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Bank concentration and retail interest rates ☆

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Abstract

The recent wave of mergers in the euro area raises the question whether the increase in concentration has offset the increase in competition in European banking through deregulation. We test this question by estimating a simple Cournot model of bank pricing. We construct country and product specific measures of bank concentration and find that for loans and demand deposits increasing concentration may have resulted in less competitive pricing by banks, whereas for savings and time deposits, the model is rejected, suggesting increases in contestability and/or efficiency in these markets. Finally, the paper discusses some implications for tests of the effect of concentration on monetary policy transmission.

JEL classification: G21; D43
Keywords: Banking structure; Competition; Euro area; Retail interest rates

1. Introduction

There are many reasons to believe that the European banking system has been subject to increasing competitive pressures. In the EU as a whole and in individual countries, banking has been successively deregulated during the past 20 years, the introduction of the Euro has potentially enlarged the market for banking, and the advent of new technology has eased the barriers to entry for new market participants. Nevertheless, the ongoing wave of bank mergers in Europe raises the possibility that competition may be diminished through increases in concentration. In the literature

☆ The views expressed in this paper are strictly those of the authors and do not represent those of the ECB.

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(e.g. Berger and Hannan, 1989), the impact of concentration on the pricing behaviour of banks is generally summarised by two opposing hypotheses. One suggests that banks will collude and use market power to extract rents (''structure performance hypothesis''). The other suggests that concentration would increase the overall efficiency of the sector. Based on this hypothesis, concentration is due to more efficient banks growing more rapidly than less efficient banks, or more efficient banks taking over less efficient ones. If this is the case, at least up to some point, banks would price their services more competitively, rather than less competitively (''efficient structure hypothesis''). In this paper we raise the further possibility that higher contestability, in part due to recent technological advances, have resulted in an overall increase in competition, irrespective of the level of concentration.

The question we pose for this paper has been extensively studied using data on banks and interest rates in the US banking market. Berger and Hannan (1989) model bank deposit prices as a function local concentration indices using US data and find strong evidence in favour of the structure performance hypothesis. Banks operating in more concentrated markets use their market power to extract rents from their customers. Point estimates suggest that banks in the most concentrated markets pay 25–100 basis points less on their deposits than banks operating in the least concentrated markets.

Further evidence against the efficient structure hypothesis is provided by Rhoades (1993), who finds that horizontal bank mergers did not have a significant effect on the efficiency relative to other banks. He notes that, nevertheless, the acquiring bank ex ante was more efficient than the acquired bank, which would ex ante have pointed to efficiency gains. While in Rhoades (1993) paper the possibility cannot be excluded that efficiency gains are only realised with considerable lags (the sample period spanned only five years), the results also do not exclude the possibility that market power was the main driving force for mergers. [1]

In the European context, there are only few papers, which directly or indirectly test for the relationship between concentration, market power, and loan pricing. For Italy, Jappelli (1987), using a similar model to the one used in this paper, finds that there are significant pricing differences between Northern and Southern Italian banks. He further finds that these differences cannot be fully accounted for by differences in risk or the cost structure of banks, and argues that they reflect the higher concentration of banks in Southern Italy. [2]

There is a related, industrial organisation based literature, which has utilised European data, but has been rather inconclusive in its findings. For example Bikker and Haaf (2002) estimate a model first proposed by Panzar and Rosse (1987). The model yields a measure of competition, the ''H statistic'', which corresponds to the sum of the elasticities of the reduced form revenues with respect to factor prices. Depending

[1] In a related paper, Amel and Hannan (1999) estimate residual demand functions in order to test, whether when assessing the competitive situation of banks, other financial institutions should be considered as direct competitors. They find strong evidence that banks operate in a distinct market from other financial institutions.

