The UBS-SBC Merger and Competition in the Swiss Retail Banking Sector[*]

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December 1999

Abstract

We address two questions about the impact of the UBS-SBC merger: (i) How will the concentration in the Swiss retail banking market change, and (ii) what are the expected consequences for the consumers. The answer to the first question is based on a comparison of Herfindahl and C3-indices in 1997 as they actually have been to as they could have been if the banks already had been merged. For both types of indices, and for the two product groups considered (loans and mortgages, savings deposits) the impact of the merger is huge. To answer the second question, we have examined how concentration interfered with savings deposits and mortgages interest rates in the previous decade, between the cantons and over time. The results obtained for savings deposits indicate that the structure performance hypothesis dominates for large cantons, while the efficiency hypothesis and the contestable market hypotheses cannot be rejected for small cantons. For mortgages, the contestable market hypotheses clearly dominates for large cantons, while for small cantons evidence is split between the efficiency hypothesis and the contestable market hypothesis.

1 Introduction

On 1st July 1998, the UBS and the SBC, two of the three Swiss big banks, have merged to form the new UBS. The announcement of the merger in December 1997 triggered a heated debate about the competitive impact of the merger. On the one hand, two economists from the University of Lausanne (Damien Neven and Thomas von Ungern Sternberg), forcefully argued that the merger would have a severe impact on competition in the retail banking segment, especially for loans to small and medium sized enterprises (see Neven and von Ungern Sternberg (1998) and von Ungern Sternberg and Neven (1998)). On the other hand, two expertises requested by the UBS countered Neven and von Ungern Sternberg mainly on their definition of the relevant markets as local (see Volkart (1998b) and Watter (1998)). Since relevant data are not publicly available, the discussion was partly based on plausibility grounds, partly on sheer assertions.

In May 1998, the Wettbewerbskommission, the Swiss antitrust agency, decided to force the new UBS to sell 25 branches as well as two subsidiary banks, namely the Banca della Svizzera Italiana and the Solothurner Bank. The UBS will have to make a list of 35 branches out of which a potential buyer can pick 25 branches at will. The list of the 35 branches will have to be accepted by the Wettbewerbskommission. The UBS has to consider branches in the three main language regions and in eight specified regions which are critical from an antitrust point of view. In addition, UBS has to maintain credit lines to those clients who had loans at one of the merged banks at least up to 2004. Last but not least, UBS is not allowed to quit partnership agreements in infrastructure enterprises.

In this study, we will investigate the competitive impact of the merger empirically. The two main questions we will look at are:

- What is the impact of the merger on concentration in the Swiss retail banking sector?

- What are the expected consequences of the change in concentration on competition in the Swiss retail banking industry?

To answer the first question, we have computed the Herfindahl index and the three-firm concentration ratio for the product groups 'loans and mortgages' and 'savings deposits'. In order to estimate the impact of the merger we have compared the concentration indices for 1997 with the indices which would have prevailed if the two banks had been merged already at that time. The analysis shows a considerable impact of the merger for both concentration indices and product groups, especially in markets with previously low concentration indices.

In order to answer the second question, i.e. the possible impact of the merger on competition, we have estimated the relationship between concentration and prices for the last decade. We take two different points of view about the impact of concentration on competition. First, we examine how concentration interferes with prices *from one canton to another*. Second, we examine the relationship between concentration and prices *over time*. We call the former *canton-analysis,* the latter *time-analysis*.

For both approaches, we have tested three hypotheses. First, the contestable-market hypothesis suggests no relationship between concentration and prices, in our case interest rates. Second, the structure-performance hypothesis suggests a negative (positive) relationship between concentration and savings deposits (mortgages) rates. Third, the market-efficiency hypothesis

suggests an opposite relationship. From an antitrust-policy point of view, the rejection of the structure-performance hypothesis would indicate that the merger has no negative impact on competition.

Our main results can be summarised as follows:

- The canton-analysis indicates that the efficient-market hypothesis cannot be rejected for deposits as well as for mortgages for small cantons. For large cantons, the structure performance hypothesis cannot be rejected for savings deposits, while the contestable-markets hypothesis cannot be rejected for mortgages.

- The time-analysis indicates that for savings deposits, the structure-performance hypothesis cannot be rejected for large cantons, while the contestable-market hypothesis cannot be rejected for small cantons. For mortgages, we cannot reject the contestable-market hypothesis.

These findings suggest that antitrust authorities should intervene in large cantons, where the market power inconveniences of concentration seem to dominate, and should not intervene in small cantons, where the efficiency gains of concentration seem to overcompensate for the inconveniences of market power.

Our results should not be extrapolated mechanically to the UBS merger. First, our estimations are based on a period with more or less steady changes of concentration. Overall, these changes are of the same magnitude as the impact of the UBS merger. However, the merger is a one-time shock, not a steady change. As we will argue below, the merger might considerably influence the game oligopolists play in local Swiss retail banking markets. Second, the results might be biased because of a wrong definition of the relevant markets. As mentioned above, the results depend crucially on the size of the cantons. For large cantons, our analysis suggests that the antitrust agency should have intervened, whereas for small cantons, an intervention would have been detrimental. We chose cantons as defining markets for retail banking products not because we are convinced that this is the relevant definition, but simply because of availability of data. Studies for the US indicate that banking markets are quite small. Whether this result applies for Switzerland, we do not know. The main result of our analysis then might be that market definition is indeed crucial, and that one needs not only data to define markets for banking products appropriately, but also a data base in accordance with the appropriate geographical definition of markets.

2 Definition of relevant markets for deposits, loans and mortgages

In our empirical analysis we will look at two product groups relevant for households and small businesses: (1) loans and mortgages, and (2) savings deposits.

For antitrust considerations, defining the relevant geographic market is of considerable significance. By construction, the Herfindahl index is higher for narrowly defined markets. Consequently, merging banks tend to define their market broadly[1], while antitrust agencies stick to

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[1] In the application for the merger, UBS defined the relevant market for loans as the national market (Watter 1998).

more narrow definitions. As noted by Simons and Stavins (1998), the US agencies, 'consider a local, economically integrated area to be a banking market. In practice, this usually means a city, a metropolitan statistical area, or a rural county.' Similarly, the German Bundeskartellamt chose a very close definition in evaluating the competitive impact of the merger between the Bayrische Volksbank and Hypobank in Bavaria. Such small markets as the towns Kempten, Augsburg or Rosenheim have been defined as relevant markets.

The fact that anti-trust agencies define local markets as relevant does not necessarily mean that this is economically appropriate. We therefore investigate the theoretical considerations which should govern the definition of relevant markets as well as the empirical findings on these questions.

The appropriate definition of a market depends on the products in consideration. Kwast, Starr-McCluer and Wolken (1997) indicate that market power problems in the banking industry are only to be expected for 'locally limited products'. In their view, locally limited products are those consumed by households and small businesses. It still remains to define the products actually falling into this category, and what 'locally limited' exactly means. Without doubt, today a household has the opportunity to buy and sell stocks not only via the bank at its residence. It can also open a deposit account at a bank located at a more distant place. Similar considerations count for other banking products. However, the question is not where consumers and small businesses could do their business, but where they actually choose to do so. In the following, we will give some theoretical arguments as to why we think the products chosen are carried out locally, and will review the evidence. This is followed by a discussion of the geographical definition of markets we have employed.

Loan and mortgage markets are characterised by asymmetric information, and based on this, banks can be seen as delegated monitors (Diamond (1984)). Monitoring is less costly the closer bank and customers are located. Different regional markets can have distinctive characteristics, which create a potential for economies of scale in information gathering.

