State-owned Banks as Competition Enhancers, or the Grand Illusion

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Abstract

We analyze the role of state-ownership in the banking sector from the perspective of competition. Considering both the market for mortgage loans and the market for savings and investment deposits in Switzerland, we test three hypothesis: (i) Is the conduct followed by the state-owned "cantonal banks" consistent with marginal cost pricing? (ii) Do cantonal banks charge and/or offer relatively customer friendly interest rates? And (iii) is competition intensified by the conduct and presence of cantonal banks. Based on a detailed database containing information at the individual bank level over the 1996-2002 period, the answer is: "No".

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1 Introduction

The Swiss banking sector is characterized by levels of concentration which are remarkably high in international comparison, with the major two banks holding about two-thirds of total assets. Moreover, it has been organized as a (legal) cartel in its recent past: a few "big banks" have been setting national reference rates until 1997. Nonetheless, despite of this market-power prone environment, the empirical evidence suggests that the pricing in the Swiss banking sector is relatively moderate.

Moderate pricing in a concentrated market is not necessarily surprising, as this might reflect the benefits of natural selection in an industry characterized by economies of scale. The plausibility of this hypothesis seems questionable, however, in a market where 97% of the banks account for only about 10% of total assets, i.e. banks of very different scale coexist. An alternative hypothesis, which we will explore in this paper, is that this situation reflects the competition enhancing effect of not-for-profit state-owned "cantonal banks".

In a world à la Arrow-Debreu, the question of ownership is irrelevant. Assuming, among others, that markets are perfectly competitive, a profit maximizing bank achieving zero excess profit is expected to behave just like its social welfare maximizing state-owned counterpart. When departing from this hypothetical world, however, differences in ownership, which translate into differences in objective functions, may matter. Regarding pricing, state-owned firms' objective – maximize welfare or more realistically achieve zero-profit – is superior from a consumer – and generally welfare – point of view than maximizing profits. Hence, state-owned firms might adopt a more consumer-friendly pricing and, by affecting the demand function faced by competing profit maximizing firms, reduce thereby their ability to extract consumer surplus.

The creation of the cantonal banks in Switzerland has been motivated along these lines. They were established in the second half of the 19th century with the basic mandate to stimulate economic development in their respective canton, i.e. in one of the 26 political states which form Switzerland. While the exact terms of their mandates are generally vague, some cantonal banks are explicitly given the mandate to intensify competition through customer friendly interest rates. Figures regarding profitability are also consistent with a zero (economic) profit objective, even though this objective is not explicitly formulated: the cantonal banks' return on assets over the 1987-2002 period was 0.21% as compared to 0.48% for the banking sector as a whole. Based on this, and on the fact that cantonal banks are major players in most cantons, it seems natural to assume that cantonal banks play a special – and from a borrower or lenders' perspective beneficial – role in the Swiss banking sector. The goal of our paper is to show if what seems a natural assumption is supported by the data.

Our starting point is to consider that differences in the objective function should lead to visible differences in the banks' conduct. That is, we expect the conduct followed by cantonal banks to deviate from the conduct which is typical in the banking sector. More precisely, in the light of their mandate, we expect their conduct to deviate in a way which directly or indirectly benefits borrowers and lenders. We would in particular expect cantonal banks to follow a relatively aggressive pricing policy that should translate into relatively low interest rates on mortgages and relatively high interest rates on deposits. Another, less obvious, consequence of a relatively aggressive pricing policy should be a relatively high price sensitivity to common cost movements (pass-through rates), i.e. relatively close to the unitary pass-through rate implied by marginal cost pricing. Finally, in a market where banks interact, we would expect cantonal banks' deviating conduct to interfere with, and affect their competing banks' conduct. The underlying assumption is that cantonal banks may affect the equilibrium outcome of a market in a way which goes beyond their direct effect on the average interest rate in that market.

We test those assumptions using a detailed database containing information at the individual bank level and covering the 1996-2002 period. Under the line, our data provide no evidence in support of these assumptions. First it appears that, whenever different, cantonal banks' pass through rates are generally *lower* than the typical pass through rate in the industry. Second, most of our results suggest that even after controlling for portfolio characteristics cantonal banks tend to charge *higher* interest rates on their mortgages and grant *lower* interest rates on their deposits than the typical bank in Switzerland. Third, we find no evidence that the interest rates are particularly borrower or lender friendly in those cantons where the presence of cantonal banks is particularly strong.

The main lesson from these findings is that, based on the Swiss case, state ownership does not appear to be an effective instrument to enhance competition in the banking sector. As a consequence, it may be worth reconsidering the rationale of state-ownership in a sector which offers no obvious public goods characteristics. And the relevance of this issue is not limited to Switzerland: According to La Porta et al. (2002, table I) in the average country, worldwide, 42% of the equity of the 10 largest banks was owned by the government in 1995.

The rest of the paper is structured as follows: in section 2, we briefly survey the related literature. Section 3 contains an example of the potential role played by state-owned banks in a market with horizontal product differentiation. This example serves as an illustration of the mechanism we focus on in the empirical analysis which is developed in section 4 to 6. We summarizes our results and discuss our findings in section 7. Finally, we present the policy implications and conclude in section 8.

2 Related literature

The question of the relative merits of state- versus private-ownership has been a widely discussed and recurrent topic for many decades and has generated an ample literature.[1] Shirley and Walsh (2000) provide a broad review of this literature. On a theoretical level and from a general point of view, the main line of

[1] For work on the value of state ownership in oligopolistic markets see, among others, De Fraja and Delbono (1989) or Cremer et al. (1989).

argumentation can be summarized as follows: state-ownership should in principle be preferred whenever some form of market failures, in particular insufficient competition, prevails; however, given information and incentive related issues, the dominance of state-ownership over private-ownership is not guaranteed even in the presence of market failure. Consistently, the empirical evidence is mixed but, in general privately owned firms turn out to be more efficient than their publicly-owned counterparts. Moreover, when considering the (small) subset of studies which focus on pricing and hence are of particular relevance to us, privately ownership unambiguously dominate, i.e. offer more friendly consumer pricing than public owned firms.[2]

Regarding the banking sector, the number of papers addressing the issue of the conduct and/or the relative performance of state-ownership is quite modest. To our knowledge, all the papers are empirical and only a few focus explicitly on pricing. La Porta et al. (2002) study the relationship at the macro level between growth and government versus privately ownership of banks. They conclude that more government ownership in the banking sector is traditionally associated with slower subsequent financial development and lower growth of per capita income and productivity. More in line with our work, i.e. at a more disaggregated level and with a stronger focus on performance within the banking market, Molyneux and Forbes (1995) show that state-owned banks were more profitable than other banks in Europe in the late 1980s. They do not however specifically address the question of pricing. The Swiss banking sector has already been the object of a few studies that tackle the issue of state-ownership. Egli and Rime (1999), for example, analyze the Swiss banking sector and, while addressing the more general question of the relationship between concentration and pricing, they test the potential effect of state-owned bank on interest rates: controlling for market concentration they reject the hypothesis of consumer friendly pricing by dominant state-owned banks. Shaffer (2002) explores the conduct of the different categories of banks in Switzerland, among them the state-owned cantonal banks. Using aggregate data, he concludes that cantonal banks appear to have exercised no market power during the period considered (1979-1991) while the big and the foreign banks seem to have enjoyed a degree of monopoly power during the same period. Finally Rime and Stiroh (2003) also investigate the Swiss banking sector with a focus on efficiency and come to the conclusion that state-owned banks are not less efficient than their privately owned counterparts.

From a methodological point of view, our research is also closely linked to recent work on the competitive role of credit unions in the banking sector. While the focus is on a different category of banks, the questions raised and the methodology employed to tackle those questions are similar. Among those studies, Feinberg (2002) investigates the pro-competitive role of credit-unions. Based on a panel of US data, he finds evidence of a negative relationship between the market share of credit unions in the saving market an their own interest

[2]According to the authors, only 3 studies, out of 52, compare the relative performance of publicly- and privately-owned banks based on prices. See Shirley and Walsh (2000), table 1, p. 50-51.

rates in the loan market. He interprets this result as an indication that credit unions should be seen as price-taking fringe competitors and play an important pro-competitive role in the banking market.

While related to the existing literature, and in particular to Egli and Rime (1999), our research differentiates itself along at least two important dimensions. First regarding the dataset: the 1996-2002 period we focus on allows us to use previously unavailable data on banks' portfolio characteristics. This data allow us in particular to risk-adjust the interest rates on mortgages in a more accurate way than used to be possible using the traditional measure, i.e. loan-loss reserves. Second, and more important, this paper is, to the best of our knowledge, the first systematic study of the conduct and the competitive role of state-owned banks.

3 The role of state-owned banks as competition enhancer: an illustrative example

In this section, we illustrate the potential role of a state-owned bank following a zero-profit objective using the Hotelling (1929) set-up.[3] This set-up seems particularly well suited to competition in the banking sector where product differentiation and, in particular geographical distance between bank branches, seem to play a major role, as was recently underlined by Petersen and Rajan (2002) and Degryse and Ongena (2002).

We assume a linear city of length 1 which is home to a continuum of uniformly with unit density distributed borrowers with an inelastic demand for bank loans. There are 3 banks, labelled 1 to 3, located along the main road at a_1, a_2 and a_3 respectively. To account for the horizontal product differentiation, it is assumed that borrowers incur a quadratic "transportation cost" when borrowing from a bank which location differs from theirs. We further assume that the marginal cost of producing banking services is zero.

This set-up allows us to compare 3 different cases. In case 1, we assume that two profit maximizing banks compete – sequentially, first in location and then, given locations, in price – with a state-owned bank, located at $a_2 = \frac{1}{2}$, which follows a zero-profit objective. In case 2, we assume that the state-owned bank is privatized, i.e. becomes a profit maximizer, while locations are assumed to remain unchanged. In case 3, locations are endogenized, i.e. three profit maximizing banks sequentially compete in locations and prices. This simple set-up allows us to highlight the fact that state-owned banks with a zero-profit objective affect the equilibrium outcome directly, by applying different prices and indirectly by modifying the other banks' optimal choices regarding pricing and location. We leave the details of the calculation in the appendix and focus on the main results, which are summarized in table 1 below.

In case I, the profit maximizing banks' locate at $a_1^I = 0.167$ and $a_3^I = 1 - a_1^I$ respectively and charge an interest rate $r_1^I = r_3^I = \frac{1}{9}$. By definition, the state

[3] See Tirole (1988), chap. 7, for a reader's digest version of the model.

owned bank charges $r_2^I = 0$. In this case, two-thirds of the population borrow from the state-owned bank $\left(X_2^I = \frac{2}{3}\right)$ while bank 1 and 2 each have a market share of $X_1^I = X_3^I = \frac{1}{6}$. The average – and, given the population of size 1, total – interest rate paid by the borrowers is $\bar{r}^I = 0.037$. In addition, the borrowers pay $T^I = 0.028$ in form of transportation costs.