[2] See also D'Amico et al. (1990).

on the magnitude of this statistic, it can be concluded whether the banking market is operating under monopolistic competition, perfect competition or monopoly. Bikker and Haaf (2002) find that all European banking markets are characterised by monopolistic competition, but based on the measure are unable to make stronger statements about the relative competitive situation across countries and across time and its effects on statutory interest rates. [3] Somewhat more closely related to this paper is a model first proposed by Bresnahan (1982) also estimated in Bikker and Haaf (2002). Bresnahan (1982) derived a parameter, λ, which is a function of the conjectural variation of the average firm in a given market and whose value indicates the degree of competition. Bikker and Haaf (2002) find that the hypothesis that the market for deposits and loans is perfectly competitive in Europe cannot be rejected, although the power of the test against the alternative of Cournot equilibrium is not very high.

Peterson and Rajan (1995) examine the effect of credit market competition on interest rates charged by banks to small businesses in the context of relationship lending. They find that creditors appear to smooth interest rates over the life cycle of the firm in a more concentrated market, charging a lower than competitive rate when the firm is young but a higher than competitive one, when the firm is old. However, their findings do not suggest an effect of concentration on the overall level of interest rate. [4]

In this paper, we test for deviations from competitive pricing in loan markets, using a simple unified theoretical framework, which allows us to differentiate between the effect of competitive conditions, the effect of cost structures and the effect of risk. We use a longitudinal data set comprising all euro area countries except Luxembourg. We extend the literature by defining Herfindahl indices for each of the euro area countries and for a number of bank products. We find that (i) bank concentration exhibits substantial differences across the euro area, which may have been understated in the previous literature by using the market shares of the five or ten largest banks. (ii) Concentration within countries for different bank products exhibits substantial differences and, hence, more disaggregated measures used in this paper are able to show a much more differentiated picture of bank concentration. (iii) The increasing concentration may have lead to collusion and higher interest margins of banks for loans and demand deposits. This is evidence in favour of the structure performance hypothesis for these products. (iv) We, however, do not find higher margins in more concentrated markets for savings and time deposits and, hence, reject the model. We suggest that an increase in contestability, which took place concurrently to the increase in concentration, as the cause for this result.

The results in the paper have some implications for tests of the effect of the financial structure in general and of competition specifically on monetary policy transmission. Previous evidence has been mixed. Hannan and Berger (1991) examine the

[3] Given the data limitations we face, we would also not have been able to estimate differential effects of concentration for different product groups, as our data do not permit us to allocate costs to different items on banks' balance sheets.

[4] Harhoff and Körting (1998) consider a similar issue, but do not focus on the effect of bank market concentration.

setting of deposit rates in more or less competitive banking markets using US data. They find that deposit rates exhibit significantly more rigidity in concentrated markets and that deposit rates are significantly more rigid when the stimulus for the deposit rate change is upward. In a sample of 31 developing and developed countries, Cottarelli and Kourelis (1994) find no effect of concentration per se, but estimate a significant effect of deregulation on monetary policy transmission. Similarly, Mojon (2000), using the same data set as this paper, finds a significant effect of deregulation on the interest rate pass through to deposits, but not to loans. We argue in this paper that these mixed findings reflect differences in the way concentration and deregulation affect the competitive environment for different parts of banks' balance sheets.

The paper is organised as follows: In Section 2 we present a simple Cournot model of loan pricing, which will provide us with a framework for the empirical tests and guide our choice of exogenous variables. Section 3 describes the empirical methodology and Section 4 the data. Section 4 also gives extensive descriptive statistics for the variables of interest. In Section 5 we present econometric evidence on the effect of concentration on contractual interest margins; Section 6 examines the robustness of the results and analyses some extensions. Finally, Section 7 concludes.