Depositors use their deposit accounts not only for savings but also for payment services. The closer the bank, the lower are the transportation costs. Also, reputational effects can provide incentives for depositors to prefer local banks.

Additionally, combining loans or mortgages and payment services at the same branch helps the bank to get information about a specific customer and improves monitoring quality, from which both parties may profit. It may also reduce the transactions costs of the customer.

Based on US data for 1992 and 1993, Kwast, Starr-McCluer and Wolken (1997) report that 97.5% of households and 92.4% of small businesses using financial services had at least one account at a local depository institution, which for 96.5% and 93.5% was the primary account. In contrast, only 20.2% of households and 8% of small businesses had accounts at non-local depository institutions. By 'local', the authors mean within 30 miles of residence or headquarters. The services most likely to be purchased locally are checking, savings and money market accounts, lines of credit, and certificates of deposit. Moreover, the authors examine the degree of clustering of financial services by households and small firms at their primary bank. Interestingly, clustering occurs for those services that are predominantly purchased locally, from which Kwast, Starr-McCluer and Wolken (1997) conclude that 'a strong

circumstantial case can be made that small businesses, as well as households, frequently tend to cluster their purchases of certain financial services at a local depository institution. Unlike households, the cluster for small businesses appears to include not only asset services, but also important credit and nonfinancial management services' (p. 988f). These results confirm those of an earlier study by Elliehausen and Wolken (1990). Rhoades (1996a), surveying the available evidence, concludes: 'Evidence indicates that local market areas are generally the appropriate focus for analysis of the competitive effects of bank mergers. In particular, surveys of both households and small businesses point strongly toward the relevance of geographical markets' (p. 344).

The relevant market definition can change over time. What immediately comes to mind are electronic banking, ATMs and the like. Electronic banking has the potential to significantly reduce information and transaction costs for some products like checking and savings accounts. Their short- and medium term impact should, however, not be exaggerated. Electronic banking today is still relatively costly. One needs a PC and an access to the Internet, and the ability to use these tools. It will certainly take decades until most customers have equipment, skills and enough confidence to move to electronic banking. In addition, electronic banking does not reduce information costs for products where the bank has to rely on information about local markets. In these cases, the advantages of clustering services still induce customers to stick to the local bank, even if some services could also be provided electronically by a distant bank. It might be the case that the customers will do part of their banking business electronically, but this will not influence the relevant market definition as long as the customers do not switch to a more distant bank. On the possible influence of ATMs, Rhoades (1996a) concludes: 'ATMs are not a substitute for a branch and are not the broad-based retail platform for the delivery of banking services that will ultimately constitute retail electronic banking' (p. 353).

New products and distributional innovations have led to a blur of the distinction between bank deposits and numerous substitutes available. This raises the question of the need to include other financial firms into an analysis of the effects of a merger in the retail banking sector. Amel and Hannan (1999) provide evidence that competition from nonbank institution can be neglected for small-scale consumer deposits.

Securitisation of loans and mortgages might also reduce the monitoring incentives of banks. But since the incentive to monitor only vanishes after the securitisation of a loan or a mortgage, and the success of a securitisation hinges on the reputation of the bank engaged, the influence is unlikely to be particularly important.

For Switzerland, an additional argument against a narrow definition of the relevant markets is that the merger will challenge the dominant positions of the cantonal banks[2]. Since interest rates for the UBS services are set nationwide, the ability of the local banks to exploit market power is reduced. Although it might be true that the UBS will set nationwide interest rates, not leaving at least some room to branch managers to adjust to local conditions would simply

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[2] Cantonal banks are state owned, and have to take public interests into consideration.

not be profit-maximising. It is hard to believe (and in times of shareholder-value maximisation also hard to justify) that a bank would refrain from making profits.

The theoretical and empirical considerations indicate that the relevant markets for savings deposits, loans and mortgages are local markets. The appropriate definition of 'localness' is still a further critical point. The German Kartellamt, for instance, takes towns with less than 100'000 inhabitants as local centres. As indicated above, Kwast, Starr-McCluer and Wolken (1997) define local markets as a circle around the banking institution with a radius of 30 miles. For Switzerland, data for similarly narrow markets are not available, but we dispose of data at the canton level. The Swiss cantons differ substantially in size and population density. Most of them have more than 100'000 inhabitants and a good part of them also have more than one central town which satisfies the definition of local markets according to the Bundeskartellamt.

3 The impact of the UBS-merger on concentration

Table 1 shows the number of banks active in each of the Swiss cantons. Clearly the canton Zürich, the centre of the Swiss financial system, hosts the largest number of banks. A lot of private banks are located in Geneva, while only few banks are active in the smaller cantons like Uri, Schwyz, Ob- and Nidwalden and the two Appenzells.

Table 1:   Number of banks active in each canton, 1997

Zürich	63	Glarus	7	Appenzell AR	7	Vaud	28
Bern	44	Zug	8	Appenzell IR	4	Valais	9
Luzern	14	Freiburg	17	St. Gallen	25	Neuchâtel	7
Uri	5	Solothurn	14	Graubünden	10	Genève	55
Schwyz	8	Basel-Stadt	18	Aargau	19	Jura	9
Obwalden	6	Basel-Land	7	Thurgau	7		
Nidwalden	5	Schaffhausen	14	Ticino	31		

These figures are only indicative of the concentration of the banking systems by cantons. More informative concentration indices are the three-firm index C3 and the Herfindahl index H. The three-firm concentration index is equal to the sum of the three highest market shares in the market under consideration. If the C3-index is 100, there are at most three banks active in the market. The Herfindahl index sums up the squares of the market shares. It can take values between 0 and 10'000. The upper bound is reached when there is a monopolistic bank. For a market with two equally large banks, the H index is 5'000, for three equally large banks 3'333. In a market where a large bank has a market share of 80% and two smaller banks have market shares of 10%, the H index is 6'600. Note that for all these cases, the C3 index is 100. The H index therefore entails more information than the C3 index.

Our data stem from the yearly reports of the banks to the Swiss National Bank. Table 2 shows the number of cantons with Herfindahl indices for different ranges.

Table 2: **Number of Cantons with Herfindahl indices for different ranges**

	Loans and Mortgages			Savings deposits		
	1987	1997	UBS	1987	1997	UBS
0-1800	6	3	0	6	3	1
1801-2500	9	11	7	8	11	8
2501-3200	1	2	6	1	2	6
3201-10000	10	10	13	11	10	11

For both product groups, the number of cantons with Herfindahl indices of less than 1800 has decreased in the last decade. The merger reduces the numbers to 0 and 1, respectively. At the other end of the spectrum, in about 40% of the cantons the Herfindahl indices exceed 3200 after the merger.

Table 3 shows the increase in the Herfindahl index implied by the merger, again for different ranges.

Table 3: **Increase of Herfindahl indices due to the UBS merger (number of cantons with increases of different ranges)**

	Loans and Mortgages	Savings
0-199	10	13
200-399	6	5
400-599	3	4
> 600	7	4

For about half the cantons, the Herfindahl index rose by more than 200 points and for roughly one fifth by more than 600 points. These are considerable numbers.

Another interesting question concerns the relationship between the level and the increase of concentration implied by the merger.

Table 4: **Relation between pre-merger levels and increases of Herfindahl indices (number of cantons)**

		<200	201-400	401-600	>600
Savings Deposits	0-1800	0	1	1	0
	1801-2500	4	2	1	3
	2501-3200	1	1	0	2
	3201-10000	8	1	0	1
Loans and Mortgages	0-1800	0	1	1	1
	1801-2500	2	3	1	5
	2501-3200	0	1	1	0
	3201-10000	9	1	0	0

As Table 4 shows, those cantons with an increase in concentration of less than 200 have pre-merger Herfindahl indices higher than 1800, most of them even higher than 3200. Conversely,

those cantons with an increase of more than 600 predominantly had low pre-merger levels. The merger therefore reduces the dispersion of concentration between cantons.

