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Research Article

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The Link between Debt Guarantees, Leverage Ratios and Salaries in Swiss Banking

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Abstract:

It is well known that state bank debt guarantees create a significant moral hazard problem by encouraging banks to invest in more risk in the pursuit of higher returns, knowing that the state will bail them out if they fail. Researchers have recently postulated that the higher returns stemming from investing in more risk may lead banks to share the proceeds with their personnel through higher wages. In this case, moral hazard effects should manifest themselves in wages that exceed the pay that banks unshielded by debt guarantees offer for equivalent qualifications. Employing an econometric approach that enables measuring the impact of debt guarantees and leverage ratios on wages, we find a positive link between risk exposure and pay in Swiss banking. Given these findings, it seems important to ensure that remuneration structures in banking do not inadvertently reward risk enhancing behavior. Our results also seem relevant for ongoing reforms in Switzerland of public liquidity backstops and capital frameworks, where the design of compensation and guarantee mechanisms aims to mitigate moral hazard effects.

Keywords: bank debt guarantees, moral hazard, wage differentials

JEL classifications : G21, G28, G32, J31

1 Introduction

Economists generally agree[1] that bank debt guarantees, whether they be explicit or implicit, create a significant moral hazard problem by encouraging bank owners to invest in more risk in the pursuit of higher returns, knowing that governments or central banks will bail them out if they fail. Recently, the moral hazard argument has been extended to bank salaries. In this vein, DENK ET AL. (2015) suggest that the higher returns that increased investments in risk engender may lead bank owners to engage in rent sharing by remunerating the job qualifications of their personnel more generously than their qualifications would mandate. In this case, moral hazard effects should also manifest themselves in wages that exceed the pay that banks unshielded by debt guarantees offer for equivalent qualifications. DENK ET AL. (2015), term such wage surpluses pay premiums.

Two methodologies have emerged in the literature for investigating the presence of pay premiums in banking. The original approach, initiated by DENK ET AL. (2015), draws on the inter-industry wage differential studies inspired by the work of DICKENS and KATZ (1987) and KRUEGER and SUMMERS (1988). These studies, which append industry-specific dummy variables to Mincer wage functions, typically find persistent wage differences across industries that workers' skills and education fail to explain. In addition, they generally discover that wages in the financial sector exceed those offered in almost all other industries[2], which DENK ET AL. (2025) interpret as evidence that the debt guarantees found in banking lead to higher salaries.

The approach favored by DENK ET AL. (2015) is problematical, however. For one, the dummy variables these studies employ merely capture any industry-specific residual variation that worker qualifications cannot explain and thus are open to myriad interpretations. Efficiency wage theories, for example, maintain that these differentials result from the attempts of firms to reduce employment turnover, to limit shirking and/or to attract better quality workers.[3] Furthermore, inter-industry wage differential studies assume that, absent industry-specific dummy variables, all industries remunerate employee qualifications uniformly, although labor productivity is known to vary across sectors. And, finally, these studies fail to establish a direct link between bank debt guarantees and pay. The relationship is merely implied. Bank salaries can differ from those in other industries for any number of reasons that have nothing to do with debt guarantees.

The second approach adopted by GROPP ET AL. (2020) and BAESSLER ET AL. (2024) avoids these shortcomings by focusing on the rescission of public bank guarantees for savings banks in Germany in 2001. This quasi-experimental setting enables the authors to employ a difference-in-differences (DiD) analysis, in which the behavior of banks before and after the loss of their guarantees is compared with the conduct of banks unaffected by this policy change. Both studies find that, after the regime change, wage growth in banks whose debt

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1 Admittedly, other researchers such as MARCUS (1984) or KEELEY (1990) have argued that debt guarantees can increase a bank's charter or franchise value and thus encourage bank owners to limit risk-taking to protect future rents. In their surveys, SCHICH (2018) and FENG ET AL. (2023) show, however, that empirical studies generally find that the moral hazard effect dominates the franchise effect. Hence, the latter can essentially be ignored.

2 See the surveys in RYCX/TOJEROW (2007) or DENK ET AL. (2015). FERRO-LUZZI (1994) finds the same result to hold in Switzerland.

3 See KRUEGER/SUMMERS (1988).

guarantees were rescinded was slightly lower than in banks unaffected by the policy change, thus suggesting that debt guarantees result in somewhat higher salaries.

The DiD approach is not without its problems either as it neglects the fact that explicit debt guarantees generally come with strings attached, i.e., with additional restrictions or obligations such as more stringent capital requirements, greater accountability or closer monitoring intended to offset the moral hazard problem that debt guarantees create. These concomitant restrictions, if effective, can mitigate the moral hazard problems to such an extent that little change in risk-taking is observed when the debt guarantees and their associated restrictions are lifted. This may be the reason why the DiD studies fail to uncover a larger wage effect.

To circumvent this errors-in-variables problem, one can replace the presence or absence of a debt guarantee by a bank's leverage ratio. If the rent-sharing proposition posited by DENK ET AL. (2015) holds then one should observe a negative (positive) relationship between a bank's leverage ratio (risk exposure) and its pay premium. Given the concomitant restrictions commonly linked to debt guarantees, a bank's leverage ratio may be a better gauge of a bank's true ability to take on risk than the presence or absence of a debt guarantee. We employ both measures in the following study.

In principle, one could apply a difference-in-differences approach to banks in Switzerland as the cantons of Geneva, Vaud and Bern dropped their debt guarantees for their cantonal banks in 2000, 2008 and 2012, respectively. Unfortunately, the data at our disposal contain too few observations to achieve statistically significant results using this approach. Hence, we adopt the methodology favored by DENK ET AL. (2015), albeit without the aforementioned shortcomings. These we avoid, for one, by applying the approach solely to the Swiss financial sector, specifically to banks that, in addition, differ with respect to their risk exposures. Furthermore, we do not assume that banks remunerate employee qualifications uniformly but instead estimate separate Mincer wage equations for banks with differing risk exposure. Since this is equivalent to interacting a risk dummy variable with the explanatory variables in a single equation, estimating separate equations captures the direct effect of risk exposure on bank's labor remuneration practices. And, finally, we apply Blinder-Oaxaca decompositions to the regression results to compute the size of pay premiums.

Our data stem from the SESAM data base managed by the Federal Statistical Office of Switzerland in Neuchâtel covering the years 2010 to 2022.[4] SESAM is an acronym for Social Security and Labor Market and consists of data on individuals from the Swiss Labor Force Survey (SLFS)[5], combined with income data from the Central Compensation Office (CCO) of the public Old-Age and Survivors' Insurance (OASI). CCO registers an individual's entire income subject to OASI contributions and thus includes bonuses. Since our income data are based on employers' reports, they should be more accurate than self-reported income that survey interviews commonly collect. We confine our data to the first wave of the SLFS panel to keep the econometrics simple.

[4] The choice of time span is due to data compatibility.