2. A simple Cournot model of loan pricing

In order to provide a framework for the empirical analysis presented below, consider the following simple model of bank behaviour, which is based on Jappelli (1993). [5] Banks are assumed to behave as price setters in the loan market, while they face a given deposit rate on their liabilities. Hence, banks behave as Cournot competitors, in the sense that the loan rate of bank k does not affect the behaviour of any of its competitors in the loan market. For simplicity, it is also assumed that banks only operate one (local) branch, issue only one type of liability, namely deposits, and offer one type of differentiated loan to their customers. Hence, the demand for loans at each bank k can be written as

$$L_k = \frac{B_0}{n} - \frac{b}{n-1}\sum_{j\neq k}^{n}(r_k - r_j) - \frac{rB}{n}, \tag{1a}$$

where

$$\frac{\partial L_k}{\partial r_k} = -b - \frac{B}{n^2} \tag{1b}$$

and n = number of banks; L_k = demand for loans at bank k; r_k = interest rate on loans at bank k; r_j = interest rate on loans at bank j; r = average interest rate on loans, i.e. $r = \sum_{i=1}^{n} r_i/n$; b = elasticity in loan demand of bank k, i.e. reduction in loans of bank k, if bank k sets a rate higher than its competitors; B_0 = aggregate demand for loans; B = total demand elasticity for loans, i.e. reduction in total de-

[5] Freixas and Rochet (1997, pp. 59–61) discuss a similar model.

mand for loans with respect to the average interest rate r. If banks face the same demand schedule, in equilibrium the loan rate will be equal for all banks. The equilibrium condition then becomes

$$L = B_0 - rB, \quad \text{where } L = \sum_{k=1}^{n} L_k. \tag{2}$$

Banks are maximising expected profits by choosing the appropriate interest rate r_k on loans. Expected revenues are denoted by $(1-\mu_k)r_kL_k$ and costs by $r_DD_k + F_k$, where μ_k represents the default probability of loans of bank k, r_D represents the deposit rate, which is the same for all banks, D_k represents the deposits of bank k and F_k the fixed costs of bank k.

Each bank then maximises the following objective function:

$$\max \Pi_k = (1-\mu_k)r_kL_k - r_DD_k - F_k \tag{3}$$

subject to

$$L_k + R_k = D_k,$$

where R_k represents required reserves, which are assumed to be proportional to deposits, i.e. $R_k = \alpha_kD_k$. Hence, the quantity of deposits in bank k can be rewritten in terms of its loan quantity or

$$D_k = \frac{L_k}{(1-\alpha_k)}. \tag{4}$$

Substituting the constraint into the objective function and using (4), we obtain

$$\max \Pi_k = (1-\mu_k)r_kL_k - r_D\frac{L_k}{(1-\alpha_k)} - F_k. \tag{5}$$

Differentiating (5) with respect to r_k gives the first order condition

$$\frac{\partial \Pi_k}{\partial r_k} = (1-\mu_k)L_k + (1-\mu_k)r_k\frac{\partial L_k}{\partial r_k} - \frac{r_D}{(1-\alpha_k)}\frac{\partial L_k}{\partial r_k} = 0. \tag{6}$$

Using (1b), imposing the equilibrium conditions (2), and rearranging yields the equilibrium interest rate on loans for bank k: [6]

$$r_k = \frac{B_0}{(nb + B + B/n)} + \frac{r_D}{(1-\mu_k)(1-\alpha_k)}\frac{(nb + B/n)}{(nb + B/n + B)}. \tag{7a}$$

Eq. (7a) shows that differences between the lending rate r_k and the borrowing rate r_D arise in markets with a low number of banks, n, or if the elasticity of substitution between the loans of different banks is less than ∞, i.e. b is less than ∞. On the other hand, as n and b approach ∞, r_k will approach r_D, which can immediately be seen applying L'Hospital's rule to (7a). In either case, the loan market would be perfectly competitive. Furthermore, the lending rate depends on aggregate loan demand B_0,

[6] Appendix A shows some intermediate steps in moving from Eq. (6) to Eq. (7a).

the elasticity of aggregate loan demand B, the probability of default of borrowers μ, and the operating costs of the bank α. [7]