As another piece of information, we compare market size, measured by population size, with the Herfindahl indices after the merger. Table 5 shows the ranges of the indices for the cantons with less than 200'000 inhabitants, a criterion that half the cantons meet.

Table 5: *Herfindahl indices after the merger for cantons with a population under 200'000 (in parentheses: all cantons)*

	Loans and Mortgages	Savings deposits
0-1800	0 (0)	0 (1)
1801-2500	2 (7)	2 (8)
2501-3200	1 (6)	2 (6)
3200-10000	10 (13)	9 (11)

Obviously, the Herfindahl indices for the small Swiss cantons are very high, but the importance of market size is spectacular.

In the United States, the decision to investigate the impact of a merger on competition relies on DOJ Merger Guidelines. According to the Guidelines, a merger potentially harms competition if the Herfindahl index after the merger is higher than 1800 *and* the merger leads to an increase of the index of at least 200 points. In case both criteria are met, the federal agencies and the Department of Justice analyse the impact of the merger under consideration. By doing so, they take possible mitigating factors into account, such as competition from thrift institutions and credit unions, the ease of entry, the attractiveness for entry, possible efficiency improvements implied by the merger, and the number of firms remaining in the market (Simons and Stavins (1998)). If a merger is considered anticompetitive, the merging bank is required to divest branches and offices as a condition for approval. As von Ungern Sternberg and Neven (1998) report, the US antitrust agencies already forced the merging banks to sell branches in cases the Herfindahl index rose over 2300. In some cases, where the concentration was already high before the merger, the index was still close to 3000 after branches had been sold, and all the agencies could do was to prevent an even higher concentration. The US agencies not only analyse planned mergers, but also provide support for banks planning to merge, thereby reducing the number of cases they have to analyse for approval.

To conclude, if the Wettbewerbskommission had based its decision on the standards used in the US, it would, without doubt, have had to take serious actions.

To our knowledge, the C3 index is nowhere used as a basis for policy considerations. Nevertheless, it is informative to look at. Qualitatively, however, the results are the same as for the Herfindahl-indices, so we have left the tables for the Appendix.

4 The impact of concentration on competition

We approximate the impact of concentration on competition by investigating the relationship between concentration and interest rates for savings deposits and mortgages.

The literature discusses three possible effects concentration can have on prices. The structure-performance approach takes concentration as exogenously given. Based on the banking-model of Klein (1971), Hannan (1991a) shows that higher concentration allows the firms to exploit market power and thus leads to less favourable prices for consumers.

The efficient-structure hypothesis, pioneered by Demsetz (1973), takes concentration as endogenous. Firms differ by exogenously given efficiency levels. Firms with high efficiency levels set lower prices and gain higher market shares. If there are economies of scale, banks in cantons with a small number of large banks produce more efficiently than banks in cantons with an atomistic banking sector. In the absence of market power, this leads to a higher concentration ratio and more consumer friendly prices in the cantons with only few banks. In addition, a high dispersion of efficiencies leads to a high dispersion of market shares, which, in itself, results in a higher Herfindahl concentration index compared to an industry with low dispersion of efficiencies.

The contestable-markets theory (Baumol, Panzar and Willig, 1982) defines sustainable market equilibria as a situation when no entry would be profitable given the equilibrium price. Due to the threat of entry, the firms in the market are not able to exploit their market power in a sustainable equilibrium.

The three theories have different implications for the relationship between concentration and prices:

Structure-Performance Hypothesis: There is a negative (positive) relationship between concentration and deposit (loan) rates.

Market-Efficiency Hypothesis: There is a positive (negative) relationship between concentration and deposit (loan) rates.

Contestable-Markets Hypothesis: There is no relationship between concentration and loan (deposit) rates.

Besides the three theories stated above, our results might be explained by other factors specific to the Swiss banking system. First, the state-owned cantonal banks are major players in most cantons. Most of them were founded in the second half of the 19th century, with the main goal to intensify competition through customer friendly interest rates. In cantons where the cantonal bank has a dominant position, such a policy may constrain the other banks to offer higher (lower) savings deposits (mortages) rates. As the large market share of the cantonal bank is reflected in a high concentration index, a positive (negative) relationship may emerge between concentration and savings deposits (mortgages) rates (as in the market-efficiency hypothesis). Second, the Swiss big banks are active in all cantons and set national reference rates for some products. In the absence of regional discrimination, prices will probably not depend on local concentration in those cantons where the big banks dominate the market (as in the contestable-market hypothesis). For savings deposits, the possibility of cantonal discrimination can be excluded as big banks offer the same rate in all cantons. For mortgages, the fact that big banks set national reference rates until 1997 does not exclude cantonal discrimination, as market power related margins may be hidden behind risk premiums.

As already said in the introduction, we use the decade prior to the UBS merger to discriminate between the three hypotheses. This will allow us to make predictions concerning the impact of the merger on future interest rates in the Swiss retail banking industry. There is an important caveat, however. The changes in concentration in the past decade have been gradual, whereas the merger implies a quite abrupt shift in industry structure. Moreover, the game played may change in those cantons where the cantonal bank looses market leadership following the merger.

5 Model, data, and estimation method

5.1 Model specification

The general specification of the model is as follows (see Hannan 1991a)[3]:

$$rL_i = a_0 + a_1 \cdot CONC_i + a_2 M_i + a_3 B_i + e_i \qquad (1)$$

$$rD_i = b_0 + b_1 \cdot CONC_i + b_2 M_i + b_3 B_i + u_i \qquad (2)$$

rL_i denotes the loan rate of bank i. rD denotes the savings deposits rate, $CONC$ a concentration index (either the Herfindahl- or the C3-index), M a vector of market characteristics, and B a vector of bank characteristics.

Equations (1) and (2) suggest that savings deposits and mortgages rates depend on concentration as well as on variables specific to banks and cantons. To control for canton-specific characteristics, we introduce total per capita bank offices and average per capita income as explaining variables. Per capita bank offices (PCBO) reflects the relative availability of bank offices and can be seen as a measure of competition in the banking market. If more offices means greater competition, higher deposit rates and a positive sign are expected. Alternatively, a higher number of offices per capita enhances a bank's ability to deliver services. Transactions costs, and, perhaps, information costs seem to be important for customers and convenience of location can then be seen as a form of product differentiation (Rhoades, 1996b). The variable thus approximates the convenience and service differentials between cantons, and the expected sign of the variable is negative for savings deposits. Finally, the number of offices per capita can be used as a proxy for strategic barriers to entry established by incumbent banks (branch proliferation), as noted by Gilbert and Matutes (1993). In case of branch proliferation, we expect a negative impact of PCBO on savings deposits rates. The average per capita income (INC) measures the relative wealth of bank customers. Wealthy customers may have attractive investment opportunities, which increases the price elasticity of deposit supply and reduces the market power of local banks.

To control for bank-specific characteristics, we introduce a dummy variable CANT which reflects the state guarantee for cantonal banks. CANT is unity for cantonal banks and zero otherwise. It is expected to have a negative sign for savings deposits, as investors demand a

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[3] Hannan (1991b) suggests introducing market share together with its interaction with concentration in the estimated equation. Our estimates based on this second specification do not differ substantially from those obtained with equation (1) and (2), although collinearity problems appear.

lower risk premium for banks liabilities guaranteed by the state. NUMB, the number of branches a bank has in a specific canton, serves as a proxy for the convenience and service components of a bank's product. Banks may offset lower deposit rates by the advantages of an extensive network of branches. The average salaries of a bank (SAL) is introduced for the same purpose, namely as a proxy for the quality of a bank's services. The expected sign of SAL and NUMB for savings deposits is negative. Finally, the variable SIZE (total assets) serves as a measure of a bank's size, which may be considered as an indicator of a bank's health. Better health leads to lower demanded risk premia and, therefore, to lower deposit rates. Bank total assets also influence operating and refinancing costs.