In case II, bank 2 is now assumed to be a profit-maximiser. However, we assume that step 1's locational pattern $\{a_1, a_2, a_3\}$ is unchanged. Under this constellation, the average interest rate paid in the city is now $\bar{r}^{II} = 0.169$. As compared to case I, the average transportation cost decreases slightly – reflecting the bigger uniformity of the market shares – but transportation costs only plays a minor role: the average interest and transportation cost paid increases from $\bar{r}^I + T^I = 0.07$ to $\bar{r}^{II} + T^{II} = 0.18$.

Finally, case III depicts the equilibrium when profits are maximized both through the choice of the optimal location and the optimal pricing. As can be seen, the optimal locational structure, is characterized by a slightly higher level of geographical differentiation which allows banks to further increase their interest rates through an increase of their local market power: $r_1^{III} = r_2^{III} = 0.203 > r_1^{II} = r_2^{II}$ and $r_2^{III} = 0.172 > r_2^{III}$. This in turn leads to a higher average interest rate $\bar{r}^{III} = 0.19 > \bar{r}^{III}$ as well as a slightly higher transportation cost.

While only illustrative, this example highlights the potential role of a state-owned bank in an industry with less than perfect competition due to horizontal product differentiation and barriers to entry: borrowers benefit not only from its lower pricing but also from its impact – due to its non-strategic spatial behavior – on the conduct of its profit maximizing competitors.

Table 1

	r_1	X_1	a_1	r_2	X_2	a_2	$\bar{r}$	T	$\bar{r}+T$
Case I									
State-owned bank (locations endogenous)	.11	.17	.17	0	.67	$\frac{1}{2}$	.04	.03	.07
Case II									
Only profit maximizing banks (locations exogenous)	.19	.28	.17	.15	.44	$\frac{1}{2}$	.17	.01	.18
Case III									
Only profit maximizing banks (locations endogenous)	.20	.27	.13	.17	.46	$\frac{1}{2}$	.19	.01	.20

4 Data and methodology

We focus on two markets: the mortgage loans and the savings and investment deposits markets. Those markets suit our purpose particularly well. In particular, the mortgage loans and deposits markets are widely dominated by banks.

For instance, banks own about 90% of all mortgage loans outstanding in Switzerland. As a consequence, focusing on the banking industry, i.e. ignoring other actors like the insurance industry should not prevent us from identifying the major forces at play in those markets. In addition, and most important, the structure of the Swiss banking sector and the data available provide us with an almost ideal laboratory to investigate the influence of state-ownership on the equilibrium outcome in the banking sector. We see three reasons for that. First, theoretical and empirical considerations suggest that the relevant market for mortgages and deposits tends to be relatively small. This allows us to treat each canton as a separate market making and take full advantage of the fact that 24 of Switzerland's 26 cantons share a similar structure, with one cantonal bank (CB hereafter) competing with numerous privately owned banks.[4] Second, the CBs are major players at the cantonal level, with average market shares that exceed 30% in both the mortgage and the deposit market (see table 2). Third, the concentration in the Swiss banking sector is high in both the mortgage and the deposit markets (see table 2). The Herfindahl index of concentration varies between about 2'300 to 2'800 depending on the year and the market considered. These figures are (unweighted) averages over all cantons. In some cantons, the index exceeds 6'500 in the deposits market and 7'800 in the mortgage market. As a point of comparison, according to the DOJ Merger Guidelines in force in the United States, the threshold above which a planned merger is considered potentially harmful for competition is 1'800. These elements, together with the fact that our dataset provides us with details regarding the geographical distribution of the individual banks' mortgage and deposits portfolios, suggest that the Swiss banking sector offers appealing characteristics for the study of the impact of market structure – and the role of state-ownership as an element of this structure – on banks' conduct.

Besides information on the size and the geographical distribution of the banks' mortgage and deposits portfolios, our dataset includes information on pricing as well as variables that reflect the individual banks' portfolio structure. These variables potentially play a central role – as control variables – when explaining differences in interest rates between banks or through time. For instance, our dataset includes an indicator of the riskiness of the banks' mortgage portfolio (variable $RISK$) as well as an indicator of the interest rate adjustment constraint they are subject to (variable $FREE$). The exact role in our context of those, and the remaining variables reported in table 2, will be highlighted in the next section, when describing the content of our econometric specifications.

Table 2: Summary Statistics[5]

[Insert table 2 about here]

Using these data, we test 3 hypothesis. First, we test if the CBs interest rates sensitivity to common cost movements (pass-through rates) are relatively

[4] See Egli and Rime (1999) for a general discussion regarding the size of the relevant market in banking with an application to Switzerland.

high. More specifically **we test the hypothesis of identical pass-through rates against the alternative that state-owned banks' pass-through rates are higher than privately owned banks' (hypothesis 1)**. This assumption draws on the following proposition (the proof is left in Appendix 3):

Proposition 1 *Consider a market where N profit maximizing banks compete with K zero-profit (state-owned). Under the following assumptions: (i) both categories of banks are identical except for their objective function, (ii) the market is characterized by horizontal product differentiation, (iii) banks compete à la Nash in interest rates, (iv) the price-elasticity of individual and total demand functions is non-zero and (v) the cost functions are separable, we have*

$$0 < \frac{\partial r^*_{i \in N}}{\partial m} < \frac{\partial r^*_{i \in K}}{\partial m} = 1$$

where r_j *is the Nash-equilibrium interest rate charged by the N profit-maximizing banks,* $\dot{r}$ *is the opportunity cost of funds and* r^*_k *is the equilibrium interest rate charged by zero-profit (state-owned) banks.*

Proposition 1 captures the fact that differences in the objective function should lead to differences in the pass-through rates. Profit maximizing banks, which benefit from some degree of market power should report only a fraction of the marginal cost movements into their interest rates while banks following a zero-profit objective should report it entirely. Hence we test if state-owned banks' pricing policy is compatible with – or as compared to privately owned banks is closer to be compatible with – marginal cost pricing.

Second, we test if the CBs' interest rates are relatively consumer friendly. More specifically, **we test the hypothesis of equal pricing against the alternative that state-owned banks charge relatively low interest rates on their mortgages and/or offer relatively high interest rates on their deposits (hypothesis 2).**

Hypothesis 1 and 2 reflect two aspects of the same assumption according to which, to be in line with their mandate and valuable from a borrower and lender perspective, the CBs should adopt a relatively aggressive conduct regarding pricing. It is important to underline that while hypothesis 1 and 2 are closely linked, they convey complementary information. For instance, rejecting assumption 1 in favour of the proposed alternative while failing to reject assumption 2 could reflect the fact that state-owned banks follow a relatively aggressive pricing policy but are, in parallel, characterized by a relatively inefficient cost structure.

Third, we test if the conduct of the CBs competitors regarding pricing is affected by the strength of the CB's presence, i.e. we test the assumption that CBs affect the equilibrium outcome of a market in a way which goes beyond their direct effect on the average interest rate in that market. More specifically, **we test the hypothesis that privately-owned banks' pricing does not depend on the strength of the CBs' presence against the alternative that privately owned banks charge lower interest rates on mortgages**

and/or offer higher interest rates on deposits when facing a stronger CB (hypothesis 3). Hypothesis 3 is linked to hypothesis 1 and 2 in the following way: failing to reject hypothesis 1 and 2 would suggest that the CBs' conduct regarding pricing is observationally equivalent to their privately owned counterpart's. This situation should be consistent with privately owned banks' pricing policy not depending on the nature of their competitors, i.e. would be consistent with failing to reject hypothesis 3. On the other hand, rejecting either hypothesis 1 *or* 2 would be consistent with the rejection of hypothesis 3.

5 Hypothesis 1: pass-through rates

In this section we test the hypothesis of identical price sensitivity to shocks (or pass-through rates) against the alternative that state-owned banks' pass-through rates are higher than privately owned banks'

5.1 Mortgage loans: specification

In the case of mortgage loans, we estimate the parameters of the following equation:

$$\Delta R^M = \alpha_0^{M,I} + \left(\alpha_1^{M,I} + \alpha_2^{M,I} I_{CB}\right) \Delta LIBOR + \alpha_3^{M,I} \Delta RISK + \alpha_4^{M,I} \Delta GDP + \varepsilon^{M,I} \tag{1}$$

where Δ measures the year on year change of a variable, R^M is an indicator of the average interest rate on mortgages charged by bank i in canton j at time t. We will come back to the exact definition of R^M below. α_0 is a vector of constants, and I_{CB} is a dummy variable which takes the value 1 when bank i is a cantonal bank and zero otherwise.

$LIBOR$ is a variable measuring the interest rate conditions on the interbank market,[6] which we use as an indicator for the opportunity cost of funds. We expect $\alpha_1^{M,I}$ to be positive: an increase in the interest rate on the interbank market should lead to an increase in the average interest rate charged by banks on their mortgage portfolio (positive pass-through rate). The parameter of interest is α_2^I : we test the hypothesis that the state-owned banks' pass-through rate is higher than their privately-owned counterparts, i.e. we test the null-hypothesis $\alpha_2^{M,I} = 0$ against the alternative $\alpha_2^{M,I} > 0$.

The estimates of $\alpha_1^{M,I}$ and $\alpha_2^{M,I}$, are likely to depend on the interest-rates term structure of the mortgage portfolios: interest rates on mortgages are often contractually set at a given level over a given period of time. Fortunately, our data allow us to account for this dimension, which is not a priori linked to differences in the objective function of a bank: the variable $FREE$ is the fraction of the mortgage portfolio for each bank and for each year which is *not* subject to any interest rate adjustment constraint. Hence, we use the adjusted average interest rate $R^M = \frac{r^M}{FREE}$, where r^M is the average interest rate charged

[6] London Interbank Offered Rate.

by a bank on its mortgage portfolio, as dependant variable. By doing this, we implicitly assume that only the interest rate charged on the $FREE$ portion of a bank's mortgage portfolio varies in response to a change affecting the RHS variables in (1).

We include a variable controlling for changes in the riskiness of the bank's mortgage portfolio ($\Delta RISK$). As an indicator for riskiness, we use the fraction of the mortgage portfolio which is categorized second and third rank, i.e. for which the loan to value ratios exceed 67%. We expect $\alpha_3^{M,I}$ to be positive as, all things equal, an increase of the riskiness of a mortgage portfolio should be reflected by higher interest rates on that portfolio.