3. Empirical model

The empirical model used in the estimation below utilises a log-linearised form of (7a), which was aggregated to the country level, to test which factors account for differences in loan rates in euro area countries. Hence, we estimate

$$\begin{aligned}\mathrm{MARGIN}_{ic} = {} & \beta_0 + \sum_i \beta_{1i} I\,\mathrm{CONC}_{ic} + \sum_i \beta_{2i} I\,\mathrm{RISK}_c \\ & + \beta_3\,\mathrm{NORISK} + \sum_i \beta_{4i} I\,\mathrm{COST}_c + \sum_i \beta_{5i} I\,\mathrm{DEM}_c \\ & + \sum_i \beta_{6i} I\,\mathrm{SUBST} + u_i + v. \end{aligned} \tag{8}$$

Rather than price takers in the deposit market, in the econometric specification it is assumed that banks are price takers in the money market. Hence, MARGIN represents the difference between a bank retail interest rate and the money market rate for product i and country c. In the following the term "product" will be used to represent different loan or deposit products or product categories. This will be clarified further in the following section of the paper. CONC represents the Herfindahl index for product i in country c and is our central variable of interest. CONC reflects the number of banks operating in the market and, hence, acts as a proxy for n in the theoretical model. RISK serves as a proxy for μ. We used the share of problem loans in country c. As for a number of countries the share problem loans is not available, we also include an indicator which takes on the value 1 if the share of problem loans is unavailable and zero otherwise. COST represents the average cost to income ratio in country c as a proxy for α. DEM is the consumer and producer confidence indices for each country, which serve as proxies for B_0, i.e. the aggregate demand for loans. The elasticity of aggregate loan demand, B, are both proxied for by the ratio of the total assets of the banking system to GDP and the stock market capitalisation in country c (SUBST). The variables are used to measure the extent to which the financial system is bank based and the degree to which arms-length modes of financing may be available, respectively.

The model was estimated with product specific effects, u_i, using standard panel data econometric methods. The econometric model allows for product specific slopes, β_i. The indicator I is set equal to one, if the Herfindahl index describes concentration in product market i and zero otherwise.

[7] Note that in the monopolistic case, i.e. when $n = 1$, the above model converges to the Monti–Klein model. In this case the monopolistic bank would set its lending rate based on the simple rule (Eq. (7b)).

$$r_k = \frac{B_0}{B} + \frac{r_D}{(1-\mu_k)(1-\alpha)}. \tag{7b}$$

Our main interest is the effect of concentration on interest margins. Based on the structure performance hypothesis, β_1 would be greater than zero, as concentration would be associated with less competitive behaviour and, hence, higher margins. In contrast, based on the efficient structure hypothesis, β_1 would be expected to be less than or equal to zero. A more concentrated market would be evidence of a more efficient size of banks, which should also be reflected in a positive β_4, the coefficient on COST. Unfortunately, given our econometric setup, we cannot exclude the possibility that a negative β_1 reflects an increased in unobserved contestability of some markets. Hence, while a non-positive β_1 can be taken as a rejection of the structure performance hypothesis, it cannot be taken as unambiguous evidence in favour of the efficient structure hypothesis.

Further, we would expect higher risk and higher costs to be associated with larger margins. More developed arms-length markets should be associated with smaller margins. We expect higher demand, as measured by our confidence indices to increase margins, both in the loan and the deposit market. For loans, higher confidence suggests more profitable investment opportunities for firms and more spending by households, both of which may be financed by additional loans. Similarly, for deposits, if confidence is high, firms and households may have less need for liquid assets such as deposits and may either invest or spend the money. This is only true under the assumption that deposits are largely held for liquidity purposes, rather than as investments. This will be further discussed in Section 5.

4. Data

4.1. Data sources

Ideally, Eq. (8) would be estimated with bank level data on interest rates and regional measures of concentration. Unfortunately, for the euro area, neither is available. Hence, we calculated country level concentration measures and countrywide data on contractual interest margins. The data used in this study were obtained from a number of different sources. The balance sheets and the income statements of euro area banks are from the Fitch-IBCA Ltd Bankscope data set, which contains annual balance sheet data for a wide variety of European banks. As the coverage of banks in Bankscope is not complete, the total assets of the banking system in a given country were obtained from OECD (1999). The interest rate data were obtained from an ECB internal database, which collects interest rate information from the national central banks of the euro area. While this part of the ECB database is confidential, the data are available from the National Central Banks of the respective countries. We limited the analysis to a sample on the period 1993–1999, as missing values both for the balance sheet information underlying the Herfindahl indices and for interest rates increases significantly for earlier periods.