For mortgages, we additionally have to control for credit risk. An increase of the risk of mortgage lending is expected to lead to higher risk premia, which induces higher mortgage rates. As a proxy for the risk, we use the ratio of provisions to total assets (RPRO).

5.2 The data

We use end-of year interest rates for savings deposits and mortgages at cantonal and regional banks for the decade preceding the UBS merger. Our database does not cover banks operating in more than one canton, which excludes the big banks. All bank related data stem from the Swiss National Bank database 'IPSO' while the data on population and income stem from the 'Annuaire statistique de la Suisse'. 'IPSO' data are confidential.

5.3 Estimation method

As mentioned in the introduction, we investigate the relationship between interest rates and concentration in a double perspective. First, we examine how concentration interferes with interest rates, based on their variations from one canton to another; we call this approach *canton-analysis*. Second, we study the relation between concentration and interest rates, based on their variation over time; this approach is called *time-analysis*.

The canton-analysis involves two methods of estimation. The first method simply consists in estimating the model on a cross section basis separately for each year of the reference period. In the second method, we pool the cross section data over the different years of the reference period and estimate the model based on the pooled data. The intercept is estimated separately for each year; technically, this is equivalent to subtract from each variable the national mean computed for each year of the reference period. As a consequence, the estimated coefficient of the concentration index does not depend on the variation over time of the national mean of concentration and essentially reflects the impact of the variation of concentration from one canton to another. The estimates of the pooled data analysis with time specific intercepts should therefore be quite similar to those obtained in the traditional cross section analysis.[4]

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[4] Another reason for this similarity is that concentration indices vary much more from one canton to another than over time.

In the time-analysis, the time series for individual banks are pooled over the different cantons. We then estimate the model based on the pooled data with canton specific intercepts. This is equivalent to subtract from each variable the cantonal mean computed over the whole reference period. As a consequence, the estimated coefficient of the concentration index captures the impact of the variation of concentration over time, without respect for the mean of cantonal concentration over the reference period.

The approach traditionally employed in the empirical industrial organisation literature is cross-section analysis. Examples for the banking industry are Evanoff and Fortier (1988), Berger and Hannan (1989), Hannan (1991a) and Neuberger and Zimmerman (1991). Recently, the traditional approach has come under attack, mostly because market idiosyncrasies are difficult to control for and question the appropriateness of static comparisons between markets. Under the term 'the new empirical industrial organisation', Bresnahan (1989) proposed to investigate market power by time-series analysis. Examples for the banking industry are Hannan and Liang (1991) and Simons and Stavins (1998). By pooling the data, we are able to apply both approaches with the same data set.

Beside these formal considerations, cross-section and time-series analyses lead to different policy conclusions. A positive relationship between concentration and prices in a cross-section study indicates that antitrust policy should be intensified in markets with high concentration. A positive relationship in a time-series analysis, however, indicates that antitrust policy should intervene in cantons where concentration is increasing.

6 Relationship between concentration and prices from one canton to another

In this section, we examine the relationship between concentration and interest rates based on their variations from one canton to another. For this approach, the three hypotheses are:

H0: Contestable-markets hypothesis: Differences of concentration between cantons have no impact on savings deposits and mortgage rates.

H1: Structure-performance hypothesis: Differences of concentration between cantons have a negative (positive) impact on savings deposits (mortgage) rates.

H2: Market-efficiency hypothesis: Differences of concentration between cantons have a positive (negative) impact on savings deposits (mortgage) rates.

A confirmation of H1 would indicate that anti-trust policy should be intensified in cantons with high concentration indices.

6.1 Specification of the model

By inserting the control variables mentioned above into equations (1) and (2), we get the following specifications for savings deposits

$$rD_i = b_0 + b_1 CONC_i + b_2 PCBO_i + b_3 INC_i + b_4 NUMB_i + b_5 SAL_i + b_6 SIZE_i \\ + b_7 CANT_i + u_i \quad (1')$$

and for mortgage rates

$$rL_i = a_0 + a_1 CONC_i + a_2 PCBO_i + a_3 INC_i + a_4 NUMB_i + a_5 SAL_i + a_6 SIZE_i$$
$$+ a_7 RPRO_i + e_i , \tag{2'}$$

where $CONC_i$ is the concentration indicator (Herfindahl index or C3 index) for the product under consideration. The intercepts act as proxies for the rate of an alternative competitive financing source, or a competitive investment opportunity of the bank. Hannan (1991a) uses a similar approach in his empirical analysis of the US loan market.

Equations (1') and (2') are estimated separately for the years 1989, 1993 and 1997, and on a pooled basis for 1989-1997. In the latter case, the intercepts are estimated separately for each year. As said in section 5.3, this is equivalent to subtract from each variable the national mean computed for each year of the reference period.

6.2 Results

Tables 6 and 7 present the results for savings deposits and mortgage loans.

For savings deposits, the coefficients of both concentration indicators are positive and significant at the 1% level in the pooled estimates. In the cross-section estimates, the relationship between concentration and savings deposits rates is also positive, but only at the 5% significance level.

Table 6: *Estimates for savings deposits rates (cross section and pooled data)*

	Herfindahl index				C3 index			
	1989	1993	1997	1989-97	1989	1993	1997	1989-97
Intercept 89	3.88			4.03	3.89			3.99
	(39.25)			(68.37)	(39.95)			(66.47)
Intercept 91				5.21				5.17
				(87.27)				(84.36)
Intercept 93		3.75		3.89		3.73		3.85
		(22.7)		(65.10)		(21.39)		(62.23)
Intercept 95				2.95				2.90
				(49.57)				(46.55)
Intercept 97			2.11	1.93			1.94	1.88
			(16.73)	(29.04)			(13.48)	(27.41)
Concentration	0.271 *	0.477 *	0.889 **	0.497**	0.517*	0.284	0.753 *	0.360 **
	(2.13)	(2.13)	(3.34)	(5.74)	(2.01)	(1.22)	(3.06)	(4.25)
Per capita bank offices	0.292*	0.353	-0.00353	0.0883	0.277*	0.313	-0.108	0.0340
	(2.34)	(1.87)	(-0.30)	(1.29)	(2.09)	(1.59)	(-0.88)	(0.47)
Average income per capita	-2.82E-06	4.80E-06	-3.50E-06	1.08E-06	-2.73E-06	4.07E-06	-6.39E-06	-3.60E-10
	(-1.64)	(1.56)	(-1.44)	(1.00)	(-1.29)	(1.13)	(-2.18)	(-0.28)
Bank assets	1.27E-09	6.64E-11	5.23E-09	7.74E-11	6.87E-10	-3.95E-10	4.36E-09	-4.35E-10
	(0.18)	(0.01)	(0.80)	(0.03)	(0.09)	(-0.04)	(0.67)	(-0.15)
Average salary of employees	0.00392**	-0.00218	-0.000210	-0.000184	0.00360**	-0.000245	-0.000185	-0.000208
	(3.98)	(-1.63)	(-0.68)	(-0.62)	(3.64)	(-1.83)	(-0.59)	(-0.70)
Number of branches	-0.000409	0.000223	0.000874	0.001511**	-0.00360**	0.00207	0.000946	0.00144**
	(-0.36)	(1.15)	(1.06)	(2.77)	(3.64)	(1.06)	(1.14)	(2.62)
Cantonal bank dummy	-0.101	-0.304**	-0.305**	-0.214**	-0.0802	-0.282**	-0.281**	-0.196**
	(-1.72)	(-3.24)	(-3.46)	(-6.02)	(-1.36)	(-2.94)	(-3.23)	(-5.48)
Adjusted R-Squared	0.071	0.083	0.147	0.947	0.055	0.065	0.135	0.946

In parentheses: t-Student values
* or ** indicate that the coefficient is significant at the 5% or 1% level respectively

The results for mortgages mirror those obtained for savings deposits. The coefficients of the concentration indices are negative and significant at the 1% level in the pooled data estimations and negative and significant at the 5% level in the cross section estimations, year 1997 excepted.