To capture possible shifts in the demand function for mortgages, we include a measure of the economic growth at the cantonal level (ΔGDP) as a control variable, with a positive expected sign for its coefficient: all things equal, an increase in economic activity should be characterized by an increase in the demand for mortgages which should in turn lead to an increase in the interest rates in the mortgage market. The inclusion of this control variable is particularly important as one would expect changes in the $LIBOR$, which reflect changes in the monetary policy of the Swiss National Banks, to be correlated with changes in the economic activity (ΔGDP). Hence, omitting the variable would lead to biased estimates for $\alpha_1^{M,I}$ and $\alpha_2^{M,I}$.[7] Finally, to allow for the possibility of a trend in the rate of growth of the interest rates charged on mortgages during the period considered, we include a linear time variable ($TIME$).[8]

5.2 Savings and investment deposits: specification

In the case of savings and investment deposits, we adopt a similar specification:

$$\Delta r^S = \alpha_0^{S,I} + \left(\alpha_1^{S,I} + \alpha_2^{S,I} I_{CB}\right) \Delta LIBOR + \alpha_3^{S,I} \Delta SAVINGS + \varepsilon^{S,I} \quad (2)$$

where r^S is the average interest rate on savings and investment deposits paid by bank i in canton j at time t. The variables I_{CB} and $LIBOR$ have all been defined in the previous section. To account for a change in the interest rate paid pay a bank on its deposits that would reflect a change in the composition of these deposits – rather than a change in pricing – we include the variable $\Delta SAVINGS$. This variable measures the changes in the share of savings deposits to total (savings and investment) deposits. In our sample, the average interest rate paid on savings deposits is higher than the interest rate paid on investment deposits. Hence, we expect $\alpha_3^{S,I}$ to be positive.

Like in the mortgage rates case, we expect the pass-through rate to be positive $\left(\alpha_1^{S,I} > 0\right)$, and test the hypothesis that the state-owned banks' pass-through rate is higher than their privately-owned counterparts, i.e. we test the null-hypothesis $\alpha_2^{S,I} = 0$ against the alternative $\alpha_2^{S,I} > 0$.

[7] The Swiss National Banks uses the 3-months libor as its reference interest rate for its monetary policy since beginning of 2000.

[8] The $TIME$ variable is inlcuded throughout our analyis. To simplify the notation, it does not explicitly appear in the equations describing the various specifications.

5.3 Results

The parameters of (1) and (2) are estimated using OLS after eliminating outliers using the *hadimvo*[9] procedure proposed by Stata. The statistical significance of the coefficient is measured on the basis of robust standard-errors, i.e. computed using the Huber White sandwich estimator of variance. We both estimate the parameters on the basis of a pooled regression and allowing for bank-level fixed effects. When considering bank-level fixed effects, differences regarding the trend followed by interest rates on mortgages or deposits, which reflect systematic differences between banks, are left unexplained and the focus is on the statistical link between changes of the opportunity cost of funds ($\Delta LIBOR$) and banks' interest rate movements around those trends. In the second case (pooled), the estimation of the parameters is based on the cross-sectional as well as on the time dimensions.

Our data regarding interest rates are not disaggregated geographically. As a consequence, banks which are active in more than one canton – and which may follow a geographically differentiated interest rate policy – cannot be accounted for properly. Hence, we decided to conduct our analysis on the basis of two different sample definitions. First, we included all the banks[10], i.e. implicitly assuming that banks active in more than one canton adopt a uniform pricing policy at the national level. Second, we restricted our sample to banks active in one canton only.[11]

The results from our estimations are summarized in table 3 (mortgage) and 4 (deposits) respectively. The results from a panel estimation with fixed-effects by banks are reported in column1 – all banks – and 3 – banks active in one canton only – while column 2 and 4 contain the results from the pooled estimation. In panel A of both tables, we report the results of the estimation where portfolio and/or bank characteristics are not controlled for, while we report the results from the full specifications given by (1) and (2) in panel B. The estimated values for α_1^I and α_2^I in equation (1) and (2) – the parameters of interest – are reported in rows 1 and 3 (variable $I_{CB}\Delta LIBOR$) of each panel respectively and the p-values for those parameters are reported in rows 2 and 4 respectively.

Four results are of particular interest. First, as expected, it appears that α_1^I is positive and statistically highly significant. That is, there is a positive and systematic correlation between changes in the opportunity cost of funds and the interest rate charged by banks on their mortgages or paid on their deposits. In the mortgage case, the value of the average pass-through rate lies between 0.286 – when the portfolio characteristics and in particular the constraints regarding interest rate adjustments are not taken into account – and 0.474 are controlled for. In the deposits case, the figures lie between 0.269 and 0.304. In words, these

[9] The *hadimvo* procedure identifies multiple outliers in multivariate data using the method of Hadi (1992, 1994). We set the the significance level for outlier cutoff at $p = .001$.

[10] Bank categories for which mortgage loans and/or savings and investment deposits are not a core activity were excluded from our sample. See the appendix for an exact definition of the sample considered.

[11] Egli and Rime (1999) follow this approach in their analysis of competition in the Swiss banking sector.

figures suggest that a 100 pb increase in the opportunity cost of funds leads to an adjustment in the banks' interest rates of about 30 to 40 bp on average after one year.

Second, our data provide some evidence that, in the mortgage market, the CBs' pass-through rate is higher than their privately owned counterparts. When controlling for portfolio characteristics (table 3, panel B), we can reject the hypothesis $\alpha_2^{M,I} = 0$ against the alternative $\alpha_2^{M,I} > 0$ in three cases out of four. The difference is not only significant in the statistical sense: our figures suggest that – when statistically significant – the CBs' pass-through rate exceeds the average by about 12% to 19%. However, this finding which is consistent with the hypothesis that CBs' conduct is (i) different and (ii) is more in line with marginal cost pricing than their privately-owned counterparts, has to be put into perspective in the light of the third and fourth results.

Three, the banks' pass-through rate in general – and the CBs' in particular – are far below 1, i.e. the value of the marginal cost pricing theoretical pass-through rate, in both the mortgage and deposit market. The hypothesis that $\alpha_1^I = 1$ and $\alpha_1^I + \alpha_2^I = 1$ can be strongly rejected in favour of the alternative $\alpha_1^I < 1$ and $\alpha_1^I + \alpha_2^I < 1$ for both markets.[12] In the mortgage market, for instance, the CBs' short-run pass-through rate is only about 50% even when controlling for contractual restriction regarding price adjustability. This result is consistent with the assumption that banks in Switzerland – including state-owned banks – benefit from (and take advantage of) some degree of market power.

Four, as can be seen from table 4 (panels A and B), the CBs' pass-through rate in the deposits market is systematically *smaller* than the industry's average: the hypothesis $\alpha_2^{S,I} = 0$ can be rejected in favour of the alternative $\alpha_2^{S,I} < 0$. This result suggests that CBs' conduct in the deposits market if further away from marginal cost pricing than the industry average. In addition, the magnitude of the difference in the deposits market is considerably higher than in the mortgage case $\left(\left|\alpha_2^{S,I}\right| > \left|\alpha_2^{M,I}\right|\right)$ and the result appears more robust: contrary to the mortgage case, the direction as well as the significance of the results in the deposits case does not depend either on the inclusion of a control variable or on the estimation strategy or sample definition adopted.

Regarding the bank specific control variables $RISK$ and $SAVINGS$, the evidence is mixed. The expected positive correlation between the riskiness and the interest rate of a mortgage portfolio is strongly supported by our data when the larger sample definition is adopted. The same is true for the expected negative correlation between the share of savings to total deposits and the interest rate on deposits, reflecting the higher interest rate paid on average, in our sample, on savings deposits. However, when estimating our model based on banks active in one canton only, these relationships are no longer statistically significant. Finally, the assumption that changes in the interest rates on mortgage should be (positively) correlated with changes in the level of economic activity at the cantonal level is not supported by our data.

[12] The null hypothesis is rejected at levels of significance which are lower than 1% in all cases.

Table 3: Test of hypothesis 1 (mortgages)
[Insert table 3 about here]

Table 4: Test of hypothesis 1 (deposits)
[Insert table 4 about here]

6 Hypothesis 2: interest rate levels

In this section, we test the hypothesis of equal pricing against the alternative that state-owned banks charge relatively customer friendly interest rates on their mortgages and/or investment and savings deposits.

6.1 Mortgage loans: specification

In the case of mortgage loans, we estimate the parameters of the following equation:

$$r^M = \alpha_0^{II,M} + \alpha_1^{II,M} I_{CB} + \alpha_2^{II,M} RISK + \alpha_3^{II,M} FREE + \quad (3)$$
$$+\alpha_4^{II,M} BRANCH + \alpha_5^{II,M} ASSETS + \alpha_6^{II,M} \Delta GDP + \varepsilon^{II} \quad (4)$$

where r^M, I_{CB}, $RISK$, $FREE$ and ΔGDP are defined as above.

The parameter of interest is $\alpha_1^{II,M}$, which measures any systematic deviation between the average interest rate charged by CBs and the rest of the banking sector. We test the null-hypothesis $\alpha_1^{II,M} = 0$ against the alternative $\alpha_1^{II,M} < 0$, i.e. we test if CBs charge a lower than average interest rate on their mortgage portfolio. To control for difference in price that reflect differences in riskiness rather than conduct we include the variable $RISK$, with an expected positive sign for $\alpha_2^{II,M}$.

In addition, we include the variable $FREE$, as the average interest rate charged on a portfolio might depend on its characteristics regarding the degree of flexibility of interest rates adjustment. The sign of $\alpha_3^{II,M}$ could be positive or negative: ceteris paribus, one would expect a portfolio which is subject to less restrictions regarding interest rates adjustability to be characterized by a relatively low average interest rate in an environment were the marginal cost of funds is decreasing and a relatively high average interest rate in an environment were the marginal cost of funds is increasing.

Further, we include the variable $BRANCH$ – the ratio of bank $i's$ branches in canton j to the sum of branches in that canton – as a proxy for service quality. As was underlined in section 3, geographical distance seems to matter in banking competition. A stronger geographical presence can be seen as a substitute for a lower interest rates on mortgages. Hence, we expect $\alpha_4^{II,M}$ to be positive. We also include a size variable $ASSETS$ – a measure of a banks' assets – as an indirect way to account for additional heterogeneity in the banks' mortgage portfolio that might be price relevant, with no a priori regarding the sign of $\alpha_5^{II,M}$. For instance, bigger banks might on average lend to bigger lenders with specific characteristics regarding riskiness – besides the dimension covered by $RISK$ – or demand elasticity. $ASSETS$ might also account for differences in pricing that reflect size related differences in cost efficiency. Finally ΔGDP is included, following the same line of arguments as above, i.e. considering that, ceteris paribus, more growth in a given canton might imply more demand for mortgage loans which should translate into higher interest rates ($\alpha_6^{II,M} > 0$).

6.2 Deposits: specification

In the case of savings and investment deposits, we estimate the parameters of the following equation:

$$r^S = \alpha_0^{II,S} + \alpha_1^{II,S} I_{CB} + \alpha_2^{II,S} SAVINGS + \alpha_3^{II,S} BRANCH + \alpha_4^{II,S} ASSETS + \varepsilon^{II,S} \tag{5}$$

where all the variables have been previously defined

Again, the parameter of interest is $\alpha_1^{II,S}$, which measures any systematic deviation from the industry average in the interest rate paid by CBs on deposits. We test the null-hypothesis $\alpha_1^{II,S} = 0$ against the alternative $\alpha_1^{II,S} > 0$, i.e. we test the hypothesis that CBs pay a higher than average interest rate on their deposits. To control for difference in price that reflect differences in the portfolio structure rather than conduct, we include the variable $SAVINGS$.