[5] FERRO-LUZZI (1994) also employs SLFS data, but without the CCO income figures as they were linked later to SLFS.

Our paper unfolds as follows. The next section explains our empirical methodology in greater detail, the section thereafter our data. The fourth section is subdivided into two parts: the first focuses on bank groups of differing risk exposure and the second on individual cantonal banks. The final section discusses our results and concludes.

2 Empirical Methodology

Our empirical approach basically consists in explaining differences in wages between employee groups. The standard procedure in such an endeavor is to apply a Blinder-Oaxaca decomposition. This technique decomposes the average observed wage gap existing between two sets of workers, denoted here as groups A and B, into a component due to differences in employee characteristics, known generally as the endowment effect, and into a component due to differences in the remuneration of these characteristics, commonly termed the coefficient effect. In the following, we name the first effect the personnel effect as it applies here to the attributes of a bank's personnel, and term the latter effect, following DENK ET AL. (2015), the pay premium as it measures how much an observed wage differential results from banks remunerating given employee characteristics differently.

The Blinder-Oaxaca decomposition is typically applied to Mincer wage equations, which specify the natural logarithm of an individual's pay (w) as a linear function of set of J pay-relevant individual attributes ($\boldsymbol{x}$) weighted by a vector of coefficients ($\boldsymbol{\beta}$), i.e.,

$$w_{Ai} = \sum_{j=1}^{J} \beta_{Aj} \cdot x_{Aij}$$

$$w_{Bi} = \sum_{j=1}^{J} \beta_{Bj} \cdot x_{Bij}$$

Based on these two equations, the average observed relative pay ($\bar{w}$) difference between groups A and B can then be decomposed additively into a component due to differences in average qualifications ($\bar{x}$) and a component due to remuneration differences ($\boldsymbol{\beta}$) in the following manner:

$$\bar{w}_A - \bar{w}_B = \sum_{j=1}^{J} \beta_{A_j} \cdot \left(\bar{x}_{Aj} - \bar{x}_{Bj}\right) + \sum_{j=1}^{J} \left(\beta_{Aj} - \beta_{Bj}\right) \cdot \bar{x}_{B_j} \qquad (1)$$

$$= \text{personnel effect} + \text{pay premium}$$

As is well known, the above decomposition is not the only permissible breakdown. Equally legitimate are the following four decompositions.

$$
\begin{aligned}
\bar{w}_A - \bar{w}_B = & \sum_{j=1}^{J} \beta_{A_j} \cdot \left(\bar{x}_{Aj} - \bar{x}_{Bj}\right) + \sum_{j=1}^{J} \left(\beta_{Aj} - \beta_{Bj}\right) \cdot \bar{x}_{B_j} \\
= & \sum_{j=1}^{J} \beta_{B_j} \cdot \left(\bar{x}_{Aj} - \bar{x}_{Bj}\right) + \sum_{j=1}^{J} \left(\beta_{Aj} - \beta_{Bj}\right) \cdot \bar{x}_{A_j} \\
= & \sum_{j=1}^{J} \beta_{A_j} \cdot \left(\bar{x}_{Aj} - \bar{x}_{Bj}\right) + \sum_{j=1}^{J} \left(\beta_{Aj} - \beta_{Bj}\right) \cdot \bar{x}_{A_j} - \sum_{j=1}^{J} \left(\beta_{Aj} - \beta_{Bj}\right) \cdot \left(\bar{x}_{A_j} - \bar{x}_{B_j}\right) \\
= & \sum_{j=1}^{J} \beta_{B_j} \cdot \left(\bar{x}_{Aj} - \bar{x}_{Bj}\right) + \sum_{j=1}^{J} \left(\beta_{Aj} - \beta_{Bj}\right) \cdot \bar{x}_{B_j} + \sum_{j=1}^{J} \left(\beta_{Aj} - \beta_{Bj}\right) \cdot \left(\bar{x}_{A_j} - \bar{x}_{B_j}\right)
\end{aligned}
$$

The third summand in the last two equations is known as a joint or combined effect, which cannot be assigned exclusively to one of the other two effects.

Since we are solely interested in determining how much more or less an individual with a fixed qualification profile (***x***) can earn in banks with differing risk exposure, we focus exclusively on the second term appearing in the above equations, i.e., on the pay premium as defined in equation (1), which does not vary across decompositions.

Since we, in addition, wish to compare wages not only between two bank groups, as the above equations suggest, but rather across several bank groups or individual banks, we select a fixed reference institute or group against which all other banks or bank groups are then compared.[6] The average employee profile in the reference bank or bank group corresponds to $\bar{\boldsymbol{x}}_B$ in equation (1).[7] Accordingly, $\boldsymbol{\beta}_A^T \bar{\boldsymbol{x}}_B$ represents the natural logarithm of the pay that an individual with the given profile could earn in bank or bank group *A* based on how profile characteristics are remunerated there, while $\left(\boldsymbol{\beta}_A - \boldsymbol{\beta}_B\right)^T \bar{\boldsymbol{x}}_B$ corresponds to the pay premium that bank or bank group *A* offer.[8]

3 Data

As mentioned in the introduction, we apply our methodology to individual data drawn from SESAM. In proceeding, we first identify which workers in our data represent bank employees. Here we rely on the General Classification of Economic Activities (NOGA) from 2008 employed in SESAM. Our study focuses on cantonal banks (NOGA code 641902), large banks (641903), regional and savings banks (641904) along with Raiffeisen banks (641905). The only banks we can identify individually in SESAM are cantonal banks. We do this by combining the NOGA code for cantonal banks with an individual's canton of employment, thereby abstracting from the possibility that cantonal banks may establish branches outside their home canton.

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6 The fact that we want to hold the employee profile constant across banks or bank groups rules out employing matching in place of regression analysis as matching does not enable profile control.

7 Bold letters denote column vectors throughout.

8 From the perspective of a treatment evaluation (cf. CAMERON/TRIVEDI, 2005) and based on equation (1), pay premiums are formally equivalent to the average treatment effect on the non-treated (ATNT), where the treatment is a debt guarantee and the non-treated are banks without such a guarantee.

Next, we group banks according to the types of state debt guarantees they enjoy. We base this essentially on institutional and legal criteria such as cantonal guarantee provisions, state ownership or historical experience. The latter we base on evidence showing that certain banks have benefited from, or are widely expected to benefit from, public backing in times of financial stress. Together, these criteria lead to the following breakdown:

(i) banks with explicit debt guarantees, consisting of all cantonal banks except those in the cantons of Bern (BE), Geneva (GE) and Vaud (VD),

(ii) banks with implicit debt guarantees, encompassing the cantonal banks of BE, GE and VD,

(iii) banks with implicit debt guarantees, containing large banks,

(iv) banks without debt guarantees, comprising regional and savings banks and, finally,

(v) Raiffeisen banks, whose exact status regarding debt guarantees is somewhat unclear as we explain below.