Table 7:   Estimates for mortgage rates (cross section and pooled data)

	Herfindahl index				C3 index			
	1989	1993	1997	1989-97	1989	1993	1997	1989-97
Intercept 89	5.85			5.88	5.89			5.95
	(47.44)			(98.99)	(46.91)			(98.04)
Intercept 91				7.10				7.18
				(118.72)				(116.07)
Intercept 93		6.19		6.05		6.28		6.12
		(25.18)		(101.13)		(27.08)		(98.98)
Intercept 95				5.44				5.54
				(92.43)				(88.68)
Intercept 97			4.27	4.53			4.12	-1.27E-08
			(62.73)	(71.51)			(49.67)	(-0.13)
Concentration	-0.492**	-0.581*	0.15	-0.50**	-0.279*	-0.662*	0.17	-0.421**
	(-3.58)	(-1.98)	(0.53)	(-6.02)	(-2.04)	(-2.11)	(0.68)	(-4.86)
Per capita bank offices	0.0256	-0.146	0.0862	-0.0277	0.0495	-0.0646	0.0696	0.0192
	(0.19)	(-0.51)	(1.48)	(0.40)	(0.33)	(0.27)	(1.18)	(0.27)
Average income per capita	-3.58E-07	-2.43E-06	-2.02E-06	2.27E-07	-5.14E-08	1.35E-06	-2.62E-06	1.74E-06
	(-0.18)	-0.52()	(-1.50)	(0.20)	(-0.02)	(0.27)	(-1.80)	(1.33)
Bank assets	-1.87E-08*	-1.44E-10	5.74E-09*	-9.15E-10	-1.9E-08*	-1.12E-09	5.80E-09*	-9.27E-10
	(-2.24)	(-0.01)	(2.51)	(-0.32)	(-2.25)	(-0.08)	(2.54)	(-0.33)
Average salary of employees	0.00131	6.44E-05	-7.26E-08	-6.82E-08	0.00173	3.52E-08	-1.51E-07	-1.27E-08
	(1.10)	(0.03)	(-0.81)	(-0.67)	(1.44)	(0.17)	(-1.11)	(-0.13)
Number of branches	0.00219	0.000904	-0.0015**	0.000218	0.00226	0.00108	-0.0013**	0.000216
	(1.71)	(0.32)	(-3.18)	(0.38)	(1.72)	(0.38)	(-2.97)	(0.38)
Ratio of provisions to total assets	-14.61	2.90	12.06**	0.033	-17.16	4.74	13.41**	0.0383
	(-1.66)	(0.28)	(2.83)	(0.49)	(-1.92)	(0.47)	(3.09)	(0.56)
Adjusted R-Squared	0.122	0.036	0.21	0.900	0.055	0.042	0.21	0.899

The positive (negative) and significant relationship observed between concentration and savings deposits (mortgages) rates leads us to reject the structure performance paradigm for both products. Our results are compatible with the market-efficiency as well as the hypothesis of consumer friendly pricing by dominant cantonal banks. However, the results could also be driven by differences in market size due to our definition of cantons as relevant markets. In order to discriminate between these hypotheses, we perform additional tests.

6.3 Testing the hypothesis of consumer friendly pricing by dominant cantonal banks

In the case of consumer friendly pricing by dominant cantonal banks, the positive (negative) relationship between savings deposits (mortgages) rates and concentration should be observable only in markets where the cantonal bank has an important markets share. To test this hypothesis, we create two dummy variables, MAJ and MIN, which reflect the dominance of the cantonal bank and enter directly in interaction with the concentration indices. MAJ is unity

when the cantonal bank controls more than half of the market and zero otherwise.[5] Conversely, MIN is unity when the cantonal banks controls less than half of the market and zero otherwise.

The modified specifications are for savings deposits

$$rD_i = b_0 + b_1 MAJ \cdot CONC_i + b_2 MIN \cdot CONC_i + b_3 PCBO_i + b_4 INC_i$$
$$+ b_5 NUMB_i + b_6 SAL_i + b_7 SIZE_i + b_8 CANT_i + u_i$$

and for mortgages

$$rL_i = a_0 + a_1 MAJ \cdot CONC_i + a_2 MIN \cdot CONC_i + a_3 PCBO_i + a_4 INC_i$$
$$+ a_5 NUMB_i + a_6 SAL_i + a_7 SIZE_i + a_8 RPRO_i + e_i .$$

Table 8: Consumer friendly pricing by dominant cantonal banks

(estimates based on pool data)

	Savings deposits		Mortgages	
	Herfindahl	C3	Herfindahl	C3
Intercept 89	4.03	3.99	5.87	5.96
	(67.44)	(65.56)	(97.89)	(96.23)
Intercept 91	5.21	5.17	7.10	7.18
	(86.20)	(83.36)	(117.94)	(113.17)
Intercept 93	3.89	3.84	6.04	6.13
	(64.15)	(61.38)	(100.39)	(96.81)
Intercept 95	2.96	2.90	5.44	5.53
	(49.12)	(46.12)	(92.02)	(85.72)
Intercept 97	1.93	1.88	4.53	4.62
	(28.87)	(27.17)	(71.17)	(68.16)
MAJ x Concentration	0.501**	0.357**	-0.547**	-0.413**
	(5.75)	(4.20)	(-6.02)	(-4.42)
MIN x Concentration	0.562**	0.345**	-0.710**	-0.402**
	(3.28)	(3.54)	(-3.72)	(-3.40)
Per capita bank offices in canton	0.0814	0.0393	-0.00566	0.0146
	(1.16)	(0.53)	(-0.08)	(0.19)
Average cantonal income per capita	9.99E-07	-2.90E-07	9.42E-07	1.61E-06
	(0.91)	(-0.22)	(0.75)	(1.13)
Bank assets	2.46E-10	-5.24E-10	-1.48E-09	-8.46E-10
	(0.08)	(-0.18)	(-0.52)	(-0.29)
Average salary of bank employees	-0.000176	-0.000213	-2.001E-08	-1.35E-08
	(-0.59)	(-0.71)	(-0.21)	(-0.14)
Cantonal bank dummy	-0.215	-0.196**		
	(0.91)	(-5.47)		
Bank number of branches	0.00147**	0.00146**	0.000334	0.000206
	(2.65)	(2.63)	(0.58)	(0.36)
Ratio of provisions to total assets			0.0372	0.0377
			(0.55)	(0.55)

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[5] Introducing only one dummy variable would suffice as the two dummies sum to unity. The two specifications lead to identical results. Our approach, however, makes the interpretation of the results easier.

Table 8 presents the results. The coefficients of both concentration indicators remain positive and significant at the 1% level for savings deposits and mortgages, independently of the dominance of the cantonal bank. The hypothesis of consumer friendly pricing by dominant cantonal banks can therefore be rejected.

