compute the *Average Bonus Share* for all employees in a particular employee group and bank-year. The *Average Bonus Share* in a particular employee group is then regressed on year fixed effects in Columns (1), (3), (5), (7), and (9), where 2007 is chosen as the reference year. In Columns (2), (4), (6), (8), and (10) we include the same bank level covariates as in Table 2. All columns control for bank fixed effects. The dependent variable in Columns (1) and (2) consists of the *Average Bonus Share* for all employees in the Trading Business (Investment Banking and Treasury Management/Capital Markets); in Columns (3) and (4) we consider the *Average Bonus Share* in the Loan Business (Retail Banking and Corporate Banking); and in Columns (5) and (6), we use the *Average Bonus Share* in Headquarter Services (human resources, accounting, etc.) and in Logistical Services (IT, customer service, etc.). In Columns (7) and (8), we consider the *Average Bonus Share* of junior employees (employed at the lowest two hierarchy levels); and in Columns (9) and (10), we use the *Average Bonus Share* of new recruits (hired at most one year before the reporting year). The sample contains bank year-observations for the years 2003 to 2010. Robust standard errors (reported in parentheses) are clustered by bank. Significance at the 10%, 5%, and 1% level is indicated by *, **, ***, respectively.

Dep. var.:	*Average Bonus Share* (by Employee Group)									
Divisions:	Trading Business D7+D8		Loan Business D3+D4		Internal Services D1+D2		Junior Employees hierarchy level ≤ 2		New Recruits tenure ≤ 1	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2003	-0.261^{***}		-0.099^{***}		-0.048^{***}		-0.047^{***}		-0.111^{***}	
	(0.072)		(0.024)		(0.008)		(0.010)		(0.027)	
2004	-0.247^{***}	-0.065	-0.089^{***}	-0.046^{*}	-0.037^{***}	-0.020^{*}	-0.037^{***}	-0.012	-0.105^{***}	-0.035
	(0.068)	(0.084)	(0.025)	(0.024)	(0.007)	(0.011)	(0.009)	(0.009)	(0.026)	(0.021)
2005	-0.155^{***}	-0.005	-0.052^{***}	-0.028	-0.018^{**}	-0.010	-0.025^{***}	-0.009	-0.087^{***}	-0.029
	(0.059)	(0.054)	(0.020)	(0.022)	(0.008)	(0.011)	(0.008)	(0.008)	(0.024)	(0.019)
2006	-0.206^{***}	-0.127^{*}	-0.054^{**}	-0.031	-0.014^{*}	-0.002	-0.021^{***}	0.000	-0.074^{***}	-0.021
	(0.065)	(0.076)	(0.023)	(0.025)	(0.007)	(0.011)	(0.008)	(0.009)	(0.021)	(0.019)
2007	Reference year									
2008	-0.359^{***}	-0.247^{***}	-0.111^{***}	-0.081^{***}	-0.050^{***}	-0.048^{***}	-0.040^{***}	-0.025^{***}	-0.082^{***}	-0.050^{*}
	(0.071)	(0.081)	(0.027)	(0.027)	(0.008)	(0.012)	(0.010)	(0.009)	(0.023)	(0.026)
2009	-0.354^{***}	-0.152^{**}	-0.083^{***}	-0.032	-0.040^{***}	-0.026^{**}	-0.037^{***}	-0.004	-0.081^{***}	-0.006
	(0.072)	(0.067)	(0.024)	(0.020)	(0.007)	(0.011)	(0.009)	(0.007)	(0.025)	(0.027)
2010	-0.531^{***}	-0.241^{***}	-0.149^{***}	-0.087^{**}	-0.070^{***}	-0.044^{**}	-0.044^{***}	-0.010	-0.162^{***}	-0.045^{*}
	(0.112)	(0.086)	(0.042)	(0.035)	(0.017)	(0.018)	(0.014)	(0.012)	(0.037)	(0.024)
Return on Trading		6.793		0.333		0.794		0.367		-2.562
		(7.648)		(1.525)		(0.879)		(0.578)		(2.317)
Return on Loans		1.073^{***}		0.344^{***}		0.091^{**}		0.175^{**}		0.343^{*}
		(0.268)		(0.123)		(0.038)		(0.079)		(0.179)
Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.26	0.34	0.19	0.30	0.21	0.26	0.13	0.26	0.14	0.21
Banks	183	72	173	66	320	82	298	78	292	78
Obs.	465	237	439	226	726	273	684	260	671	263