That large banks enjoy implicit debt guarantees rests on ISCH-TAUDIEN ET AL. (2026) and related work documenting past interventions and the expectation of state support in the future. For cantonal banks, we draw on rating agency reports such as Moody's, which explicitly link banks' credit strengths to that of their cantons. For example, Moody's October 2024 rating[9] of the Bern Cantonal Bank AG moves it up a notch based on the agency's assumption of strong affiliate support from the Canton of Bern. This illustrates that market participants factor in a meaningful degree of implicit government backing.

We group Raiffeisen banks in a separate category due to their cooperative structure. Although legally independent, the over 200 Raiffeisen banks in Switzerland are organized in a single cooperative, named Raiffeisen Switzerland, which bears responsibility for the business policy and strategy of the member banks along with their risk management and auditing. Raiffeisen Switzerland is presently the second-largest bank group in Switzerland and hence classified as a systemically relevant bank subject to special capital requirements. It is uncertain whether the debt of Raiffeisen Switzerland is implicitly guaranteed because of its large size.

In defining a bank employee's pay, we take an individual's annual income subject to OASI contributions, thus including bonuses, as reported in SESAM, adjust it for inflation using the consumer price index and then divide the result by 12 and an individual's degree of unemployment, which consists of a percentage lying between 0 and 100 percent. The result thus corresponds to the real monthly income of a full-time bank employee. We then take natural logarithms of this income in accordance with the standard specification of a Mincer wage function.

To economize on regressors, we convert the categories for an individual's highest level of educational attainment appearing as the variable TBQ1 in SESAM into years of schooling based on the scheme appearing in *Table 1*.

[9] https://www.bekb.ch/-/media/bekb/portal/documents/news/rating_action-moodys-ratings-affirms-berner-20241004.pdf

Tab. 1: Conversion of Levels of Educational Attainment into Years of Schooling

Educational attainment	TBQ1	Years
Compulsory education	1	9
Vocational training	2	11
Secondary school, business school (1–2 years)	3	10
Secondary school, general education	4	12
Apprenticeship	5	12
Full-time vocational school	6	12
High school diploma, teacher training college	7	13
Advanced vocational training	8	15
University	9	18

Table 2 lists the variables employed as regressors in our study. The same variables commonly appear in Mincer wage equations. As the table indicates, employee profiles vary little across the five categories except for group (3) consisting of large banks. These institutions exhibit exceptionally large shares of foreign personnel and managers and the highest average monthly pay.

Tab. 2: Average Employee Profile by Bank Category, 2010-2022

Variable	(1)	(2)	(3)	(4)	(5)
Monthly Salary in CHF	10'778	9'394	11'228	9'469	9'274
Age	42.9	43.7	41.8	41.9	42.1
Foreigner	0.15	0.19	0.34	0.14	0.09
Years of Schooling	14.3	14.5	15.5	13.7	13.8
Managerial Position	0.13	0.11	0.26	0.14	0.18
Supervisory Position	0.25	0.29	0.21	0.25	0.30
Clerk	0.62	0.60	0.53	0.62	0.52
Tenure in Years	12.5	13.6	12.1	11.2	9.4
Sample Size	992	235	2'683	291	653

(1) Explicit state debt guarantee: all cantonal banks except those of BE, GE, and VD
(2) Implicit state debt guarantee: cantonal banks in BE, GE, and VD
(3) Implicit state debt guarantee: large banks
(4) No state debt guarantee: regional banks and savings banks
(5) Raiffeisen Switzerland
Salaries inflation-adjusted using the CPI.

4 Empirical Results

4.1 Bank Groups

Differences in the average profiles of employees in the five bank groups can, according to the Blinder-Oaxaca decomposition, be attributed to two factors: (i) differences in the caliber of

staff the banks employ as captured in the vector $\boldsymbol{x}$ and (ii) differences in how the banks remunerate job qualifications as measured by estimates of β.
We obtain values for the vector β by estimating separate Mincer wage equations for each of the five bank groups using ordinary least squares (OLS). Our regression results appear in *Table 3*.

The coefficient estimates presented in *Table 3* measure the slopes of the wage equations. In the case of continuous variables, they represent the relative change in an employer's salary due to a one unit increase in the given variable. In the case of years schooled, this change is commonly termed the rate of return on education and measures the increase in pay from an additional year of schooling. The table indicates that this return varies from 4.9 to 7.7 percent across the five bank groups, a range commonly yielded by Mincer wage equation estimates.[10] The variation in these returns also shows that the five bank groups do not remunerate educational qualifications uniformly.

Tab. 3: OLS Wage Equation Estimates, 2010-2022

Variable	(1)	(2)	(3)	(4)	(5)
Constant	6.494	7.272	6.317	7.290	5.879
	(0.000)	(0.507)	(0.138)	(0.000)	(0.000)
Age	0.068	0.012	0.085	0.035	0.095
	(0.000)	(0.031)	(0.008)	(0.026)	(0.000)
Age^2	-0.0007	0.000	-0.0008	-0.0003	-0.0010
	(0.000)	(0.000)	(0.000)	(0.203)	(0.000)
Years of Schooling	0.059	0.077	0.049	0.050	0.063
	(0.000)	(0.016)	(0.003)	(0.000)	(0.000)
Management Position	0.648	0.772	0.543	0.488	0.361
	(0.000)	(0.097)	(0.021)	(0.000)	(0.000)
Supervisory Position	0.161	0.238	0.208	0.126	0.116
	(0.000)	(0.071)	(0.019)	(0.003)	(0.000)
Foreigner	0.025	-0.089	0.064	-0.082	0.020
	(0.421)	(0.089)	(0.019)	(0.129)	(0.751)
Years of Tenure	0.011	0.004	0.013	-0.005	0.004
	(0.002)	(0.009)	(0.003)	(0.468)	(0.440)
Years^2 of Tenure	0.000	0.000	0.000	0.000	0.000
	(0.014)	(0.000)	(0.000)	(0.299)	(0.498)
R^2	0.580	0.473	0.486	0.465	0.490
Sample Size	992	235	2683	291	653

(1) Explicit state debt guarantee: all cantonal banks except those of BE, GE, and VD
(2) Implicit state debt guarantee: cantonal banks in BE, GE, and VD
(3) Implicit state debt guarantee: large banks
(4) No state debt guarantee: regional banks and savings banks
(5) Raiffeisen Switzerland
Heteroskedasticity-robust standard errors appear in parentheses.

The use of variables in combination with their squares serves to determine whether a variable's effect increases or decreases as the variable itself increases, in other words, whether the relationship is non-linear. Differing signs of a variable and its square indicate that the initial effect diminishes as the variable increases, while uniform signs indicate that the effect increases. *Table 3* shows, for example, that pay increases with age but at a diminishing rate in

[10] See, for example, the surveys from LEMIEUX (2006) or POLACHEK (2007)

all five bank groups. This common finding in Mincer wage equation estimates is taken to reflect declining returns to work experience.[11]

In the case of categorical variables, the estimates in *Table 3* give the relative change in pay if an individual exhibits the characteristic in question. Note, however, that differences in natural logarithms, which the coefficients represent, are only roughly equivalent to relative changes. In truth, the relative change is equal to exp(β)-1. Using this formula, one can confirm that for values of β between -0.10 and +0.10 the approximation is good; but for values below this range, β overstates the relative change; and for values above it, β understates it.