6.4 Testing for the influence of canton size

To test the possibility that the relationship between interest rates and concentration is biased by differences in size between the cantons, we have divided the 26 cantons into three classes according to their population. The 'large' class contains the cantons with more than 300'000 inhabitants (8 cantons), the 'medium' class includes the cantons with population between 300'000 and 100'000 (9 cantons) and the 'small' class the remaining 9 cantons with less than 100'000 inhabitants.

Tables 9 and 10 present the results for both products: to save space, we display only the coefficient of the concentration index and its p- value based on a Wald test of the null hypothesis that concentration has no impact on interest rates.

Table 9:   *Savings deposits: estimates for cantons stratified by size (pooled data)*

		Herfindahl			C3		
		small canton	medium canton	large canton	small canton	medium canton	large canton
MAJ x Concentration	Coefficient	1.09 **	0.209	0.22	0.98 **	0.398	0.32
	probability	0.0002	0.6034	0.4778	0.0005	0.2302	0.7447
MIN x Concentration	Coefficient	1.23 *	0.296	-1.11 **	1.01 **	0.443	-2.11 *
	probability	0.0399	0.6845	0.0006	0.0063	0.2606	0.0350

* and ** indicate that the coefficient is significant at the 5% level, respectively at the 1% level

Table 10:   *Mortgages: estimates for cantons stratified by size (pooled data)*

		Herfindahl			C3		
		small canton	medium canton	large canton	small canton	medium canton	large canton
MAJ x Concentration	Coefficient	-0.75*	0.046	0.138	-1.39 *	0.103	-0.0310
	probability	0.0495	0.745	0.4345	0.032	0.672	0.7591
MIN x Concentration	Coefficient	-1.63*	0.332	-0.171	-1.75 *	0.213	-0.145
	probability	0.04821	0.1824	0.3628	0.0315	0.4448	0.1717

* and ** indicate that the coefficient is significant at the 5% level, respectively at the 1% level

Interestingly, concentration has a positive (negative) and significant impact on savings deposits (mortgages) only in small cantons, regardless of the dominance of the cantonal bank. No significant relationship is observed in medium-sized cantons. In large cantons, we find a negative relationship between concentration and savings deposits rates when the cantonal bank is not dominant.

6.5 Interpretation of the results

Our results support the efficiency paradigm for savings deposits as well as for mortgages for small cantons. For medium-sized cantons, both the structure-performance and the market-efficiency hypotheses are rejected, and the contestable-market hypothesis is supported. For large cantons, finally, the structure-performance hypothesis cannot be rejected for savings

deposits; for mortgages, the absence of a significant relationship leads us to reject both the structure-performance as well as the market-efficiency hypothesis.

The confirmation of the efficiency hypothesis for small cantons and its rejection for large cantons can be explained by the existence of decreasing economies of scale. In the small cantons, banks operate on low volumes (CHF 500 millions average credit volume per bank), i.e. on the segment of the cost curve where economies of scale are present. As a consequence, banks in small cantons characterised by high concentration can be more efficient than banks in small cantons characterised by low concentration. In the large cantons, banks operate on higher volume (CHF 1400 million on average), i.e. on the segment of the cost curve where economies of scale have already been exhausted; in that case, high concentration is unlikely to bring efficiency gains.

Our results are less categorical than those obtained in similar studies for the United States, which generally supports the structure performance paradigm for retail banking products. Hannan (1991a) finds that the C3 index has a positive and significant impact on commercial loans of less than 100'000 dollars, while Neuberger and Zimmerman (1991) observe a negative and significant impact of the C3 concentration ratio on negotiable order of withdrawal deposit accounts and money market deposit accounts. Using data from 1996, Radecki (1998) finds a positive impact of concentration on savings deposits rates at state levels, but no impact at local levels. In addition to the aforementioned drawbacks in our database, two main elements may explain the observed differences between the United States and Switzerland. First, the regional segmentation of the banking market may be less pronounced in Switzerland: distances are shorter, there are no legal restrictions to bank entry in the cantons, and the big banks may contribute equalising the cantonal level of competition by setting national reference rates. Second, the dominance of cantonal banks in local markets reduces the relevance of the level of concentration in tests of the structure performance paradigm.

7 Relationship between concentration and prices over time

In this section, we test whether changes in concentration over time had an impact on savings deposits and mortgage rates. A similar approach has been used by Simons and Stavins (1998) in their study of the impact of mergers on MMDA and CD's interest rates in the United States.

We pool time series for individual banks over the different cantons in order to increase the number of degrees of freedom. The model is estimated on the basis of the pooled data using canton specific intercepts. As said in section 5.3, this is equivalent to subtract from each variable the cantonal mean computed over the reference period.

We conduct two tests. The first is specified in relative terms and attempts to determine whether savings deposit (mortgage) rates decrease (increase) by more than the national average in those cantons where concentration increases by more than the national average. Using this approach, we can omit including a competitive reference rate as control variable (alternative refinancing source or alternative investment opportunity). This constitutes a substantial advantage, given the difficulty to identify an appropriate reference rate for instruments without explicit maturity like savings deposits and mortgages. The main weakness of the relative test is its inability to capture the impact of changes in concentration on prices when concentration indices follow a similar trend in all cantons.

For the relative test, the hypotheses are:

H0: Contestable-markets hypothesis: Changes of concentration over time differing from the change of the national average have no impact on interest rates.

H1: Structure-performance hypothesis: Changes of concentration over time differing from the change of the national average change over time have a negative (positive) effect on deposit (mortgage) interest rates.

H2: Market-efficiency hypothesis: Changes of concentration over time differing from the change of the national average have a positive (negative) effect on deposit (mortgage) interest rates.

The second test is specified in absolute terms. It determines whether absolute changes in the concentration indices affect the relationship between deposit (mortgage) interest rates and the competitive reference rate. This approach can identify the impact of concentration on interest rates even in cases where the changes in concentration are similar in all cantons. However, its reliability is reduced by the difficulty of controlling precisely for the competitive reference rate. For this test, the three hypotheses tested are similar to those above, except that we look at changes in absolute rather than relative terms.

A confirmation of H1 in the absolute or in the relative test would have two implications for antitrust policy. First, it would indicate that changes in the cantonal concentration indices are more relevant than changes in the national indices. Second, it would indicate that policy has to be intensified in cantons where the merger leads to an important increase in concentration, independently of the absolute level of the indices.

The results of the time-analysis should not be mechanically extrapolated to make a prediction of the impact of the UBS-merger on competition. As shown in table 11, the average increase in concentration implied by the UBS merger is similar in amplitude to the variations in concentration observed during the last ten years. Nothing guarantees that the instantaneous change in concentration implied by the merger will have an impact on interest rates similar to changes in concentration of the same amplitude but occurring progressively over a decade.