The bank balance sheet data are unconsolidated data, whenever available. Bankscope provides data both in the national accounting format and in a standardised global format. After careful inspection of the data, we decided to use the data based

on national accounting rules, as their quality seemed to be superior. [8] Hence, the share of problem loans as well as the average cost to income ratio are our own calculations based on these data. The consumer and industrial confidence indicators are from the European Commission Business and Consumer Surveys, which are published by the European Commission on a quarterly basis. The market capitalisation of the stock market for each country was obtained from FIBV (International Federation of Stock Exchanges).

Based on available data, we were able to calculate Herfindahl indices for each country for the following bank products: overall, short-term, long-term customer loans, mortgage loans, and demand, fixed maturity and saving deposits. In order to facilitate comparisons with the previous literature (ECB, 1999; De Bandt and Davis, 1999), we also calculated the Herfindahl index for total assets. This Herfindahl index of concentration is defined as the sum of squared market shares. For example the Herfindahl index for customer loans would be written as

$$H_f = \sum_{k=1}^{K} \left(\frac{L_k}{\sum_{k=1}^{K}(L_k)} \right)^2 \times 1000, \tag{9}$$

where L_k represents consumer loans of bank k and the total number of banks in the country is represented by K. The Herfindahl index will therefore vary between 1000 in case of only one bank in the country to values close to zero for a country with atomically small banks.

The measure allows an analysis of the concentration in the banking sector across euro area countries, as well as across different bank products. In contrast to the market share of the five or ten largest banks, the Herfindahl index will reflect changes in the market structure among smaller banks. In addition, concentration may differ for different bank retail products within a given country. For example, while concentration may have increased for retail deposits, the mortgage market may still be quite dispersed. Most importantly, as we will see below, our approach allows concentration to have a different effect on, say, demand deposits than time deposits.

It could be argued that the Herfindahl index monotonically varies with country size. This is true, however, only to a limited extend as evidenced by the figures given in Table 3 below. More serious may be the criticism that using country specific measures of concentration ignores the possibility that country boundaries may no longer be the appropriate definition of a market in the European context. Our measure also ignores the possibility that some markets may be more contestable than others. However, it seems to us that both of these shortcomings of the measure would bias the results against finding a significant relationship between concentration and margins. [9]

[8] We found the data based on national accounting rules to be more reliable and internally consistent than those in the standardised format, which is also provided by Bankscope.

[9] Further, the level of concentration may in itself be a flawed indicator of the degree of collusion. For example, it is conceivable that concentrated markets are very competitive and fragmented markets can be characterised by multi-market collusion.

Table 1
Number of banks used to calculate the Herfindahl indices by country and year: standardised data

	Period	Average number of banks
Austria	1994–1999	95
Belgium	1993–1999	106
Finland	1993–1999	12
France	1993–1999	442
Germany	1994–1999	2103
Ireland	1995–1999	43
Italy	1994–1999	359
The Netherlands	1994–1999	57
Portugal	1994–1999	29
Spain	1991–1999	163

Source: Bankscope.

When calculating the Herfindahl indices, we were faced with the problem that in Bankscope, the number of banks in each country, for which information is available, fluctuates quite significantly from year to year. This could be due to two reasons. One, there were new entrants, increasing the number of banks or exits, largely through mergers, reducing the number of banks. This is in fact what we are attempting to measure. However, the fluctuations could also be due to fluctuations in coverage in the Bankscope data set. If the second reason dominates, which we suspect based on a visual inspection of the data, this could significantly bias our results. In order to address this issue, we identified a constant number of banks for which data were available throughout the sample period. In addition, for the 10 (small countries) to 20 (large countries) largest banks we manually identified all mergers and adjusted the sample correspondingly. This suggests that our measure may understate the degree of concentration in later years for some countries, in which there were a very significant number of mergers of smaller banks. However, the measure will fully reflect structural differences in concentration across countries. The effect of a merger of two very small banks on our measure of concentration is small and our results should not be significantly affected by the failure to account for them over time. Table 1 shows the resulting sample of banks, which we used to calculate the Herfindahl indices.