Tab. 4: Pay Premiums that Employees in Regional and Savings Banks (4) Could Expect to Earn in Other Bank Groups, 2010-2022

	(1)	(2)	(3)	(5)
Pay Premium	4.26%	5.63%	9.86%	-4.19%
p-value	0.035	0.006	0.000	0.064

(1) Explicit state debt guarantee: all cantonal banks save those of BE, GE, and VD
(2) Implicit state debt guarantee: cantonal banks of BE, GE, and VD, respectively
(3) Implicit state debt guarantee: large banks
(4) No state debt guarantee: regional banks and savings banks
(5) Raiffeisen Switzerland
Pay premiums result from applying the Blinder-Oaxaca decomposition to the wage equations in *Table 3.*
p-values are based on one-sided tests of the signs of the pay premiums.

Based on the estimates in *Table 3*, we can now calculate pay premiums using a Blinder-Oaxaca decomposition. The rates of remuneration in regional and savings banks (4) serve as our basis of comparison, i.e., represent the vector β_B in equation (1) for the pay premium. We choose these banks as our reference group as they are subject the most to market discipline as evidenced by the S&L bank crisis in Switzerland in the beginning of the 1990s,[12] which saw a number of these banks either collapse or be taken over by large banks. The pay premiums based on this reference group appear in *Table 4*. The premiums give the relative increase (positive sign) or decrease (negative sign) in pay that an average employee in a regional or savings bank could expect to earn in each of the other bank groups given how these bank groups remunerate individual profile characteristics. The results indicate that an average employee in a regional or savings bank could earn more in all bank groups save in the Raiffeisen group. As the p-values show, the signs of all pay premiums are statistically significant.

Table 5 shows the degree to which bank-specific differences in the remuneration of individual profile characteristics contribute to the size of the pay premiums appearing in *Table 4*. Recall from equation (1) that a pay premium is simply the sum of the intergroup differences between the coefficients (β) linked to each variable (x), weighted with the average profile characteristics ($\bar{x}$) of the personnel in the reference bank group. According to *Table 5*, age and tenure are the largest contributing factors in all four bank groups. Years of schooling also play a dominant role in all bank groups except in the case of large banks.

[11] Cf. LEMIEUX (2006) or POLACHEK (2007).

[12] Regional and savings banks suffered massive mortgage-lending losses in the beginning of the 1990s due to a sudden rise in interest rates aimed at lowering inflation.

Tab. 5: Components of Pay Premiums, 2010-2022

Variable	(1)	(2)	(3)	(5)
Constant	-0.678	0.110	-0.855	-1.406
	(0.033)	(0.849)	(0.006)	(0.000)
Age	1.401	-0.939	2.091	2.518
	(0.057)	(0.521)	(0.004)	(0.005)
Age^2	-0.8063	0.582	-1.132	-1.4114
	(0.059)	(0.497)	-(1.957)	(0.006)
Years of Schooling	0.127	0.367	-0.021	0.179
	(0.530)	(0.206)	(0.917)	(0.407)
Management Position	0.013	0.021	0.001	-0.011
	(0.089)	(0.061)	(0.846)	(0.166)
Supervisory Position	-0.007	-0.005	0.009	0.009
	(0.400)	(0.733)	(0.259)	(0.327)
Clerk	-0.040	-0.081	-0.028	0.028
	(0.076)	(0.017)	(0.176)	(0.250)
Foreigner	0.008	-0.001	0.010	0.007
	(0.095)	(0.942)	(0.017)	(0.224)
Swiss	-0.046	0.003	-0.062	-0.044
	(0.086)	(0.942)	(0.011)	(0.217)
Years of Tenure	0.181	0.098	0.198	0.104
	(0.034)	(0.444)	(0.018)	(0.292)
$Years^2$ of Tenure	-0.100	-0.100	-0.113	-0.015
	(0.053)	(0.157)	(0.027)	(0.822)
Pay Premium (= sum)	0.043	0.056	0.099	-0.042
	(0.068)	(0.165)	(0.000)	(0.132)

p-values appear in parentheses based on two-sided tests.

Of central interest, however, is how pay premiums vary with the presence or absence of debt guarantees. According to the rent-sharing proposition forwarded by Denk et al. (2015), debt guarantees should lead to positive pay premiums. That is also what we find in *Table 4*. One would assume, however, that pay premiums increase as debt guarantees become explicit, i.e., more binding, and yet that is not what we observe. Note, though, that according to *Table 7*, which presents the p-values of all pairwise premium comparisons, not all inter-group differences are statistically significant. This is true specifically of differences between the pay premium of cantonal banks with an implicit debt guarantee and those, respectively, of cantonal banks with an explicit guarantee and large banks. The lack of statistical significance stems in part from the small number of observations for cantonal banks with implicit debt guarantees (see *Table 3*), resulting in large standard errors for this bank group.

In part, the fact that pay premiums increase as debt guarantees become explicit is also due to the criticism of the DiD studies we voiced in the introduction, namely that debt guarantees often stipulate additional conditions aimed at damping the risk-taking debt guarantees encourage. Hence, although explicit guarantees appear more binding at face value, because of concomitant conditions, they need not induce more risk-taking and, by extension, higher pay premiums.

In the case of implicit debt guarantees, the certainty of the guarantee also needs to be considered. For example, the implicit guarantee that large banks enjoy due to their size can be taken as certain since their collapse would endanger the viability of the Swiss financial system. The 2008/09 financial crises or the bailout of Credit Suisse are cases in point. This certainty encourages large banks to invest in more risk. Hence the large pay premium.

Due to its large size, the Raiffeisen Group also must adhere to the strict regulatory standards designed for "too big to fail" (TBTF) institutions although its members are to our knowledge not protected by debt guarantees.

Tab. 6: Statistical Significance of the Differences in Pay Premiums across Bank Groups

Bank Group	(2)	(3)	(5)
(1)	0.376	0.000	0.000
(2)		0.163	0.015
(3)			0.000

(1) Explicit state debt guarantee: all cantonal banks save those of BE, GE, and VD
(2) Implicit state debt guarantee: cantonal banks of BE, GE, and VD, respectively
(3) Implicit state debt guarantee: large banks
(5) Raiffeisen Switzerland
The figures in the table represent p-values based on one-sided tests of the signs of the differences in pay premiums across bank groups.