A positive sign for $\alpha_2^{II,S}$ is expected, reflecting the fact that during the period covered, the interest rate on savings deposits tends to exceed the interest rate on investment deposits. Further, we expect $\alpha_3^{II,S}$ to be negative, as the variable $BRANCH$ – which is a proxy for service quality – can be seen as a substitute for a higher interest rates on deposits. Following a similar line of arguments as for mortgage loans, we include the size variable $ASSETS$ as an indirect way to account for additional heterogeneity in the banks' mortgage portfolio that might be price relevant, with no a priori regarding the sign of $\alpha_4^{II,S}$.

6.3 Results

We apply the same methodology to estimate the parameters of (3) and (5) (OLS after elimination of outliers and robust standard errors). We conduct our estimations with and without **cantonal**-level fixed effects. When including cantonal-level fixed effects, we allow for unexplained differences in the average interest rates between cantons. Hence, in that case, α_1^{II} is to be interpreted as the average spread between the CBs' pricing relatively to the average pricing in the canton they are active in. In other words, α_1^{II} allows us to assess if the conditions applied by state-owned banks to their borrowers or lenders systematically deviate from the conditions applied by their competitors in the same local (cantonal) market. When pooling the data, α_1^{II} is to be interpreted as the systematic deviation between the pricing followed by state-owned banks and the industry average at the national level.

The results from our estimations are summarized in table 5 (mortgages) and 6 (deposits) respectively. The results from a panel estimation with fixed-effects by canton are reported in column1 – all banks – and 3 – banks active in one canton only – while column 2 and 4 contain the results from the pooled estimation. In panel A of both tables, we report the results of the estimation where portfolio and/or bank characteristics are not controlled for, while we report the results from the full specifications given by (3) and (5) in panel B. The estimated values for α_1^{II} in equation (3) and (5) – the parameters of interest – are reported in rows 1 and 3 (variable I_{CB}) of each panel respectively and the p-values for those parameters are reported in rows 2 and 4 respectively.

As can be seen from tables 5 and 6, our results suggest that, under the line, state-owned CBs *do not* appear to adopt a more consumer friendly pricing than their competitors. If anything, CBs appear to be *less* consumer friendly than the average bank in Switzerland. Regarding mortgage loans, the evidence is mixed. Overall, the CB's charge a higher than average interest rate on their mortgage portfolio: in panel A of table 7, $\alpha_1^{II,M} = 0$ can be rejected in favour of the alternative $\alpha_1^{II,M} > 0$ at a 10% level of significance or lower. This difference, however, appears to reflect differences in the portfolios' or banks' characteristics like riskiness and quality (branch density). Once controlling for those characteristics, the interest rate difference is no longer statistically significant. In one case (banks active in one canton only, fixed effects) the results are even consistent with the assumption 2, i.e. $\alpha_1^{II,M} = 0$ can be rejected in favour of the alternative $\alpha_1^{II,M} < 0$ at an acceptable level of significance (10%). This case however constitutes the exception rather than the rule. Regarding savings and investment deposits, the evidence that CBs are *less* consumer friendly than average is compelling: the interest paid by CBs on their savings and investment deposits are systematically lower, i.e. the assumption $\alpha_1^{II,S} = 0$ can be rejected in favour of the alternative $\alpha_1^{II,S} < 0$ independently of the specification adopted at levels of significance that are in general much below 1% and in all cases below 5%. The size of the cantonal bank negative premium lies between 13 and 27 basis points or about 7% and 15% of the average interest rate depending on the specification adopted.

Regarding the control variables, the evidence is mixed. Considering the mortgage market, the parameters measuring the role of the variable $RISK$ and $BRANCH$ are positive (whenever significant). This is consistent with the a priori that mortgage portfolios (i) containing a relatively large share of second and third rank mortgages and (ii) associated with a higher quality of service, should be characterized by higher than average interest rates. Considering the savings market, differences in interest rates – and in particular the negative premium on CB's deposits – do not appear to reflect systematic differences in the density of banks' branches: the parameter measuring the effect of the variable $BRANCH$ is statistically significantly from zero at an acceptable level of significance (10%) in one case only (banks active in one canton only, pooled) and, in that case, shows the wrong sign. Interestingly, whenever significant, the size variable ($\ln ASSETS$) consistently suggests that – controlling for other characteristics – bigger banks offer less consumer friendly conditions both in the market for mortgages ($\alpha_5^{II,M} > 0$) and on deposits ($\alpha_4^{II,S} < 0$). While we do not formally test this assumption, this result is consistent with the bigger banks benefitting from (and taking advantage of) higher than average levels of market power.

Table 5: Test of hypothesis 2 (mortgages)
[Insert table 5 about here]

Table 6: Test of hypothesis 2 (deposits)
[Insert table 6 about here]

7 Hypothesis 3: Impact on competing banks' conduct

In this section, we test the hypothesis that privately-owned banks' pricing does not depend on the presence of state-owned banks against the alternative that privately owned banks adopt a more consumer friendly policy when facing the competition of a strong state-owned bank.

7.1 Mortgage loans: specification

In the case of mortgage loans, we estimate the parameters of the following equation:

$$\begin{aligned} r^M = \; & \alpha_0^{III,M} + \alpha_1^{III,M} MS_{CB}^M + \alpha_2^{III,M} CONC^M + \alpha_3^{III,M} I_{CB} + \\ & \alpha_4^{III,M} RISK + \alpha_5^{III,M} FREE + \alpha_6^{III,M} ASSETS + \alpha_7^{III,M} \Delta GDP + \varepsilon^{III,M} \end{aligned} \quad (6)$$

where the variables $r, I_{CB}, RISK, FREE$, $ASSETS$ and GDP have all been previously defined. The variable MS_{CB}^M measures the share of CBs in the mortgage market of the canton it is active in and $CONC^M$ is the Herfindahl concentration index in the mortgage market, we use an indicator for market power in that canton.

The parameter of interest is $\alpha_1^{III,M}$. We test the null-hypothesis $\alpha_1^{III,M} = 0$ against the alternative $\alpha_1^{III,M} < 0$, i.e. that privately owned banks adopt a more consumer friendly pricing in cantons where state-owned banks own a larger share of the mortgage market. We estimate (6), using a panel approach and focusing on the so-called between effects, where a group is defined as a canton. In other words, we try to explain the extent to which differences between cantons regarding in particular the market share of state-owned banks and the level of market concentration in the market for mortgages are correlated with differences regarding mortgage pricing in that market.[13] A negative $\alpha_1^{III,M}$ would mean that, on average, cantons where state-owned banks own a larger market share are also those cantons where banks tend to offer better conditions to their borrowers

We include the variable $CONC$ to control for the potential impact of market concentration on interest rates. The regression of interest rates on a measure of concentration is a standard approach in the structure-performance literature[14]. According to the industrial organization literature, $\alpha_2^{III,M}$, the parameter reflecting the effect of market concentration on the interest rate level in the mortgage market could be positive, negative or zero. A positive value for $\alpha_2^{III,M}$ would be in line with the so-called structure-conduct-performance theory, which states that higher levels of concentration are primarily associated with higher levels of market power which in turn lead to higher price levels. On the other hand, higher levels of concentration might reflect the survival of the most efficient banks in a competitive market characterized by substantial economies of scale. Hence, a canton where the concentration is high might be a canton where only the most efficient and relatively large banks have survived. Under the assumption of a sufficient level of competition, such a structure might be associated with lower interest rates on mortgages. If $\alpha_2^{III,M}$ is zero, this may indicate either that those two effects compensate themselves or would also be consistent with the so-called contestable market theory (Baumol et al. 1982): due to the threat of entry, the firms in the market are not able to exploit their market power in a sustainable equilibrium, where a sustainable market equilibrium is defined as a situation when no entry would be profitable given the equilibrium price.

Regarding the additional control variables, based on the line of arguments developed in the previous sections and the results obtained so far, we expect $\alpha_4^{III,M}$ $(RISK)$, $\alpha_5^{III,M}$ $(FREE)$ and $\alpha_6^{III,M}$ $(ASSETS)$ to be positive, while we do not expect the economic activity (ΔGDP) to play a significant role. Finally, the dummy variable I_{CB} is included in the specification to correct for the impact of CBs' own price on the cantonal average.

7.2 Savings and investment deposits : specification

In the case of savings and investment deposits, we adopt a similar specification:

$$\begin{aligned} r^S = \; & \alpha_0^{III,S} + \alpha_1^{III,S} MS_{CB}^S + \alpha_2^{III,S} CONC^S + \alpha_3^{III,S} I_{CB} + \\ & \alpha_4^{III,S} SAVINGS + \alpha_5^{III,S} ASSETS + \varepsilon^{III,S} \end{aligned} \tag{7}$$

where MS_{CB}^S and $CONC^S$ measure the market share of CBs and the concentration in the deposits market respectively and all other variables have been previously defined.

[13] Note that using this approach implies using averages that are *not*-weighted by the market shares of the different banks.

[14] See Berger and Hannan (1989), among others.

The parameter of interest is $\alpha_1^{III,S}$ and we test the null-hypothesis $\alpha_1^{III,M} = 0$ against the alternative $\alpha_1^{III,M} > 0$, i.e. that privately owned banks adopt a more consumer friendly pricing in cantons where state-owned banks own a larger share of the deposits market. In line with the approach adopted for mortgages, we estimate the parameters of (7) focusing on the "between effect", i.e. on the extent to which differences between cantons regarding in particular the market share of state-owned banks or the level of market concentration in the deposits market are correlated with differences regarding pricing in that market.

The discussion regarding the impact of concentration based on the mortgage market also applies to the deposits market, with opposite signs however: $\alpha_2^{III,S} < 0$ would be in line with the assumption that higher levels of concentration are primarily associated with higher levels of market power, while $\alpha_2^{III,S} > 0$ would be consistent with the idea that only the most efficient banks survive in a competitive market characterized by substantial economies of scale. Regarding the remaining control variables, based on the line of arguments developed in the previous sections and the results obtained so far, we expect $\alpha_4^{III,S}$ ($SAVINGS$) to be positive and $\alpha_5^{III,M}$ ($ASSETS$) to be negative.