Table 11:   Trends in concentration: the UBS merger and the last decade

	Mortgages		Savings deposits	
	C3	Herfindahl	C3	Herfindahl
Variation implied by the merger (cantonal average)	0.078	0.041	0.060	0.035
Variation during the period 1987-97 (cantonal average of absolute values)	0.059	0.044	0.048	0.049
Maximal range during the period 1987-97 (cantonal average)	0.081	0.060	0.067	0.063

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7.1 Specification of the model in relative terms

We use the following specifications for the savings deposits

$$\tilde{r}D_i^t = \boldsymbol{b}_k + \boldsymbol{b}_1 \cdot \widetilde{CONC}_i^t + \boldsymbol{b}_2 \cdot \widetilde{PCBO}_i^t + \boldsymbol{b}_3 \cdot \widetilde{WAGE}_i^t + \boldsymbol{b}_4 \cdot \widetilde{CANT}_i^t + e_i^t$$

and for mortgage loans:

$$\tilde{r}L_i^t = \boldsymbol{a}_k + \boldsymbol{a}_1 \cdot \widetilde{CONC}_i^t + \boldsymbol{a}_2 \cdot \widetilde{PCBO}_i^t + \boldsymbol{a}_3 \cdot \widetilde{WAGE}_i^t + \boldsymbol{a}_4 \cdot \widetilde{RPRO}_i^t + u_i^t$$

where $\boldsymbol{a}_k$, $\boldsymbol{b}_k$ are canton specific intercepts and all variables with a *tilde* are defined as deviations from the national mean. We have, for example, $\tilde{r}D_i^t = rD_i^t - rD_{CH}^t$, with rD_{CH}^t representing the national mean. [6]

7.2 Specification of the model in absolute terms

As said above, the model in absolute terms requires the inclusion of a competitive reference rate as control variable. In the absence of an explicit maturity for savings deposits and mortgages, we proxy the reference rate with a basket of money market and swap rates.

We use the following specifications for savings deposits

$$rD_i^t = \boldsymbol{b}_k + \boldsymbol{b}_1 \cdot CONC_i^t + \boldsymbol{b}_2 \cdot PCBO_i^t + \boldsymbol{b}_3 \cdot SAL_i^t + \boldsymbol{b}_4 \cdot CANT_i^t$$
$$+ \boldsymbol{b}_5 \cdot i1m^t + \boldsymbol{b}_6 \cdot i3y^t + \boldsymbol{b}_7 \cdot i10y^t + u_i^t$$

and mortgage loans

$$rL_i^t = \boldsymbol{a}_k + \boldsymbol{a}_1 CONC_i^t + \boldsymbol{a}_2 PCBO_i^t + \boldsymbol{a}_3 SAL_i^t + \boldsymbol{a}_4 RPRO_i^t$$
$$+ \boldsymbol{a}_5 \cdot i1m^t + \boldsymbol{a}_6 \cdot i3y^t + \boldsymbol{a}_7 \cdot i10y^t + e_i^t.$$

where $i1m^t$ is the 1 month money market rate, $i3y^t$ the 3 years swap rates (one year moving average) and $i10y^t$ the 10 years swap rates (one year moving average).

7.3 Results

Table 12 presents the results for savings deposits and mortgages based on the test in relative terms. We observe a negative relationship between savings deposits rates and concentration, significant at the 1% level for the Herfindahl index and at the 5% level for the C3 index. No significant relationship emerges between mortgage rates and concentration.

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[6] The national mean does not include banks active in more than one canton.

Table 12: Test in relative terms

(pooled data estimation with canton specific intercepts)

All variables defined as deviations from the national mean	Savings deposits		Mortgages	
	Herfindahl	C3	Herfindahl	C3
Concentration	-1.55**	-0.565*	-0.454	-0.473
	(-4.20)	(-2.12)	(-1.11)	(-1.43)
Total per capita bank offices	-0.0268	0.0402	0.00707	0.0177
	(-0.65)	(1.28)	(0.17)	(0.41)
Average salary of bank's employees	-0.000491	-0.000342	0.00465	0.000672
	(-1.01)	(-0.70)	(1.01)	(1.70)
Cantonal bank dummy	-0.0934**	-0.0722**		
	(-3.22)	(-2.74)		
Ratio of provisions to total assets			0.0296	0.0324
			(0.46)	(0.50)
Maximal canton specific intercept	0.734**	0.409**	0.21	0.265
	(5.82)	(4.40)	(1.60)	(1.94)
Minimal canton specific intercept	-0.167*	-0.250*	-0.593**	-0.561**
	(-2.27)	(-2.61)	(-4.76)	(-4.61)
Adjusted R-Squared	0.267	0.252	0.103	0.106

The negative relationship between savings deposits and the Herfindahl index remains significant in the test in absolute terms (Table 13), although at the 5% level only, while the relationship with the C3 index disappears. For mortgages, the test in absolute terms confirms the absence of a significant relationship between concentration and interest rates.

Table 13: Test in absolute terms

(pooled data estimation with canton specific intercepts)

	Savings deposits		Mortgages	
	Herfindahl	C3	Herfindahl	C3
Concentration	-1.19*	0.142	-0.614	-0.571
	(-2.08)	(0.33)	(-1.26)	(-1.54)
Total per capita bank offices	-0.528**	-0.579**	-0.389**	-0.378**
	(-6.13)	(-6.44)	(-5.05)	(-4.96)
Average salary of bank's employees	-0.000979	-0.00100	0.00129	0.00134
	(-1.29)	(-1.32)	(1.49)	(1.42)
1 month interbank rate	-0.818**	-0.812**	-0.806**	-0.808**
	(-35.38)	(-34.05)	(-41.44)	(-41.64)
10 years swap rate (12 month moving average)	-3.58**	-3.58**	-3.14**	-3.12**
	(-30.07)	(-30.07)	(-31.28)	(-31.05)
3 years swap rate (12 month moving average)	3.99**	3.99**	3.58**	3.57**
	(37.04)	(36.73)	(39.31)	(39.25)
Cantonal bank dummy	-0.0837	-0.0848*		
	(-1.95)	(-1.97)		
ratio of provisions to total assets			0.103	0.107
			(1.43)	(1.48)
Maximal canton specific intercept	9.47**	9.09**	9.23**	10.49**
	(24.89)	(20.53)	(42.02)	(31.86)
Minimal canton specific intercept	7.96**	7.67**	10.38**	9.47**
	(29.11)	(19.38)	(33.55)	(31.45)
Adjusted R-Squared	0.918	0.918	0.878	0.878

Overall, the results provide partial evidence in favour of the structure-performance hypothesis for savings deposits. Concerning mortgages, none of the concentration indicators have a significant influence on interest rates and we can reject the structure-performance hypothesis for this product.

7.4 Pools including cantons with similar features

The 26 cantons differ considerably with respect to (i) their population, (ii) the amplitude of changes in concentration experienced during the reference period and (iii) the correlation between changes in concentration and changes in cantonal bank market share. It is therefore prudent to test whether the negative relation between savings deposits and concentration observed in section 7.3 depends on canton characteristics. For this purpose, we divide the cantons into pools of comparable size according to the three main features mentioned above. The model is then reestimated for each pool. The results are presented in Tables 14 to 16. To save space, we display only the coefficient of the concentration index and its p-value based on a Wald test of the null hypothesis that concentration has no impact on savings deposits rates.

Concerning canton size, we expect the negative relationship between concentration and savings interest rates to be more pronounced in large than in small cantons, where increases in concentration are more likely to lead to efficiency gains in the presence of decreasing economies of scale. This hypothesis is confirmed by the results for the Herfindahl index and, partially, by those obtained with the C3 index.

Table 14: **Estimates stratified by cantons' population size**

Savings deposits		Herfindahl			C3		
		low population	medium population	high population	low population	medium population	high population
Absolute test	coefficient	-0.490	-1.361	-1.269*	0.447	0.690	-0.465
	probability	0.24	0.38	0.0328	0.8315	0.3096	0.4578
Relative test	coefficient	-0.718	-0.782	-1.65**	-0.540	-0.182	-1.175*
	probability	0.398	0.4102	0.0072	0.0978	0.6843	0.0044

Large variations in concentration are more likely to affect competition as they can modify the game played in the regional oligopolies (emergence of a new market leader etc.). Consequently, the negative relationship between concentration and savings deposits should be more visible in cantons which experienced large variations of concentration during the reference period. The results in Table 15 confirm this assumption for the Herfindahl index, but are inconclusive for the C3 index.