Since additional regulatory restrictions commonly accompany debt guarantees, banks leverage ratios may provide a more accurate picture of banks' true ability to invest in risk, assuming of course that banks exploit this ability, which seems plausible given banks' profit motive. As *Table7* now indicates, cantonal banks with explicit debt guarantees and the Raiffeisen Group exhibit the largest capital cushions. This implies that the regulatory authorities keep both bank groups on a short leash. It also suggests that concomitant measures such as stricter capital requirements, greater accountability or closer monitoring aimed at countering moral hazard and TBTF can be quite effective in practice. In line with their large capital cushions and associated lower returns, these two bank groups also display the lowest pay premiums.

Tab. 7: Pay Premiums and Basel III Leverage Ratios, 2010-2022

	(1)	(5)	(2)	(3)
Basel III Leverage Ratio	8.3%	7.2%	6.9%	5.3%
Pay Premium	4.26%	-4.19%	5.63%	9.86%

(1) Explicit state debt guarantee: all cantonal banks save those of BE, GE, and VD
(2) Implicit state debt guarantee: cantonal banks of BE, GE, and VD, respectively
(3) Implicit state debt guarantee: large banks
(5) Raiffeisen Switzerland
Pay premiums from *Table 4*
Leverage ratios stem from the annual FINMA publication "Key Metrics for Banks and Security Firme" and represent overall averages for the time span 2015 to 2022. Earlier issues do not exist.

It is also interesting to note in *Table 7* that large banks with merely implicit, yet unquestionably certain debt guarantees carry the least capital and, due to their presumably higher returns, also offer the largest pay premiums.[13] In general, with perhaps the exception of

[13] Note that the high pay premium that large banks offer is not simply result from banks' attempts to reduce employment turnover or to attract higher quality candidates by means of higher wages in accordance with efficiency wage theories since *Table 3* indicates that employees at large banks display roughly the same degree of schooling and tenure (the reciprocal of employee turnover) as employees at other banks. Nor can the high pay premium result from economies of scale or scope since parametric and non-parametric

Raiffeisen banks, *Table 7* suggests a strict negative relationship between banks' leverage ratios and their pay premiums, which aligns with the rent-sharing argument forwarded by DENK ET AL. (2015). Of course, four observations are insufficient to establish statistical significance. For this reason, we employ a larger sample in the next section to investigate the relationship between equity ratios and pay premiums further.

4.2 Cantonal Banks

We limit our focus in the following to cantonal banks as they are the only institutions that we can identify individually with the data at our disposal. In our investigation, we first estimate Mincer wage functions as before, but for each bank separately, then calculate each bank's pay premium and compare these with their equity ratios. Our wage equation estimates for the banks appear in *Table 8*, and their pay premiums along with their equity ratios in *Tables 9 and 10*. The coefficient estimates in *Table 8* show that the cantonal banks do in fact remunerate the profile characteristics of their employees differently, which means that we can expect pay premiums to exist.

Recall that the Blinder-Oaxaca decomposition methodology is based on pairwise comparisons. Our data enable the application of this methodology to 18 banks[14]. Despite the reduced number, 18 banks nevertheless yield 306 possible pairwise comparisons, far too many to be manageable. Hence, we choose two separate reference banks with which we compare the remaining 17 banks respectively. That reduces the number of comparisons to 34. To gain a general overview, we choose two polar opposites: the cantonal bank with the highest overall capitalization in our sample, the Schaffhausen Cantonal Bank, and the one with the lowest, the Geneva Cantonal Bank. The employee profiles of these banks serve as $\bar{x}_B$, and the differences in the coefficient estimates in *Table 8* for $(\beta_A - \beta_B)$ in equation (1).

We turn first to the results in *Table 9*, which employs the Geneva Cantonal Bank as the basis of comparison. The first column of figures in the table presents the banks' pay premiums and the four remaining columns their associated equity ratios. If the correlation between equity ratios and pay premiums is in fact negative, as the rent-sharing proposition predicts, all of the banks listed in *Table 9* should exhibit a negative pay premium, i.e., pay identical employees less than the Geneva Cantonal Bank does, since they are more highly capitalized than the Geneva Cantonal Bank. As *Table 9* shows, save for the Uri Cantonal Bank, this is also the case. However, the relationship is not statistically significant overall as indicated by the p-values of the correlation coefficients appearing in the last row of the table. Hence, although practically all cantonal banks with a higher level of capitalization than the Geneva Cantonal Bank exhibit negative pay premiums, i.e., remunerate employees with the average profile of an employee of the Geneva Cantonal Bank less, the relationship between pay premiums and equity ratios is not strictly linear overall.

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production function estimates by RIME/STIROH (2003) and SHELDON (1993, 1994) show that economies do not exist in Swiss banking.

[14] Two cantons (AR and SO) do not have a cantonal bank; SESAM lacks enough observations to run a regression for the cantons of AI, FR, JU, NW and OW on a full set of explanatory variables; and the cantonal bank of ZH is excluded because — unlike all other cantonal banks — it enjoys, as a systemically important bank, both a cantonal and an (implicit) federal guarantee, thus leaving us with 18 cantonal banks in total.