7.3 Results

One potential problem has to be highlighted before turning to the results: while the conduct of other banks and hence the average interest rate in a given canton might depend on the market share of the state-owned bank in that canton, this market share in turn is likely to depend on the pricing adopted by the rest of the banking sector in that canton. As a consequence, the market share of the state-owned bank will not be independent of the shocks that affect the interest rates ($\varepsilon^{III,M}$ and $\varepsilon^{III,S}$ respectively), violating a basic rule under which the parameters of (6) and (7) could be estimated using OLS. To address this simultaneity issue, we estimate the parameters of (6) and (7) using a two-stage procedure, whereby we instrument the market share of the cantonal bank using the CBs' (lagged) number of branches measured as a percentage of the sum of all bank branches in the canton it is active in. This instrument is highly correlated with the contemporaneous market-share of the state-owned bank[15] but should be orthogonal to contemporaneous shocks affecting the interest rates.[16]

The estimation results for hypothesis 3 are reported in table 7 and 8. We report both the results based on the OLS (columns 1 and 3) and the instrumental variables (columns 2 and 4) estimation method respectively. As was already mentioned, we estimate the parameters of both (6) and (7) using a panel-approach and focusing on the *between* effect.

Regarding the parameters of interest, $\alpha_1^{III,M}$ and $\alpha_1^{III,S}$, we find no evidence in support of the hypothesis that privately owned banks adopt a more consumer

[15] The correlation is 0.79 and 0.81 in the mortgages and deposits market respectively.

[16] To address a similar issue, Feinberg (2002) uses a different approach: he substitutes the market share on the loans market by the market share on the deposits market, considering that it is unlikely that a bank's loan pricing decision would have a significant impact on its share of deposits in that market, while market shares on both markets should be correlated.

friendly pricing in cantons where state-owned banks own a larger share of the market. The assumption $\alpha_1^{III} = 0$ can never be rejected in favour of the alternative $\alpha_1^{III,M} < 0$ and $\alpha_1^{III,S} > 0$ respectively. In fact, when considering the mortgage market (table 7) $\alpha_1^{III} = 0$ can systematically be rejected in favour of the alternative that privately owned banks adopt a *less* consumer friendly pricing in cantons where state-owned banks own a larger share. In the case of deposits, the size of the CBs' market share does not appear to interfere with the privately-owned banks conduct in any systematic way.

Two additional results are worth underlying. First, in the mortgage market, the interest rates appear to be systematically lower in cantons where the mortgage market is more concentrated. This finding is consistent with the efficiency hypothesis, i.e. that higher levels of concentration are primarily the result of natural selection in industries characterized by substantial economies of scale. In the deposits market, the role of market concentration is less marked but it also tends to be consistent with the efficiency hypothesis. This result is in line with Egli and Rime (1999), who find evidence supporting the efficiency hypothesis for both markets, over the 1989–1997 period.[17] Second, most of the remaining control variables appear to play no significant role. This situation is somewhat surprising, in particular in the light of the robustness of the role played by a variable like $RISK$ in our previous results. However, the stability of the value and the significance taken by the estimate of $\alpha_1^{III,M}$, regardless of the specification adopted, suggests that the lack of significance of the control variable is not too much of a concern, i.e. is not a signal for a major drawback in the estimation.

Finally, as a robustness check, we used an alternative endogenous variable, namely the average interest rate at the cantonal level *weighted* by the market share of the individual banks in that canton. So far, our specifications implied a comparison of the unweighted average interest rate between canton. To some extent however, the use of the weighted average appears more appropriate in this context, as the relevant issue is to know whether CBs have an impact on the average interest rate paid by borrowers or received by depositors in a given canton. However, the use of the weighted average comes at a cost. Given the high levels of concentration at the cantonal level, the weighted average mainly reflects the interest charged, respectively offered, by the main 2 or 3 banks active in that canton, among which at least one is active at the national level. As was already made clear, we had to assume that this latter category of banks follows a uniform pricing policy, due to the lack of pricing information at the cantonal level. As a consequence, the use of weighted averages considerably reduces the variability of the interest rates between cantons. Acknowledging these reservations, we tested this third hypothesis using the alternative endogenous variable definition. It turns out that our results are robust to such a change. None of the estimates for the variable of interest was affected by the change in a material

[17] Egli and Rime (1999) further investigate this issue, concluding that the efficiency hypothesis applies only in the smaller cantons. For the large cantons, the structure-performance hypothesis cannot be rejected for savings for mortgages while both the structure-performance as well as the market-efficiency hypothesis is rejected for mortgages.

way.

Table 7: Test of hypothesis 3 (mortgages)
[Insert table 7 about here]

Table 8: Test of hypothesis 3 (deposits)
[Insert table 8 about here]

8 Summary of results and limitations

We tested three hypothesis that correspond to different aspects of the same question: are state owned cantonal banks special in such a way that they play a particular role as competition enhancers? The vast majority of our results speak against this view. First, based on pass-through rates, there is only limited evidence that cantonal banks' conduct is more in line with marginal cost pricing than their privately-owned counterparts'. In general, the conduct of both categories of banks regarding interest rate adjustment to shocks affecting financing costs do not differ systematically or, quite surprisingly, the opposite result emerges. Second, based on interest rate *levels*, it appears that, if anything, cantonal banks offer interest rates that are *less* favorable to consumers than the average bank in Switzerland. Third, we do not find evidence that cantonal banks have a positive – from the borrower's or lender's point of view – effect on their competitors' conduct, as those cantons where state-owned banks' market share is relatively high do not benefit from relatively low interest rates on their mortgages. Again, if anything, the opposite appears to be true. Before turning to the policy implications of these findings, four limitations have to be highlighted.

First, the scope of our analysis is limited by data availability. In particular, the absence of data on pricing for this category of loans prevented us from including the market for non-mortgage corporate loans into our analysis. One cannot exclude a priori that the conduct of cantonal banks in this market would be different from their conduct in the two markets covered by our study, in a sense that would be more in line with their mandate and our expectations. While we are not in a position to test this hypothesis explicitly, we deem it unlikely as most of the cantonal banks' mandates do not mention categories of loans or deposits that should be given particular support.

Second, the R^2 of our regressions are relatively low. In particular, when focusing on the interest rate levels (hypothesis 2), the R^2 fluctuate between 13% and 26%, depending on the specification considered. This means that the variables included in our model explain only about 20% of the variability (across time and between banks) of the interest rate levels. This suggests that potentially important control variables are missing from our analysis. In particular, on the deposits side, we are unable to correct for the duration of the portfolios while, on the mortgage side, this correction is somewhat rudimentary. Hence, we cannot exclude that (the absence of) differences in interest rates between the cantonal banks and the rest of the industry reflects unobserved differences in portfolio characteristics rather than (the absence of) differences in conduct. This is unlikely, however, as the observed variables suggest that cantonal banks' portfolio characteristics are similar to those of the average bank in Switzerland.

Third, our analysis focuses mainly on interest rates, which constitute one dimension of banking services only. We do not account for differences in commissions – another important component of the price of banks' services – and control only for one aspect of service quality, namely branch density. Regarding commissions, anecdotal evidence suggest that cantonal banks indeed tend to charge relatively cheap. Regarding service quality, cantonal banks are so called universal banks and, as such, offer a large scope of banking services, which is one important aspect of service quality. Another important aspect of quality is the, sometimes explicit, guarantee offered by cantonal banks on their deposits. The existence of this guarantee might be a main driving factor explaining the observed negative premium on CB's deposits. Taking these elements into account might hence shift the picture in favour of the cantonal banks. This shift should be of limited magnitude, however, in particular in the market for mortgages, as mortgage loans are standardized products, for which the interest rate undoubtly represents the main component of the (quality adjusted) total cost of the bank service.

Finally, it remains questionable if we succeeded in achieving the ambitious objective set by our third hypothesis: determine the extent to which the conduct of privately-owned banks depends on the presence of state-owned banks among their competitors. Ideally, we would like to assess what would be the consequences, in terms of interest rates, of skipping the cantonal banks from the Swiss banking landscape. As was highlighted in our illustrative example (see section 3), there should be two effects: an increase in the market concentration and, possibly, a change in the conduct of the other banks due to the disappearing of the "cantonal bank's effect". The specification we adopted should cover both effects. However, the capturing of the second effect requires a measure of the intensity of the presence of the cantonal bank, which is endogenous and reflects, among other things, the conduct of the other banks. While we tried to address this endogeneity problem, doubts remain that our attempt was successful.

9 Discussion and policy implications

The starting point of our analysis was to consider that, because of a different objective function, one would expect the state-owned cantonal banks' conduct to deviate from the typical conduct in the banking sector in some measurable way. More precisely, we expected cantonal banks' interest rates to be relatively sensitive to common cost movements and we also expected cantonal banks to charge relatively low interest rates on mortgages and offer relatively high interest rates on deposits. In addition, we expected cantonal banks' deviating conduct to interfere with, and affect their competing banks' conduct. Our results suggest that, under the line, these expectations are not supported by the data. In particular, our results provide ample evidence that cantonal banks pay lower than average interest rates on their deposits. One explanation for this result – besides the exercise of market power for which our data provides some evidence – is that it is the reflect of the (explicit or implicit) state guarantee offered to cantonal banks.

Hence, based on the available data, cantonal banks do not appear to fulfill their mandate: they do neither adopt a customer friendly conduct nor intensify competition in any special way. In other words, cantonal banks can not be credited with the moderate pricing that is observed in the Swiss banking sector despite of the unusually high level of concentration in international comparison. Based on these results, a potentially important argument in favour of keeping – and in general subsidizing – a system of state-owned banks, namely that they play a central role as competition enhancers in concentrated banking markets appears empirically unfounded. And, as we underlined in the introduction, the question of the rationale of maintaining widespread state-ownership is not limited to Switzerland as, according to La Porta (2002), almost half of the equity of the 10 largest banks in each country, worldwide, was owned by the government in 1995.

It is important to underline however that our analysis does not cover the market of non-mortgage corporate loans. It can not be a priori excluded that cantonal banks indeed play an important role as competition enhancers in this market. In addition, banks in Switzerland are currently in the process of refining their pricing strategy, in particular in order to better account for heterogeneity regarding riskiness. A by-product of this process could be that besides riskiness, banks' pricing in the future will better reflect the heterogeneity regarding demand elasticities. As a consequence, the value of cantonal banks as competition enhancer might well increase in the future. In other words, the time may be badly chosen to get rid of cantonal banks. However our findings suggest that cantonal banks should be put under stronger scrutiny regarding the fulfillment of their mandate by their respective owners.

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Appendix 1: data

Databases

The data used in this study were obtained from three different sources:

- For bank related data we use end-of year individual-bank data on mortgage loans from the Swiss National Bank's banking statistics database. The database contains data on mortgage loans and savings and investment deposits holdings and number of branches for each banks in each canton. In addition, the database contains data on the average interest rates charged on the mortgage portfolio and offered on the deposits portfolio as well as other balance sheet items for each bank at the nationwide level. Cantonal distribution of mortgage loans is defined after the location of the issuing bank. This database is confidential.
- The measure of economic activity at the cantonal level (GDP) stems from BAK Basel Economics.
- The data on 30 days interbank interest rates ($LIBOR$) stems from Reuters.

Sample definition

Our sample covers the 1996–2002 with a yearly frequency. The choice of the period was primarily guided by the availability of data regarding the riskiness and the price adjustability of the individual banks' mortgage portfolios.