Table 15: **Estimates stratified by the amplitude of the concentration change**

Savings deposits		Variations in Herfindahl index			Variations in C3 index		
		small amplitude	medium amplitude	large amplitude	small amplitude	medium amplitude	large amplitude
Absolute test	coefficient	-0.752*	-0.696	-1.28*	-3.91	-3.07	0.51
	probability	0.0354	0.6860	0.0387	0.4574	0.055	0.3175
Relative test	coefficient	-0.789	0.246	-1.85**	-2.35*	0.0539	0.124
	probability	0.5822	0.789	0.0005	0.0303	0.9391	0.7209

If cantonal banks are not profit maximisers, the negative impact of concentration on savings deposits interest rates over time should be more pronounced in the cantons where the changes in concentration are not correlated with changes in the cantonal bank market share. As shown in Table 16, the hypothesis is supported by the estimations based on the Herfindahl index. For the C3 index, however, the results are inconclusive.

Table 16:   Estimates stratified by the correlation between changes in concentration and changes in the cantonal bank market share

Savings deposits		Herfindahl			C3		
		low correlation	medium correlation	high correlation	low correlation	medium correlation	high correlation
Absolute test	coefficient	-4.58**	0.0866	-3.30**	0.172	0.454	-2.92*
	probability	0.0069	0.9409	0.0009	0.8600	0.4673	0.0442
Relative test	coefficient	-2.61**	-1.43	-0.315	-0.921*	0.209	-0.441
	probability	0.0010	0.0614	0.7189	0.0475	0.6454	0.3903

7.5 Interpretation of the results

The results of the *time-analysis* indicate that for savings deposits, the structure performance hypothesis cannot be rejected for large cantons, while the contestable market hypotheses cannot be rejected for small cantons. For mortgages, the contestable market hypothesis cannot be rejected.

The absence of a significant relationship between concentration and interest rates for mortgages is surprising. The heterogeneous character of our mortgage rates sample, which contains mortgages with variable as well as fixed interest rates, may explain this lack of consistency. The difficulty of controlling for the riskiness of lending on a forward looking basis also reduces the reliability of the mortgages estimates.

The results obtained for savings deposits are comparable to the findings by Simons and Stavins (1998), who, for the United States, observe a negative and significant relationship between money market deposits accounts interest rates and increases in concentration following mergers.

8 Conclusions

The empirical evidence in this study indicates a rather complex relationship between concentration and interest rates for retail banking products in Switzerland.

For savings deposits, the *canton-analysis* and the *time-analysis* indicate a negative relationship between concentration and interest rates for large cantons. For small cantons, a positive relationship emerges in the canton-analysis while no relationship is found in the time-analysis. Based on these results, we cannot reject the structure performance hypothesis for large cantons. For small cantons, the empirical evidence is split between the efficiency hypothesis and the contestable market hypothesis.

For mortgages, the canton-analysis indicates a negative relationship between concentration and interest rates for small cantons and no significant relationship for large cantons. In the time-analysis, no significant relationship emerges for this product. Based on these results we

cannot reject the contestable market hypothesis for large cantons. For small cantons, we are unable to discriminate between the efficiency hypothesis and the contestable market hypothesis.

These findings suggest that antitrust authorities, if they base their decisions on concentration indices, should intervene in large cantons – where the market power inconveniences of concentration seem to dominate – rather than in small cantons – where the efficiency gains of concentration seem to overcompensate the inconveniences of market power.

The fact that the structure performance hypothesis dominates in some cases for savings deposits while being systematically rejected for mortgages is rather puzzling, as both products are traditionally assigned to the retail banking segment, characterised by weak arbitrage opportunities and high barriers to entry. This inconsistency may signal that the estimates for savings deposits or/and for mortgages are not reliable; here we place less confidence in the results for mortgages because of the difficulty to control for credit risk and because of the mix between variable and fixed interest rate claims. Another interpretation is that the structure performance hypothesis is unlikely to emerge on the mortgage segment, as our database includes not only households, but also firms, which have more bargaining power than households.

The comparison between the results of the canton-analysis and those of the time-analysis also deserves some comments. For savings deposits and large cantons, both approaches indicate the dominance of the structure performance hypothesis. For savings deposits and small cantons, the efficiency hypothesis dominates in the canton-analysis while the contestable market hypothesis prevails in the time-analysis. When the savings deposits model is estimated for the 26 cantons altogether, the two approaches lead to opposite conclusions, i.e. the non rejection of the efficiency hypothesis under the canton-analysis and the non rejection of the structure performance hypothesis under the time-analysis. This last result can be seen as a further confirmation that concentration indices should not be compared across cantons of different size. It may also indicate that banks' customers can more easily arbitrage interest rate differentials between the cantons than between the periods, especially if concentration follows a national trend. A last interpretation is that the canton-analysis and the time-analysis raise different econometric difficulties, namely the necessity to control for canton specificity under the first approach and for period specificity under the second approach.

Various factors can explain the contrast between our results and those obtained for the United States, where the bulk of empirical evidence supports the structure-performance hypothesis for cross-section as well as for time series data. First, the absence of legal barriers to bank entry in the Swiss cantons, the shorter distances and the national interest rate policy by the big banks reduce the local segmentation of the Swiss retail banking market. Second, the dominant position of cantonal banks, which are not necessarily profit maximisers, makes the level of concentration less relevant for test of the structure performance hypothesis. Third, as mentioned in the introduction, we might have employed a wrong definition of the relevant markets.

Finally, the apparently harmless effects of concentration on competition observed for small cantons during the last years should not be carelessly extrapolated into the future. First, cantonal banks may get under greater pressure to adopt a profit maximising behaviour and, consequently, to exploit their dominant position. Second, the game played in the local oligopolies

may change in the future as the new UBS becomes the market leader in cantons where it formerly only ranked in second or third position. Third, we cannot exclude an attempt by big banks to introduce some cantonal discrimination for savings deposits and mortgages. In these three cases, the predictions of the structure performance paradigm could materialise in the cantons with high concentration levels, leading to undesirable effects on mortgages and savings deposits rates.

To our knowledge, this study is the most comprehensive so far. We use several concentration indices, several products, and several methods within the same data set. Our results strongly suggest that this is necessary to provide reliable policy recommendations.

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Appendix: The Impact of the merger on concentration, C3-Indices

Table A1: C3 indices in different ranges (number of cantons)

	Loans and Mortgages			Savings deposits		
	1987	1997	UBS	1987	1997	UBS
0-69	12	8	2	10	8	2
70-79	5	9	6	6	9	7
80-89	5	4	11	6	4	10
90-100	4	5	7	4	5	7

Table A2: Increase of C3-indices due to the UBS merger in different ranges (number of cantons)

	Loans and Mortgages	Savings deposits
0-5	9	11
6-10	8	10
11-15	8	5
16-20	1	0

Table A3: Relationship between pre-merger levels and increases of C3-indices (number of cantons)

		0-5	6-10	11-15	16-20
Savings Deposits	0-69	0	4	2	0
	70-79	3	3	2	0
	80-89	3	3	1	0
	90-100	5	0	0	0
Loans and Mortgages	0-69	1	3	3	1
	70-79	2	2	5	0
	80-89	1	3	0	0
	90-100	5	0	0	0

Table A4: C3-indices after the merger for cantons with population less than 200'000 (in parentheses: all cantons)

	Loans and Mortgages	Savings deposits
0-69	0 (2)	0 (2)
70-79	3 (6)	3 (7)
80-89	3 (11)	5 (10)
90-100	7 (7)	5 (7)