Tab. 8: Mincer Wage Equation Estimates for Cantonal Banks, 2010-2022

Variable	AG	BE	BL	BS	GE	GL	GR	LU	NE	SG	SH	SZ	TG	TI	UR	VD	VS	ZG
Constant	5.919	8.142	7.055	7.001	8.726	7.352	6.774	6.390	8.236	0.097	5.735	5.518	7.732	6.988	6.871	6.403	7.307	7.352
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.522)	(0.000)	(0.000)	(0.000)
Age	0.082	0.020	0.023	0.041	-0.096	0.033	0.074	0.070	-0.035	-0.001	0.122	0.095	0.012	0.033	0.120	0.069	0.035	0.033
	(0.002)	(0.594)	(0.481)	(0.370)	(0.370)	(0.536)	(0.001)	(0.005)	(0.529)	(0.000)	(0.074)	(0.000)	(0.763)	(0.268)	(0.734)	(0.058)	(0.456)	(0.536)
Age^2	-0.001	0.000	0.000	0.000	0.001	0.000	-0.001	-0.001	0.001	0.039	-0.001	-0.001	0.000	0.000	-0.001	-0.001	0.000	0.000
	(0.009)	(0.639)	(0.831)	(0.571)	(0.571)	(0.600)	(0.002)	(0.041)	(0.364)	(0.002)	(0.109)	(0.002)	(0.985)	(0.626)	(0.853)	(0.213)	(0.588)	(0.600)
Years of Schooling	0.089	0.021	0.076	0.028	0.109	0.056	0.023	0.061	0.040	0.851	0.044	0.103	0.056	0.077	-0.108	0.063	0.042	0.056
	(0.000)	(0.152)	(0.002)	(0.151)	(0.151)	(0.055)	(0.186)	(0.000)	(0.237)	(0.023)	(0.041)	(0.000)	(0.016)	(0.011)	(0.822)	(0.000)	(0.096)	(0.055)
Management Position	0.608	0.800	0.566	0.807	0.495	0.464	0.471	0.475	0.958	0.173	0.405	0.531	0.498	0.732	0.632	0.977	0.298	0.464
	(0.000)	(0.000)	(0.015)	(0.001)	(0.001)	(0.006)	(0.000)	(0.000)	(0.000)	(0.000)	(0.005)	(0.000)	(0.003)	(0.000)	(0.661)	(0.000)	(0.130)	(0.006)
Supervisory Position	0.175	0.247	0.296	0.319	0.164	-0.066	0.187	0.157	0.406	0.216	-0.036	0.113	0.019	0.097	1.114	0.286	0.189	-0.066
	(0.071)	(0.002)	(0.022)	(0.001)	(0.001)	(0.610)	(0.005)	(0.008)	(0.008)	(0.014)	(0.789)	(0.090)	(0.846)	(0.420)	(0.532)	(0.011)	(0.120)	(0.610)
Foreigner	-0.054	-0.204	-0.122	0.186	-0.224	-0.138	-0.145	-0.013	0.201	-0.006	-0.089	-0.210	-0.040	-0.260	1.041	-0.075	0.244	-0.138
	(0.723)	(0.118)	(0.576)	(0.086)	(0.086)	(0.524)	(0.579)	(0.900)	(0.173)	(0.125)	(0.615)	(0.001)	(0.697)	(0.005)	(0.613)	(0.372)	(0.124)	(0.524)
Years at Present Job	0.007	-0.005	0.016	0.034	0.025	0.028	0.032	0.004	0.074	0.000	-0.048	-0.002	0.004	-0.018	0.105	-0.002	0.025	0.028
	(0.642)	(0.611)	(0.541)	(0.024)	(0.024)	(0.221)	(0.003)	(0.696)	(0.013)	(0.655)	(0.070)	(0.802)	(0.787)	(0.236)	(0.672)	(0.894)	(0.432)	(0.221)
$Years^2$ at Present Job	0.000	0.000	0.000	-0.001	-0.001	-0.001	-0.001	0.000	-0.002	6.167	0.002	0.000	0.000	0.000	-0.004	0.000	-0.001	-0.001
	(0.900)	(0.551)	(0.648)	(0.015)	(0.015)	(0.344)	(0.006)	(0.930)	(0.008)	(0.924)	(0.027)	(0.520)	(0.984)	(0.243)	(0.691)	(0.956)	(0.373)	(0.344)
R^2	0.819	0.570	0.589	0.681	0.606	0.320	0.723	0.600	0.698	0.713	0.899	0.850	0.535	0.831	0.960	0.535	0.549	0.541
Sample Size	42	73	46	48	42	13	55	102	27	70	17	33	44	37	10	120	26	39

p-values appear in parentheses.

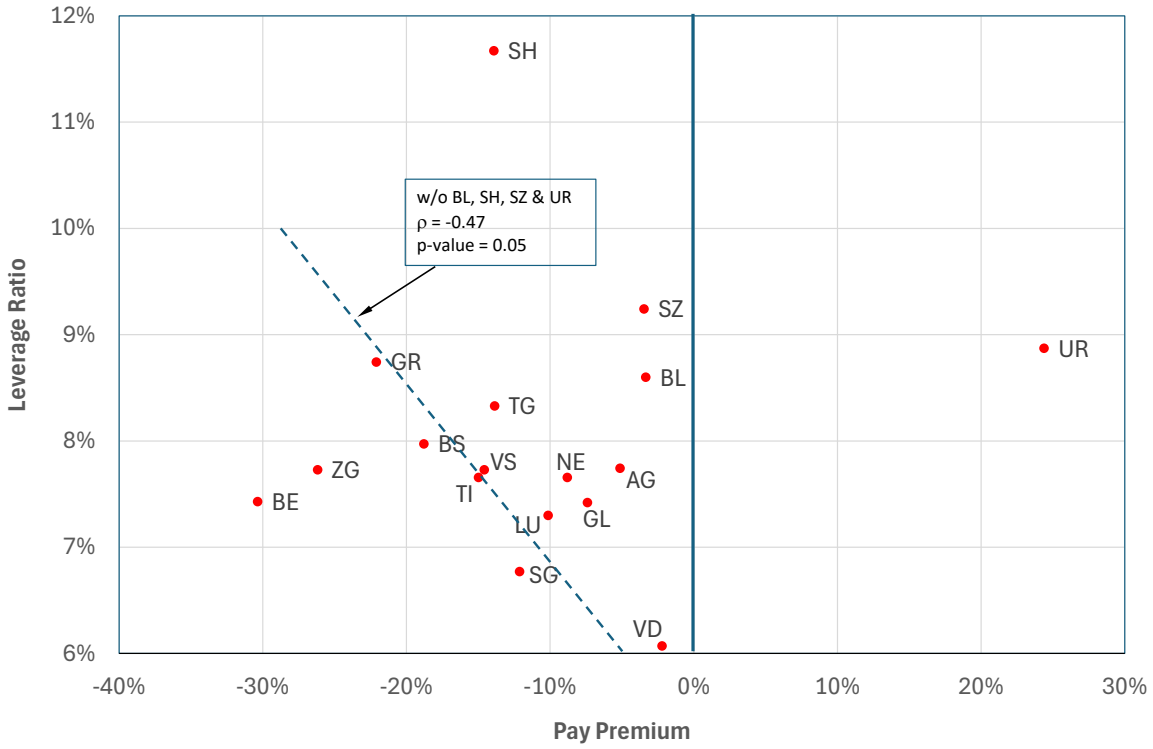
Tab. 9: Pay Premiums and Equity Ratios of Cantonal Banks Based on the Geneva Cantonal Bank, 2010-2022

Cantonal Bank	Pay Premium	CET1 in % of RWA	T1 in % of RWA	Total Capital Ratio in % of RWA	BASEL III Leverage Ratio
Aargau Cantonal Bank	-5.13% (0.699)	17.8%	17.8%	17.9%	7.7%
Bern Cantonal Bank	-30.4% (0.559)	18.8%	18.8%	19.3%	7.4%
Basel-Country Cantonal Bank	-3.3% (0.792)	19.7%	19.7%	19.8%	8.6%
Basel-City Cantonal Bank	-18.8% (0.110)	17.4%	17.8%	17.9%	8.0%
Glarus Cantonal Bank	-7.4% (0.825)	11.4%	16.4%	18.6%	7.4%
Graubünden Cantonal Bank	-22.1% (0.140)	19.6%	19.6%	19.6%	8.7%
Lucerne Cantonal Bank AG	-10.1% (0.411)	13.5%	15.9%	16.7%	7.3%
Neuchâtel Cantonal Bank	-8.8% (0.501)	17.5%	17.5%	17.8%	7.7%
St. Gallen Cantonal Bank AG	-12.1% (0.357)	15.4%	15.9%	17.0%	6.8%
Schaffhausen Cantonal Bank	-13.9% (0.384)	25.3%	25.3%	25.6%	11.7%
Schwyz Cantonal Bank	-3.5% (0.776)	21.5%	21.5%	22.2%	9.2%
Thurgau Cantonal Bank	-13.9% (0.263)	18.3%	18.3%	18.5%	8.3%
Bank of the Canton of Ticino	-15.0% (0.204)	15.6%	16.2%	17.6%	7.7%
Uri Cantonal Bank	24.4% (0.752)	18.3%	18.3%	18.6%	8.9%
Vaud Cantonal Bank	-2.2% (0.878)	17.3%	17.3%	17.5%	6.1%
Valais Cantonal Bank	-14.6% (0.266)	17.3%	17.3%	17.7%	7.7%
Zug Cantonal Bank	-26.2% (0.072)	17.9%	17.9%	18.0%	7.7%
Correlation between Pay Premium and Capital		-3.5% (0.447)	43% (0.041)	-1.1% (0.483)	9.3% (0.361)