The sample selection was made using the categorization proposed by the Swiss national bank. Banks belonging to the following categories were included: cantonal banks, big banks, saving and regional banks, raiffeisen banks and trading banks; hence, we excluded banks belonging to categories for which the mortgage and the deposits do not constitute a main source of income. Details regarding the definition of the bank categories can be found in the statistical yearbook of the Swiss banks[18].

Variables definition

Data at cantonal level

$CONC^M$ and $CONC^S$ are the the Herfindahl index of concentration in the mortgage and the deposits market respectively for each canton and each time period. It is based on individual banks' mortgage loans and savings and investment deposits outstanding in each canton. Formally, $CONC = \sum_i MS_i^2$, where MS_i is the share of bank i in the relevant market of a particular canton, i.e. $MS_i = \frac{L_i}{\sum_i L_i}$ where L_i measures bank i's nominal amount of mortgage loans, respectively savings and investment deposits, outstanding in this canton.

MS^M_{CB} and MS^S_{CB} measure the share of the cantonal bank in the relevant market of a given canton.

[18] The yearbook is a Swiss national bank publication and can be downloaded free of charge under the following address: www.snb.ch/e/publikationen/publi.html.

ΔGDP measures the growth rate of the cantonal gross domestic product in deviation to the average national GDP growth rate.

Data at the individual bank level

$ASSETS$ is the natural logarithm of a bank's domestic assets, in million CHF.

$BRANCH$ is the natural logarithm of the ratio of bank i's branches in canton j to the sum of bank branches in that canton.

$FREE$ is the share of a bank's mortgage portfolio which is *not* subject to any interest rate adjustment time-constraint, i.e. $FREE = \frac{\tilde{L}}{L}$ where $\tilde{L}$ is the stock of mortgage loans which is not subject to any interest rate adjustment time-constraint.

I_{CB} is dummy variable which takes value one when a bank is a cantonal bank and zero otherwise.

r^M and r^S are the interest rates charged on mortgages loans, respectively offered on the savings and investment deposits, and measured at the individual bank level.

$R^M = \frac{r^M}{FREE_i}$ is the adjusted interest rate on the mortgage portfolio.

$RISK$ measures the sum of the second and third rank mortgages as a fraction of the total mortgage loan portfolio of a bank. The rank of a mortgages is determined by its loan to value ratio where the upper limit of the ratio is 2/3 and 8/10 for first and second rank mortgages respectively. Third rank mortgages are not subject to a maximal loan to value limits.

Data at the national level

$I_{CB}\Delta LIBOR$ is the product between the cantonal bank dummy and the change in the $LIBOR$ variable.

$LIBOR$ is the three-months London Interbank Offer Rate, the reference interest rate of the Swiss National Bank. It is computed as the yearly average of the daily rates.

$TIME$ is a linear function of the date.

Appendix 2: illustrative example

We assume a "linear city" à la Hotelling (1929) of length 1 which is home to a continuum of uniformly distributed borrowers indexed by i. Each agent i borrows one unit (i.e. the individual and aggregate demand for loans in the economy is inelastic) and is characterized by the following indirect utility function:

$$W_i = \bar{W} - r - (x_i - a_j)^2$$

where $\bar{W}$ is an arbitrarily large positive constant, r is the interest rate and $(x_i - a_j)^2$ is the quadratic "transportation cost" incurred by the borrower due to the distance he has to travel to reach its lender. The market is served by 3 banks, labelled (and located at) a_1, a_2 and a_3 and facing constant (zero) marginal cost. Without loss of generality, we assume that

$$0 \leq a_1 \leq a_2 \leq a_3 \leq 1.$$

The demand faced by each bank in this set-up is standard:

$$D_1 = X_1 = \frac{1}{2}\frac{r_2 - r_1}{(a_2 - a_1)} + \frac{a_1 + a_2}{2} \text{ if } X_1 > 0 \text{ and } 0 \text{ otherwise} \tag{8}$$

$$D_2 = X_2 = \left(\frac{1}{2}\frac{r_3 - r_2}{(a_3 - a_2)} + \frac{a_3 + a_2}{2}\right) - \left(\frac{1}{2}\frac{r_2 - r_1}{(a_2 - a_1)} + \frac{a_1 + a_2}{2}\right) \tag{9}$$

$$\text{if } X_2 > 0 \text{ and } 0 \text{ otherwise} \tag{10}$$

$$D_3 = X_3 = 1 - \left(\frac{1}{2}\frac{r_3 - r_2}{(a_3 - a_2)} + \frac{a_3 + a_2}{2}\right) \tag{11}$$

$$\text{if } X_3 > 0 \text{ and } 0 \text{ otherwise.} \tag{12}$$

Banks compete sequentially in location and in interest rates. We consider 3 different cases. In the first case, 2 profit maximizing banks compete with a state-owned zero profit bank. In case 2 – where the locations are exogenous – and case 3 – where the locations are endogenous – there are 3 profit maximizing banks.

Case 1

In this case, 2 profit-maximizing banks compete with a zero-profit state-owned bank. We arbitrarily assume that the state-owned bank locates at the center of the city.[19] Formally, we assume that the state-owned bank charges an interest rate $r_2 = 0$ and is located at $a_2 = .5$.

The privately owned banks maximize: $\Pi_j = D_j r_j$ where D_j for $j = 1, 2$ is given by (8) and (9) respectively by choosing their locations in the first stage

[19] Under this condition, there is no direct interaction between the two profit maximising banks, i.e. each profit maximising bank competes only competes with the (passive) state-owned bank and not directly with the other profit maximising bank. This assumption simplifies the computation without affecting the core outcome of the model.

and then, given the locational structure, by choosing the interest rate charged. We solve the game backwards.

Maximizing Π_j with respect to the interest rates yields yields the following Nash-equilibrium interest rates:

$$r_1^* = \left(a_1 - \frac{1}{2}\right)\left(\frac{c}{2a_1 - 1} - \frac{1}{2}a_1 - \frac{1}{4}\right) \tag{13}$$

$$r_3^* = \left(\frac{1}{2} - a_3\right)\left(\frac{1}{2}a_3 - \frac{c}{2a_3 - 1} - \frac{3}{4}\right) \tag{14}$$

The optimal locations are obtained by substituting (13) and (14) into the profit function and maximizing with respect to a_1 and a_2 respectively. The interior solution of the maximization problem is:

$$a_1^* = \frac{1}{6}, a_3^* = \frac{5}{6}$$

and hence,

$$r_1^* = r_3^* = \frac{1}{9}$$

Using these results together with $a_2 = .5$ and $r_2 = 0$, implies:

$$D_1 = D_3 = \frac{1}{6}, D_2 = \frac{2}{3}$$

that is, the state-owned bank serves two-thirds of the market and hence the profits and the average interest rate in the economy are:

$$\Pi_1 = \Pi_3 = \frac{1}{54} \simeq .019, \Pi_2 = 0$$

$$\bar{r} = r_1 D_1 + r_2 D_2 + r_3 D_3 = \frac{1}{27} \simeq .037$$

and the average transportation cost is:

$$T = \int_0^{a_1} (a_1 - v)^2 \, dv + \int_{a_1}^{\varepsilon_1} (v - a_1)^2 \, dv + \int_{\varepsilon_1}^{a_2} (a_2 - v)^2 \, dv + \int_{a_2}^{\varepsilon_2} (v - a_2)^2 \, dv + \int_{\varepsilon_2}^{a_3} (a_3 - v)^2 \, dv + \int_{a_3}^{1} (v - a_3)^2 \, dv$$

where $\varepsilon_1 = \frac{1}{2}\frac{r_2 - r_1}{(a_2 - a_1)} + \frac{a_1 + a_2}{2}, \varepsilon_2 = \left(\frac{1}{2}\frac{r_3 - r_2}{(a_3 - a_2)} + \frac{a_3 + a_2}{2}\right)$

and hence:

$$T = \frac{1}{36} \simeq .028$$

Case 2

In this case, we assume that the locational structure is identical to case 1, but all 3 banks are now profit maximizers. Formally, we maximize the profit function (**??**) for $j = 1, 2, 3$, taking the locations

$$a_1 = \frac{1}{6}, a_2 = \frac{1}{2}, a_3 = \frac{5}{6}$$

as given. Mechanical calculation yields the following Nash-equilibrium interest rates are:

$$r_1^* = r_3^* = \frac{5}{27} \simeq 0.185, r_2^* = \frac{4}{27} \simeq 0.148$$

which implies:

$$\begin{aligned} D_1 &= D_3 = \frac{5}{18} \simeq 0.278, D_2 = \frac{4}{9} \simeq .444 \\ \Pi_1 &= \Pi_3 = \frac{25}{486} \simeq .051, \Pi_2 = \frac{16}{243} \simeq .066 \\ \bar{r} &= \frac{41}{243} \simeq .0.169, T = \frac{11}{972} \simeq .0113 \end{aligned}$$

Case 3

In this case, we assume that 3 profit maximizers compete both in interest rates (stage 2) and in location (stage 1).[20] Formally, we first maximize the profit function (**??**) using the interest rate as argument for $j = 1, 2, 3$, which yields the following reaction functions:

$$\begin{aligned} r_1 &= (a_1 - a_2)\left(-\frac{1}{2}a_1 - \frac{1}{2}a_2 - \frac{r_2}{-2a_1 + 2a_2}\right) \\ r_2 &= \frac{1}{2a_3 - 2a_1}\left(a_3 r_1 - a_1 r_3 - a_2 r_1 + a_2 r_3 + a_1 a_2^2 - a_1^2 a_2 - a_1 a_3^2 + a_1^2 a_3 + a_2 a_3^2 - a_2^2 a_3\right) \\ r_3 &= (a_2 - a_3)\left(\frac{1}{2}a_2 + \frac{1}{2}a_3 - \frac{r_2}{-2a_2 + 2a_3} - 1\right) \end{aligned}$$

which can be solved to give - after some computation - the following Nash-equilibrium interest rates:

$$\begin{aligned} r_1^* &= \frac{1}{6a_3 - 6a_1} * \\ &\left(2a_1 a_2 - 2a_1 a_3 + 2a_2 a_3 + 3a_1^3 - 2a_2^2 - 2a_1 a_2^2 - a_1^2 a_2 - a_1 a_3^2 - 2a_1^2 a_3 + a_2 a_3^2 + 2a_2^2 a_3\right) \\ r_2^* &= \frac{1}{3a_3 - 3a_1} * \\ &\left(2a_1 a_2 - 2a_1 a_3 + 2a_2 a_3 - 2a_2^2 + a_1 a_2^2 - a_1^2 a_2 - a_1 a_3^2 + a_1^2 a_3 + a_2 a_3^2 - a_2^2 a_3\right) \\ r_3^* &= \frac{1}{6a_3 - 6a_1} * \\ &\left(8a_1 a_2 - 8a_1 a_3 - 4a_2 a_3 - 2a_2^2 + 6a_3^2 - 3a_3^3 - 2a_1 a_2^2 - a_1^2 a_2 + 2a_1 a_3^2 + a_1^2 a_3 + a_2 a_3^2 + 2a_2^2 a_3\right). \end{aligned}$$

[20] This corresponds to a standard Hotelling with 3 players set-up (see for example XX).