Table 4: Labor Cost Reduction in the Crisis and Pre-Crisis Bonus Pay

We compute the percentage change of a given bank's labor expenses between 2007 and 2008. The *Percentage Labor Cost Change 2007 to 2008* is then regressed on the *Average Bonus Share in 2007* which is computed as the average *Bonus Share* across all employees in a given bank in 2007. The *Percentage Labor Cost Change 2007 to 2008* is reported for the (i) *Average Bonus Pay* of bank employees in Column (1), (ii) the *Average Base Pay* in Column (2), (iii) the *Average Total Pay* (= Bonus + Base) in Column (3), and (iv) the *Bank-Wide Average Pay* per employee (from Bankscope) in Column (4). In all columns, we control for *Loans/Assets*, *Deposits/Assets*, *(Book) Equity/Assets*, and *Log Assets*—all measured in 2007. Columns (5) and (6) add the interaction term with the percentage change of total bank income (plus changes in loan provisions) from 2007 to 2008. Robust standard errors are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, ***, respectively.

	Percentage Labor Cost Change 2007 to 2008					
	Average Bonus Pay (1)	*Average Base Pay* (2)	*Average Total Pay* (3)	*Bank-Wide Labor Expenses* (4)	*Average Total Pay* (5)	*Bank-Wide Labor Expenses* (6)
Avg. Bonus Share in 2007	−43.662**	−4.498	−40.543***	−22.436***	−45.785***	−31.029***
	(18.022)	(3.530)	(5.490)	(6.726)	(6.018)	(7.125)
Avg. Bonus Share in 2007					0.139*	0.449***
× *Income Change* (%)					(0.075)	(0.129)
Income Change (%)					0.000	−0.086**
					(0.014)	(0.033)
Controls measured in 2007:						
Loans/Assets	−27.832	−1.008	−1.424	12.375	−7.809	16.129
	(29.801)	(5.538)	(9.764)	(8.082)	(11.401)	(14.012)
Deposits/Assets	41.414	−6.665	14.293	21.056**	1.815	24.490*
	(42.745)	(7.514)	(13.455)	(9.959)	(11.150)	(12.951)
Equity/Assets	164.434*	−3.758	62.004**	−3.335	15.899	87.173
	(85.866)	(14.539)	(30.222)	(29.796)	(55.369)	(98.742)
Log Assets	−0.589	0.449	0.535	−3.893***	0.717	−3.252**
	(3.874)	(0.769)	(1.078)	(1.258)	(1.125)	(1.330)
R^2	0.16	0.09	0.57	0.29	0.63	0.41
Observations	46	46	46	50	35	39

Table 5: Bank Heterogeneity and Pre-Crisis Bonus Pay

We compute the *Average Bonus Share* for all employees in a particular employee group in the last year before the crisis. The *Avg. Bonus Share in 2007* in a particular employee group is then regressed on *Employment Share of Trading* and *Non-Interest Income Share in 2003*. We define *Employment Share of Trading* as as the relative number of employee observations in Investment Banking (D7) and Treasury Management/Capital Markets (D8). The *Non-Interest Income Share in 2003* is defined as non-interest income divided by total gross income in 2003. In all columns, we control for *Loans/Assets*, *Deposits/Assets*, *(Book) Equity/Assets*, and *Log Assets*—all measured in 2003. We regroup under (i) Trading Business all employees in Investment Banking (D7), and Treasury Management/Capital Markets (D8); (ii) Loan Business all employees in Retail Banking (D3), and Corporate Banking (D4), and (iii) Internal Services all employees in Headquarter Services (D1) and Logistical Services (D2). Robust standard errors are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, ***, respectively.

Dependent variable:	*Average Bonus Share* in 2007 (by Employee Group)					
Divisions:	Trading Business D7+D8		Loan Business D3+D4		Internal Services D1+D2	
	(1)	(2)	(3)	(4)	(5)	(6)
Employment Share of Trading	2.233***		0.688***		0.258**	
	(0.638)		(0.173)		(0.096)	
Non-Interest Income Share in 2003		1.237***		0.315**		0.152***
		(0.351)		(0.116)		(0.046)
Controls measured in 2003:						
Loans / Assets	0.054	1.116**	-0.328**	-0.178	-0.077*	0.047
	(0.326)	(0.420)	(0.128)	(0.165)	(0.043)	(0.050)
Deposits / Assets	0.161	-0.253	0.150	0.034	0.052	0.005
	(0.369)	(0.409)	(0.145)	(0.170)	(0.061)	(0.053)
Equity / Assets	1.368	-0.014	1.111	0.767	0.625**	0.447
	(1.323)	(1.230)	(0.706)	(0.728)	(0.258)	(0.278)
Log(Assets)	-0.038	-0.022	-0.005	0.006	0.006	0.009
	(0.050)	(0.048)	(0.015)	(0.016)	(0.007)	(0.007)
R^2	0.53	0.41	0.52	0.41	0.34	0.30
Observations	48	48	42	42	50	50