p-values appear in parentheses and refer to two-sided tests.
ET1: Common Equity Tier 1 capital (core capital)
T1: Tier 1 capital
RWA: risk-weighted assets
Basel III Leverage Ratio = Tier I capital divided by unweighted assets
Figures on equity ratios stem from the annual FINMA publication "Key Metrics for Banks and Securities Firms" for the years 2015 to 2022. Earlier issues do not exist.

Figure 1 investigates why a linear relationship between equity ratios and pay premiums fails to emerge. The chart presents a scatter plot of the first and last column (leverage ratio) of figures in *Table 9*. If we drop the outliers consisting of the cantonal banks of Basel-Country (BL), Schaffhausen (SH), Schwyz (SZ) and Uri (UR), we find that a statistically significant negative relationship does exist between a cantonal bank's leverage ratio and its pay premium as the rent-sharing hypothesis leads one to expect: the correlation coefficient equals -0.47 and has a p-value of five percent. Hence, a negative relationship does exist for most cantonal banks, but it breaks down when outliers are included.

Fig. 1: Scatter Plot of the Leverage Ratios and the Pay Premiums of Cantonal Banks based on Geneva Cantonal Bank as Reference Bank, 2010-2022



Source: *Table 8*, columns 1 and 5
The dotted line results from a linear regression of a bank's leverage ratio on its pay premium, excluding the outlier cantonal banks in BL, SH, SZ and UR.
The labels correspond to the official abbreviations for the Swiss cantons.

We obtain a similar result when we set the Schaffhausen Cantonal Bank as our reference bank (cf. *Table 10*). Here all pay premiums except those of the Basel-Country and Bern cantonal banks are positive as one would expect if pay premiums and equity ratios were negatively correlated. But the negative correlation does not hold across all the cantonal banks. Based on the p-values of the correlation coefficients appearing in the last row in *Table 9*, no statistically significant linear relationship exists between pay premiums and equity across all cantonal banks.

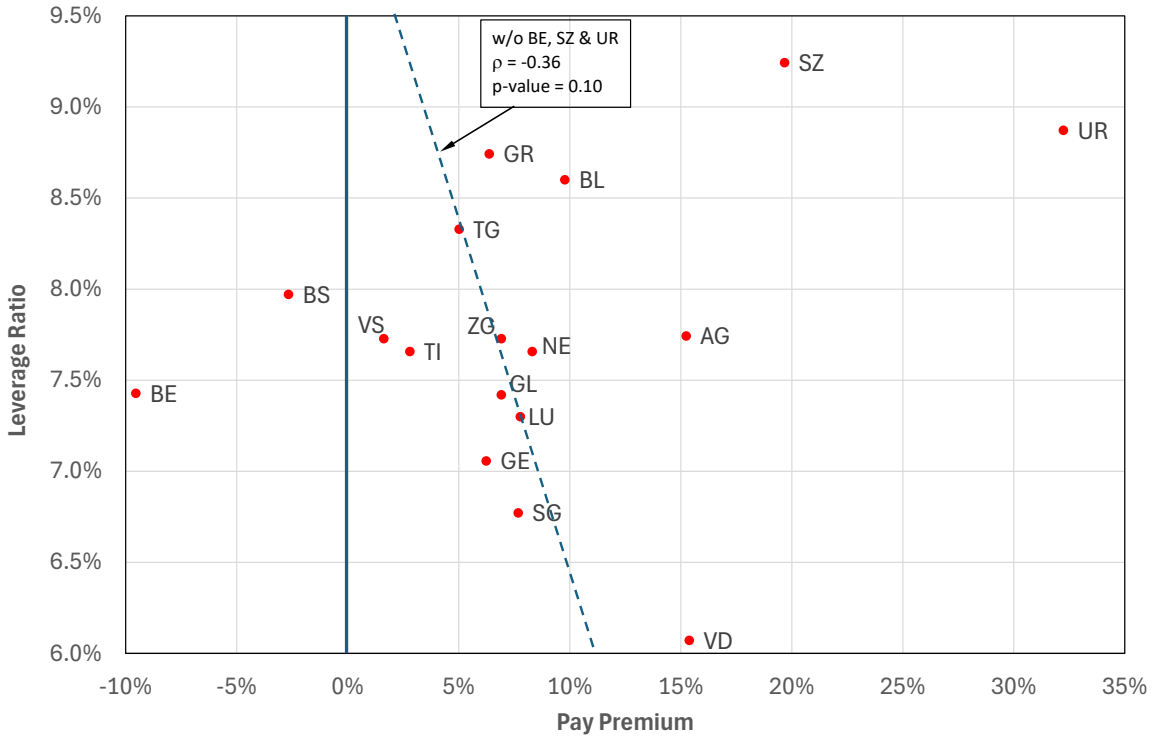
Tab. 10: Pay Premiums and Equity Ratios of Cantonal Banks Compared to the Schaffhausen Cantonal Bank, 2010-2022

Cantonal Bank	Pay Premium	CET1 in % of RWA	T1 in % of RWA	Total Capital Ratio in % of RWA	BASEL III Leverage Ratio
Aargau Cantonal Bank	15.24% (0.025)	17.8%	17.8%	17.9%	7.7%
Bern Cantonal Bank	-9.5% (0.179)	18.8%	18.8%	19.3%	7.4%
Basel-Country Cantonal Bank	9.8% (0.302)	19.7%	19.7%	19.8%	8.6%
Basel-City Cantonal Bank	-2.7% (0.783)	17.4%	17.8%	17.9%	8.0%
Geneva Cantonal Bank	6.2% (0.627)	13.1%	14.6%	15.7%	7.1%
Glarus Cantonal Bank	6.9% (0.364)	11.4%	16.4%	18.6%	7.4%
Graubünden Cantonal Bank	6.4% (0.405)	19.6%	19.6%	19.6%	8.7%
Lucerne Cantonal Bank AG	7.8% (0.163)	13.5%	15.9%	16.7%	7.3%
Neuchâtel Cantonal Bank	8.3% (0.421)	17.5%	17.5%	17.8%	7.7%
St. Gallen Cantonal Bank AG	7.7% (0.358)	15.4%	15.9%	17.0%	6.8%
Schwyz Cantonal Bank	19.7% (0.001)	21.5%	21.5%	22.2%	9.2%
Thurgau Cantonal Bank	5.0% (0.477)	18.3%	18.3%	18.5%	8.3%
Bank of the Canton of Ticino	2.8% (0.694)	15.6%	16.2%	17.6%	7.7%
Uri Cantonal Bank	32.2% (0.590)	18.3%	18.3%	18.6%	8.9%
Vaud Cantonal Bank	15.4% (0.067)	17.3%	17.3%	17.5%	6.1%
Valais Cantonal Bank	1.6% (0.839)	17.3%	17.3%	17.7%	7.7%
Zug Cantonal Bank	6.9% (0.364)	17.9%	17.9%	18.0%	7.7%
Correlation between Pay Premium and Capitalization		18% (0.240)	21% (0.217)	20% (0.224)	31% (0.115)