In the second stage, we maximize the profit function (??) evaluated at equilibrium interest rates, using the location as argument, for $j = 1, 2, 3$ and get the following interior solution:

$$a_1 = \frac{1}{8}, a_2 = \frac{1}{2}, a_3 = \frac{7}{8}$$

and hence, $r_1^* = r_3^* = \frac{13}{64}$ and $r_2^* = \frac{11}{64}$, which implies:

$$\begin{aligned}
D_1 &= D_3 = \frac{13}{48} \simeq .271, D_2 = \frac{11}{24} \simeq .458 \\
\Pi_1 &= \Pi_3 = \frac{169}{3072} \simeq .055, \Pi_2 = \frac{121}{1536} \simeq .079 \\
\bar{r} &= \frac{145}{768} \simeq .189, T = \frac{35}{3072} \simeq .014
\end{aligned}$$

Appendix 3: pass-through rates

Proposition 2 *We assume a market for banking loans with N profit maximizing banks and K zero-profit (state-owned) banks. Both categories of banks are identical except for their objective function. We further assume that this market is characterized by (i) product differentiation, (ii) Nash-competition in interest rates, (iii) non-zero price-elasticity of individual and total demand functions and (iv) a separable cost function. Under those assumptions, we have:*

$$0 < \frac{\partial r^*_{i\in N}}{\partial m} < \frac{\partial r^*_{i\in K}}{\partial m} = 1$$

where r_j *is the Nash-equilibrium interest rate charged by the N profit-maximizing banks,* $\dot{r}$ *is the opportunity cost of funds and* r^*_k *is the equilibrium interest rate charged by zero-profit (state-owned) banks.*

Proof. We assume that N profit maximizing and K not for profit banks compete in a differentiated products environment. The individual demand faced by bank i is $x_i(r_i, \dot{r})$ where r_i is the interest rate charged by bank i, and $\dot{r}$ is the $N + K - 1$ vector of interest rates charged by the competitors. We assume that the marginal cost of producing banking services is given by the perfectly competitive interbank market rate m. Hence, the profit function can be written as:

$$\Pi_i = x_i(r_i, \dot{r})(r_i - m). \tag{15}$$

Assuming a non-cooperative behavior, bank $i \in N$ will choose r_i in order to maximize (15), taking other banks' interest rates as given, i.e. satisfying the following first order condition:

$$\frac{\partial \Pi_i}{\partial r_i} = \frac{\partial x_i(r_i, \dot{r})}{\partial r_i}(r_i - m) + x_i = 0. \tag{16}$$

Assuming that there is a unique function $r^*_{i\in N}(m, \dot{r})$ that satisfies (16) and that a symmetric Nash equilibrium with $r^*_i(m, \dot{r}) = r^*_j(m, \dot{r}) = r^*_N(m)$ $\forall i, j \in N$ and $r^*_{i\in K} = m$ exists, we can differentiate (16) according to m, using the implicit function theorem:

$$\frac{\partial x_i}{\partial r^*_i(m, \dot{r})}\left(2\frac{\partial r^*_i(m, \dot{r})}{\partial m} - 1\right) + \frac{\partial x_i}{\partial \dot{r}^*}\left(\frac{\partial \dot{r}^*}{\partial m} + \frac{\partial \dot{r}^*}{\partial r^*_i}\frac{\partial r^*_i(m)}{\partial m}\right) = 0, \tag{17}$$

where $\dot{r}^* = \{r^*_N(m, r_i), m\}$ is a $N - 1 + K$ vector of reaction functions.

We further assume that the individual demand function satisfies two weak conditions. First we assume that the individual demand function is downwards sloped:

$$\frac{\partial x_i}{\partial r_i} < 0 \tag{18}$$

and second, we assume that the direct (negative) effect on the individual demand resulting from an interest rate increase is less than compensated by the indirect (positive) effect due to the increase of the competitors prices, i.e. we impose a necessary condition for a downwards sloping aggregate demand function:

$$\frac{\partial x_i}{\partial m} = \frac{\partial x_i}{\partial r_i^* (m, \dot{r})} \frac{\partial r_i^* (m, \dot{r})}{\partial m} + \frac{\partial x_i}{\partial \dot{r}^*} \left(\frac{\partial \dot{r}^*}{\partial m} + \frac{\partial \dot{r}^*}{\partial r_i} \frac{\partial r_i}{\partial m} \right) < 0. \tag{19}$$

Combining (17) and (19) implies:

$$\frac{\partial x_i}{\partial r_i^* (m, \dot{r})} \left(\frac{\partial r_i^* (m, \dot{r})}{\partial m} - 1 \right) > 0$$

and hence, using (**??**), we have:

$$\frac{\partial r_i^* (m, \dot{r})}{\partial m} < 1, \forall i \in N$$

which proves proposition 1. Proposition 1 also applies in the case of the deposit savings market. The proof, which is analogue, is available on request from the authors. ■

Appendix 4: Tables

Table 2: Summary Statistics[21]

Summary statistics (all figures are averages over all Cantons and Banks, unweighted)								
Year		1996	1997	1998	1999	2000	2001	2002
Observations		315	296	261	258	248	238	277
Interest rates on mortgage loans	*Mean*	4.73	4.48	4.21	3.93	4.40	4.26	3.84
(variable r^M; percentage points)	*Std. Dev.*	0.32	0.20	0.22	0.20	0.15	0.12	0.17
Interest rates on deposits	*Mean*	2.13	2.01	1.78	1.61	2.11	1.83	1.45
(variable r^S; percentage points)	*Std. Dev.*	0.55	0.27	0.25	0.26	0.35	0.32	0.20
Concentration (mortgage market)	*Mean*	2'458	2'494	2'837	2'800	2'731	2'780	2'498
(variable $CONC^M$; Herfindahl index)	*Std. Dev.*	1'192	1'196	1'064	1'247	1'203	1'192	792
Concentration (deposit market)	*Mean*	2'319	2'352	2'627	2'666	2'649	2'695	2'478
(variable $CONC^S$; Herfindahl index)	*Std. Dev.*	1'008	1'002	946	1'093	1'060	1'051	701
Market share of CBs (mortgage market)	*Mean*	.35	.35	.35	.36	.36	.36	.35
(variable MS^M_{CB})	*Std. Dev.*	.17	.17	.17	.18	.17	.17	.16
Market share of CBs (deposit market)	*Mean*	.34	.33	.33	.33	.34	.34	.32
(variable MS^S_{CB})	*Std. Dev.*	.16	.16	.16	.16	.16	.16	.14
Share of freely adjustable mortgage rates	*Mean*	.66	.65	.65	.64	.70	.69	.60
(variable FREE)	*Std. Dev.*	.20	.21	.22	.22	.19	.20	.24
Share of 2nd and 3rd rank mortages	*Mean*	.14	.12	.12	.10	.10	.09	.09
(variable RISK)	*Std. Dev.*	.11	.10	.11	.08	.07	.07	.07
Bank branches (ratio)	*Mean*	.08	.09	.10	.10	.11	.11	.10
(variable BRANCH)	*Std. Dev.*	.11	.10	.11	.08	.07	.07	.07
Share of savings to total deposits	*Mean*	.79	.77	.77	.76	.76	.74	.74
(variable SAVINGS)	*Std. Dev.*	.20	.23	.24	.25	.24	.25	.22
Sum of domestic assets	*Mean*	33'100	35'600	44'000	41'000	38'400	39'900	39'500
(variable ASSETS; CHF millions)	*Std. Dev.*	44'100	50'100	80'300	76'500	62'700	60'100	58'400
Growth of cantonal economic activity	*Mean*	-0.004	-0.004	-0.001	-0.001	0.000	-0.001	-0.002
(variable GDP)	*Std. Dev.*	.02	.02	.02	.01	.01	.01	.01
3 Months interbank interest rate *(variable LIBOR)*		1.72	1.45	1.32	1.17	2.93	2.68	0.935

Table 3: Test of hypothesis 1 (mortgages)

Mortgage loans				
	All Banks		Banks active in one canton only	
	Fixed effects (banks)	Pooled	Fixed effects (banks)	Pooled
Panel A: WITHOUT control for portfolio characteristics				
Dependant variable: **Δr^M**; sample: 1996-2002				
ΔLIBOR	0.294***	0.286***	0.317***	0.317***
	0.000	*0.000*	*0.000*	*0.000*
$I_{CB}\Delta$LIBOR	-0.031**	-0.025***	-0.044**	-0.044***
	0.034	*0.002*	*0.015*	*0.002*
ΔGDP	-0.264	-0.632	-0.680	-0.692
	0.583	*0.225*	*0.388*	*0.421*
TIME	0.062***	0.053***	0.078***	0.077***
	0.000	*0.000*	*0.000*	*0.000*
CONSTANT	-0.393***	-0.353***	-0.481***	-0.476***
	0.000	*0.000*	*0.000*	*0.000*
Observations	1539	1539	770	770
Groups	334		150	
R-Squared	0.76	0.69	0.76	0.72
Panel B: WITH control for portfolio characteristics				
Dependant variable: **ΔR^M**; sample: 1996-2002				
ΔLIBOR	0.479***	0.474***	0.428***	0.426***
	0.000	*0.000*	*0.000*	*0.000*
$I_{CB}\Delta$LIBOR	0.019	0.057**	0.076***	0.080**
	0.540	*0.030*	*0.001*	*0.013*
ΔRISK	1.665***	1.796***	-0.905**	-0.523
	0.000	*0.000*	*0.030*	*0.273*
ΔGDP	-0.379	-0.731	-0.856	-1.025
	0.696	*0.414*	*0.389*	*0.343*
TIME	0.064***	0.059***	0.100***	0.099***
	0.000	*0.000*	*0.000*	*0.000*
CONSTANT	-0.504***	-0.481***	-0.658***	-0.655***
	0.000	*0.000*	*0.000*	*0.000*
Observations	1440	1440	712	712
Groups	26		147	
R-Squared	0.64	0.64	0.74	0.73

p-values are in italics
*,**,*** indicate coefficients which are significant at, or below, the 10%, 5% and 1% respectively
OLS Regression; Robust standard-errors

Table 4: Test of hypothesis 1 (deposits)