We calculated the contractual interest margins for loans as the difference between lending rates and money market rates. For deposits we used the difference between money market rates and deposit rates, in order to maintain comparability between loan and deposit products. We used the money market rate in order to control for different monetary conditions and levels of inflation among the 11 countries. We were able to match the Herfindahl indices of four loan markets (overall, short-term loans, long-term loans and mortgages) and the three deposit markets (demand, savings and time deposits) to their respective contractual interest rates (Table 2). In total, the resulting sample consists of 246 Herfindahl index/interest margins pairs, for all 11 euro area countries, except Luxembourg, where we were unable to obtain

Table 2
Contractual interest margins and Herfindahl indices

Retail interest rates	Herfindahl indices
Loan market	
Interest on customer loans – Money market rate	Customer loans
Interest on short-term loans – Money market rate	Short-term loans
Interest on long-term loans – Money market rate	Long-term loans
Interest on mortgages – Money market rate	Mortgage loans
Deposit market	
Money market rate – Interest on demand deposits	Demand deposits
Money market rate – Interest on savings deposits	Savings deposits
Money market rate – Interest on time deposits	Time deposits

interest rate data. [10] Money market rates were obtained from the IMFs International Financial Statistics.

4.2. Descriptive statistics

Table 3 shows that the trends exhibit by the market share of the largest five banks and the Herfindahl index over time and within a country are broadly similar. Looking at our core sample period, from 1995 to 1999, we find that the concentration process in European banking has continued, but may have decelerated relative to the early 1990s and late 1980s. The market share of the top five banks and the Herfindahl index on average show 11% and 10% growth, respectively.

One would expect, however, two main differences between the two indicators. One, over time, in countries with a sizeable number of mergers among smaller banks (Germany, Austria), we would expect concentration to increase more rapidly based on the Herfindahl index. We see this in Germany, where there were a lot of mergers among small co-operative banks. The Herfindahl index increased at about four times the rate during 1995/99 compared to the market share of the top five banks. Similarly, in countries with a large number of new entrants into the market, which tend to be small, the market share of top five banks will not reflect the decline in concentration in the banking sector. This effect is reflected in the concentration numbers for Ireland. In Ireland, both indicators suggest that concentration has declined, but the Herfindahl suggests a decline that is more than twice the size of that indicated by the market share of top five banks.

Second, concentration measured as the market share of the top five banks tends to understate and may misrepresent the differences in concentration among countries.

[10] Nevertheless, some issues remain regarding differences in the share of fixed and variable rate loans and other differences due to heterogeneity in tastes and traditions across countries.