p-values appear in parentheses and refer to two-sided tests.
CET1: Common Equity Tier 1 capital (core capital)
T1: Tier 1 capital
RWA: risk-weighted assets
Basel III Leverage Ratio = Tier I capital divided by unweighted assets
Equity ratios stem from the annual FINMA publication "Key Metrics for Banks and Securities Firms" for the years 2015 to 2022. Earlier issues do not exist.

Here again we present a scatter plot (cf. *Figure 2*) of the values appearing in the first and last column of figures in *Table 10*. If we once again eliminate the outliers, consisting in this case of the cantonal banks of Bern (BE), Schwyz (SZ) and Uri (UR), we find a negative relationship does exist between a bank's leverage ratio and its pay premium: the correlation coefficient (ρ) equals -0.36, which is linked to a p-value of 10 percent.

Fig. 2: Scatter Plot of the Leverage Ratios and the Pay Premiums of Cantonal Banks based on Schaffhausen Cantonal Bank as Reference Bank, 2010-2022



Source: *Table 9*, columns 1 and 5.
The dotted line results from a linear regression of a bank's leverage ratio on its pay premium, excluding the outlier cantonal banks in BE, SZ and UR.
The labels correspond to the official abbreviations for the Swiss cantons.

As a final control, we also run a pooled regression, in which the four leverage ratios are alternatively appended to a single Mincer wage function common to all banks. Problematic with this approach is of course that it, along with inter-industry wage studies, assumes that all banks remunerate profile characteristics uniformly. Nonetheless, pooled regression may provide corroborating evidence for a negative relationship. Estimates of the four equity coefficients appear in *Table 11*. As the table indicates, all signs are negative as the rent sharing hypothesis predicts, although they merely come close to being statistically significant at conventionally accepted error levels. Nevertheless, they are more likely negative than positive. The coefficient estimates imply that a one percentage point increase in a bank's equity ratio would lower the average bank salary between 0.38 and 0.92 percent.

Tab. 11: Equity Coefficient from a Pooled Mincer Wage Function Regression, 2010-2022

CET1 in % of RWA	T1 in % of RWA	Total Capital Ratio in % of RWA	BASEL III Leverage Ratio
-0.55%	-0.45%	-0.38%	-0.92%
(0.110)	(0.210)	(0.258)	(0.193)

p-values from one-sided sign tests appear in parentheses

5 Conclusion

Our paper has followed the suggestion laid out by DENK ET AL. (2015) to search for signs of the risk-inducing effects of state bank debt guarantees in the wage setting practices of shielded banks. Yet we avoided several methodological shortcomings in their work by (i) restricting our analysis solely to banks that, in addition, differ in their risk exposures and by (ii) improving the econometrics by employing an approach that enables measuring the direct link between banks' risk exposures and their remuneration practices.

Based on the rationale posed by DENK ET AL. (2015), one should expect banks to share the returns stemming from the increased risk taking that public debt guarantees engender with their personnel in the form of pay premiums, defined as wages that exceed the pay that personnel qualifications mandate. And indeed, we find that banks with state debt guarantees do pay more for the same set of employee qualifications than regional and savings banks lacking these guarantees do. The pay premiums range from four to ten percent depending on the type of guarantee. It appears, however, that explicit debt guarantees, which – taken at face value – should create a larger moral hazard problem and encourage greater risk-taking, unexpectedly yield smaller pay premiums than implicit assurances.

In explaining this finding, we noted that debt guarantees are often linked to additional restrictions or obligations such as more stringent capital requirements, greater accountability or closer monitoring, which can lessen the moral hazard effects that debt guarantees create and which debt guarantees alone fail to capture. To avoid this errors-in-variables problem, we also investigated the relationship between equity ratios and pay premiums and found it to be negative if one ignores outliers, which conforms with the rent-sharing hypothesis posited by DENK ET AL. (2015).

The negative relationship between equity ratios and pay premiums may raise the danger of an excessive interest of banks in maintaining an unduly low level of capitalization. This should be especially true of banks that base remuneration at least in part on returns on equity relative to peer banks, without providing equivalent counter incentives that would promote effective risk limitation.

Several policy options are available to lessen this danger. For one, remuneration rules for top management could be adjusted in those instances where they disproportionately favor reductions in equity capital. For another, the planned statutory public liquidity backstop for systemically important Swiss banks (SIBs), which aims to provide a limited state guarantee for emergency loans in resolution, could include an appropriate compensation mechanism. And finally, the ongoing TBTF reform could strive to minimize the overall value of state guarantees for SIBs by ensuring sufficiently robust capitalization. In the final analysis, it is of course up to law makers to decide which course of action, if any, should be taken.

Abbreviations

AG: Aargau

AI: Appenzell-Innerrhoden

AR: Appenzell-Ausserrhoden

BE: Bern

BL: Basel-Country

BS: Basel-City

CCO: Central Compensation Office of OASI

CET1: common equity tier 1 capital

DiD: difference-in-differences

FINMA: Swiss Financial Market Supervisory Authority

FR: Fribourg

GE: Geneva

GL: Glarus

GR: Grisons

JU: Jura

LU: Lucerne

NE: Neuchâtel

NOGA: General Classification of Economic Activities

NW: Nidwalden

OASI: Old-Age and Survivors' Insurance

OW: Obwalden

RWA: risk-weighted assets

SESAM: Social Protection and Labor Market

SG: Saint Gall

SH: Schaffhausen

SIB: systemically important bank

SLFS: Swiss Labor Force Survey

SO: Solothurn

SZ: Schwyz

T1: Tier 1 capital

TBTF: too big to fail

TG: Thurgau

TI: Ticino

UR: Uri

VD: Vaud

VS: Valais

ZG: Zug

ZH: Zurich

Declarations

1 Availability of data and materials

The data upon which this study is based are available from the Federal Statistical Office in Neuchâtel, Switzerland.

2 Competing interests

The author declares that he has no competing interests.

3 Funding

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4 Authors' contributions

The author read and approved the final manuscript.

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