Savings and Investment Deposits				
	All Banks		Banks active in one canton only	
	Fixed effects (banks)	Pooled	Fixed effects (banks)	Pooled
Panel A: WITHOUT control for portfolio characteristics				
Dependant variable: Δr^S; sample: 1996-2002				
ΔLIBOR	0.271***	0.269***	0.302***	0.305***
	0.000	*0.000*	*0.000*	*0.000*
I_{CB}ΔLIBOR	-0.067***	-0.069***	-0.106***	-0.109***
	0.006	*0.000*	*0.000*	*0.000*
TIME	0.034***	0.034***	0.036***	0.038***
	0.000	*0.000*	*0.000*	*0.000*
CONSTANT	-0.233***	-0.235***	-0.266***	-0.272***
	0.000	*0.000*	*0.000*	*0.000*
Observations	1576	1576	739	739
Groups	345		141	
R-Squared	0.49	0.46	0.57	0.53
Panel B: WITH control for portfolio characteristics				
Dependant variable: Δr^S; sample: 1996-2002				
ΔLIBOR	0.280***	0.277***	0.304***	0.304***
	0.000	*0.000*	*0.000*	*0.000*
I_{CB}ΔLIBOR	-0.070***	-0.075***	-0.105***	-0.107***
	0.000	*0.000*	*0.000*	*0.000*
ΔSAVINGS	2.134***	1.548***	0.104	-0.166
	0.000	*0.000*	*0.880*	*0.718*
TIME	0.036***	0.037***	0.035***	0.036***
	0.000	*0.000*	*0.000*	*0.000*
CONSTANT	-0.269***	-0.266***	-0.260***	-0.266***
	0.000	*0.000*	*0.000*	*0.000*
Observations	1501	1501	705	705
Groups	342		138	
R-Squared	0.52	0.49	0.55	0.54

p-values are in italics
*,**,*** indicate coefficients which are significant at, or below, the 10%, 5% and 1% respectively
OLS Regression; Robust standard-errors

Table 5: Test of hypothesis 2 (mortgages)

Mortgage loans				
	All Banks		Banks active in one canton only	
	Fixed effects (cantons)	Pooled	Fixed effects (cantons)	Pooled
Panel A: WITHOUT control for portfolio and bank characteristics				
Dependant variable: r^M; sample: 1996-2002				
I_{CB}	0.038*	0.035*	0.095***	0.057**
	0.091	*0.063*	*0.008*	*0.013*
ΔGDP	-0.006	-0.230	-0.024	-0.828
	0.993	*0.646*	*0.983*	*0.397*
TIME	-0.079***	-0.079***	-0.062***	-0.063***
	0.000	*0.000*	*0.000*	*0.000*
CONSTANT	4.539***	4.538***	4.456***	4.467***
	0.000	*0.000*	*0.000*	*0.000*
Observations	1560	1560	775	775
Groups	26		26	
R-Squared	0.23	0.22	0.14	0.13
Panel B: WITH control for portfolio and bank characteristics				
Dependant variable: r^M; sample: 1996-2002				
I_{CB}	-0.009	0.002	-0.094*	-0.063
	0.716	*0.948*	*0.073*	*0.130*
FREE	0.066*	0.084*	0.244***	0.210***
	0.090	*0.058*	*0.000*	*0.002*
RISK	0.414***	0.426***	-0.064	0.059
	0.000	*0.000*	*0.621*	*0.670*
ASSETS	0.001	0.003	0.042***	0.032***
	0.738	*0.552*	*0.006*	*0.003*
BRANCH	0.032***	0.02***	0.010	0.014
	0.000	*0.007*	*0.558*	*0.236*
ΔGDP	-0.107	-0.077	-0.168	0.225
	0.868	*0.872*	*0.870*	*0.802*
TIME	-0.076***	-0.075***	-0.064***	-0.066***
	0.000	*0.000*	*0.000*	*0.000*
CONSTANT	4.533***	4.458***	3.825***	3.990***
	0.000	*0.000*	*0.000*	*0.000*
Observations	1514	1514	765	765
Groups	26		26	
R-Squared	0.24	0.25	0.17	0.17

p-values are in italics
*,**,*** indicate coefficients which are significant at, or below, the 10%, 5% and 1% respectively
OLS Regression; Robust standard-errors

Table 6: Test of hypothesis 2 (deposits)

Savings and Investment Deposits				
	All Banks		Banks active in one canton only	
	Fixed effects (cantons)	Pooled	Fixed effects (cantons)	Pooled
Panel A: WITHOUT control for portfolio and bank characteristics				
Dependant variable: Δr^S; sample: 1996-2002				
I_{CB}	-0.161***	-0.200***	-0.270***	-0.313***
	0.000	*0.000*	*0.000*	*0.000*
TIME	-0.065***	-0.065***	-0.062***	-0.063***
	0.000	*0.000*	*0.000*	*0.000*
CONSTANT	2.100***	2.107***	2.220***	2.233***
	0.000	*0.000*	*0.000*	*0.000*
Observations	1592	1592	741	741
Groups	26		26	
R-Squared	0.14	0.14	0.17	0.21
Panel B: WITH control for portfolio and bank characteristics				
Dependant variable: Δr^S; sample: 1996-2002				
I_{CB}	-0.193***	-0.194***	-0.131**	-0.217***
	0.000	*0.000*	*0.028*	*0.000*
SAVINGS	0.177***	0.202***	0.059	0.198***
	0.000	*0.000*	*0.496*	*0.004*
ASSETS	-0.041***	-0.043***	-0.037*	-0.049***
	0.000	*0.000*	*0.059*	*0.000*
BRANCH	0.009	0.007	0.002	0.022*
	0.337	*0.491*	*0.926*	*0.099*
TIME	-0.056***	-0.057***	-0.060***	-0.061***
	0.000	*0.000*	*0.000*	*0.000*
CONSTANT	2.598***	2.599***	2.623***	2.766***
	0.000	*0.000*	*0.000*	*0.000*
Observations	1535	1535	735	735
Groups	25		25	
R-Squared	0.26	0.26	0.24	0.25

p-values are in italics
*,**,*** indicate coefficients which are significant at, or below, the 10%, 5% and 1% respectively
OLS Regression; Robust standard-errors

Table 7:Test of hypothesis 3 (morgages)

	Mortgage loans			
	All Banks		Banks active in one canton only	
	Between (cantons) effect estimation			
	OLS	IV[1)]	OLS	IV[1)]
Panel A: WITHOUT control for portfolio and bank characteristics				
Dependant variable: r^M; sample: 1996-2002				
MS_{CB}	0.273***	0.236**	0.359**	0.425**
	0.006	*0.027*	*0.047*	*0.045*
CONC[2)]	-0.033**	-0.031**	-0.065**	-0.069***
	0.033	*0.038*	*0.010*	*0.005*
I_{CB}	-0.084	-0.047	0.064	0.053
	0.689	*0.827*	*0.371*	*0.475*
ΔGDP	-1.287	-1.164	-4.718*	-4.958**
	0.231	*0.274*	*0.062*	*0.042*
TIME	0.072	0.051	-0.208	-0.209
	0.563	*0.692*	*0.153*	*0.136*
CONSTANT	3.873***	3.973***	5.137***	5.135***
	0.000	*0.000*	*0.000*	*0.000*
Observations	1560	1560	775	775
Groups	26	26	26	26
R-Squared	0.38	0.37	0.40	0.40
Panel B: WITH control for portfolio and bank characteristics				
Dependant variable: r^M; sample: 1996-2002				
MS_{CB}	0.261**	0.235**	0.453**	0.500**
	0.012	*0.038*	*0.012*	*0.014*
CONC[2)]	-0.040**	-0.038**	-0.0657**	-0.069***
	0.021	*0.029*	*0.014*	*0.007*
I_{CB}	0.385	0.369	0.107	0.105
	0.347	*0.356*	*0.297*	*0.295*
RISK	0.609	0.617	0.535	0.526
	0.239	*0.218*	*0.221*	*0.213*
FREE	0.160	0.150	0.308*	0.323*
	0.496	*0.517*	*0.099*	*0.075*
ΔGDP	0.006	0.048	-1.390	-1.461
	0.996	*0.969*	*0.504*	*0.476*
log ASSETS	-0.015	-0.013	0.007	0.006
	0.532	*0.581*	*0.799*	*0.811*
TIME	0.047	0.032	-0.213***	-0.214***
	0.729	*0.821*	*0.000*	*0.000*
CONSTANT	4.020***	4.071***	4.762***	4.756***
	0.000	*0.000*	*0.000*	*0.000*
Observations	1552	1552	766	766
Groups	26	26	26	26
R-Squared	0.48	0.47	0.75	0.74

1) Instrumental variables estimation.
Instrumented: MS_{CB}
Instruments: Number of branches at the cantonal level (deviation from cantonal average)
2) The original CONC coeficient are scaled up by a factor 1'000.
p-values are in italics
*,**,*** indicate coefficients which are significant at, or below, the 10%, 5% and 1% respectively

Table 8:Test of hypothesis 3 (deposits)

Savings and Investment Deposits				
	All Banks		Banks active in one canton only	
	Between (cantons) effect estimation			
	OLS	IV[1)]	OLS	IV[1)]
Panel A: WITHOUT control for portfolio and bank characteristics				
Dependant variable: Δr^S; sample: 1996-2002				
MS_{CB}	-0.173	-0.264*	-0.021	-0.178
	0.177	*0.066*	*0.928*	*0.531*
CONC[2)]	0.064**	0.072**	0.088**	0.1***
	0.042	*0.018*	*0.022*	*0.009*
I_{CB}	-0.848**	-0.795**	-0.496***	-0.472***
	0.022	*0.023*	*0.000*	*0.000*
TIME	-0.343*	-0.376**	-0.200	-0.173
	0.077	*0.046*	*0.270*	*0.340*
CONSTANT	3.293***	3.440***	2.653***	2.545***
	0.001	*0.000*	*0.002*	*0.001*
Observations	1592	1592	741	741
Groups	26	26	26	26
R-Squared	0.45	0.43	0.64	0.64
Panel B: WITH control for portfolio and bank characteristics				
Dependant variable: Δr^S; sample: 1996-2002				
MS_{CB}	-0.048	-0.084	0.171	0.028
	0.614	*0.424*	*0.500*	*0.931*
CONC[2)]	0.028	0.032	0.061	0.073
	0.225	*0.166*	*0.177*	*0.120*
I_{CB}	-0.160	-0.184	-0.325**	-0.328**
	0.703	*0.659*	*0.047*	*0.032*
SAVINGS	0.208	0.218	0.330	0.290
	0.253	*0.220*	*0.324*	*0.384*
log ASSETS	-0.060**	-0.057**	-0.050	-0.044
	0.015	*0.013*	*0.226*	*0.292*
TIME	-0.182	-0.201	-0.257	-0.229
	0.203	*0.154*	*0.164*	*0.210*
CONSTANT	3.332***	3.362***	3.249***	3.090***
	0.000	*0.000*	*0.005*	*0.003*
Observations	1576	1576	735	735
Groups	25	25	25	25
R-Squared	0.77	0.77	0.70	0.70

1) Instrumental variables estimation.
Instrumented: MS_{CB}
Instruments: Number of branches at the cantonal level (deviation from cantonal average)
2) The original CONC coeficient are scaled up by a factor 1'000.
p-values are in italics
*,**,*** indicate coefficients which are significant at, or below, the 10%, 5% and 1% respectively