Table 3
Euro area: top five market shares and Herfindahl indices

		Total assets										
		1991	1992	1993	1994	1995	1996	1997	1998	1999[a]	Growth 1995–1999	Mean as percent of maximum
Austria	Top 5 Market share					39.19	38.96	48.25	50.07	50.38	28.55	57.35
	Herfindahl index				70.06	70.04	71.50	80.94	97.88	91.67	30.88	24.62
Belgium	Top 5 Market share					51.20	52.20	53.90	72.50	75.80	48.05	77.26
	Herfindahl index			94.60	95.74	96.22	98.58	104.50	114.12	177.01	83.96	35.28
Finland	Top 5 Market share					70.62	71.74	72.72	73.51	72.81	3.10	91.37
	Herfindahl index			211.00	227.47	327.79	324.94	336.62	343.23	341.09	4.06	100.00
France	Top 5 Market share					41.30	41.20	38.00	39.20	40.90	−0.97	50.71
	Herfindahl index			42.64	39.84	39.84	39.92	41.41	43.69	53.63	34.61	13.05
Germany	Top 5 Market share					16.67	16.08	16.68	19.15	19.36	16.14	22.23
	Herfindahl index				13.93	14.84	15.90	17.79	21.70	23.76	60.11	5.62
Ireland	Top 5 Market share					44.4	42.2	40.7	40.1	40.00	−9.91	52.43
	Herfindahl index					147.07	149.73	122.60	107.41	110.59	−24.80	38.08
Italy	Top 5 Market share					32.36	32.11	30.71	38.73	40.22	24.29	44.02
	Herfindahl index				30.68	31.68	29.15	28.29	29.20	28.50	−10.04	8.77
Netherlands	Top 5 Market share					76.14	75.36	79.42	81.69	82.94	8.93	100.00
	Herfindahl index				198.93	205.83	202.34	211.64	231.84	191.66	−6.88	62.34
Portugal	Top 5 Market share					74.00	80.00	76.00	75.22	74.72	0.97	96.05
	Herfindahl index				101.60	95.71	93.09	93.88	93.66	95.71	0.00	28.20
Spain	Top 5 Market share					47.30	46.00	45.20	44.60	50.80	7.40	59.13
	Herfindahl index	37.08	37.39	41.64	38.79	37.60	38.96	39.92	42.71	56.82	51.12	12.91
Average (unweighted)	Top 5 Market share					49.32	49.59	50.16	53.48	54.79	11.10	65.06
	Herfindahl index					106.66	106.41	107.76	112.54	117.04	9.73	32.89

Sources: ECB, ECB (1999), De Bandt and Davis (1999).

[a] First half of 1999 for the Top 5 Market share data.

In the last column of Table 3, we calculated the mean concentration level as a percentage of the maximum. One immediately notices that the country with the most concentrated banking system in the euro area is The Netherlands, when measuring concentration as the market share of the five largest banks, and Finland, when using the Herfindahl index. This in itself is interesting, as it reflects the fact that The Netherlands besides a number of very large banks also has smaller banks, with, however, a relatively small market share. In Finland, this is not the case. The difference is only picked up in the Herfindahl index. Further, the euro area mean level of concentration is 65% of the concentration in the most concentrated market, when looking at the market share of the top five banks and only 33%, when using the Herfindahl index.

In case of individual countries, this difference may be quite dramatic; this is especially so for countries with a relatively large number of smaller banks. For example in Germany, based on the market share of the top five banks, Germany's banking system is about on fifth as concentrated as the most concentrated market in the euro area; based on the Herfindahl index, Germany's banking system is one twentieth as concentrated. Similarly, France is half as concentrated and one seventh as concentrated, respectively.

Turning to individual bank products, Herfindahl indices for individual balance sheet items are shown in Chart 1. Overall, as for total assets, Germany's banking sector, along with most other large countries, shows the least concentration, whereas the most concentrated is Finland followed by The Netherlands. However, the differences within countries are substantial: German Herfindahl indices for deposits and loans range from 5 to 30. Similarly, in Italy the Herfindahl indices range from 25 to 160. These differences among products are somewhat smaller in countries that exhibit an overall high level of concentration. The Herfindahl indices for The Netherlands' and Finnish banking systems vary between 200 and 350 in The Netherlands and between 350 and 500 in Finland, although the index for time deposits in Finland reaches a peak at 800 in 1996.

The product-specific Herfindahl indices also exhibit some interesting patterns across countries. In most countries, concentration in loan markets tends to be lower than in deposit markets. Within the loan market, it appears that the mortgage market was particularly concentrated. A mean comparison test confirmed this notion. Similarly, within the deposit market, time deposits exhibit a higher concentration than demand or savings deposits, although a mean comparison test suggests that the difference is not statistically significant. For individual countries, these differences can nevertheless be substantial. For example in Italy, concentration in the market for time deposits is about four times as high as in the market for saving deposits. Similarly, in Spain, the market for savings deposits, at least for part of the sample period, is eight times as concentrated as the market for consumer loans. The figures suggest that considerable additional information may be gained by considering product groups separately, given that the differences in the levels of concentration among products suggest considerable specialisation in banking markets.

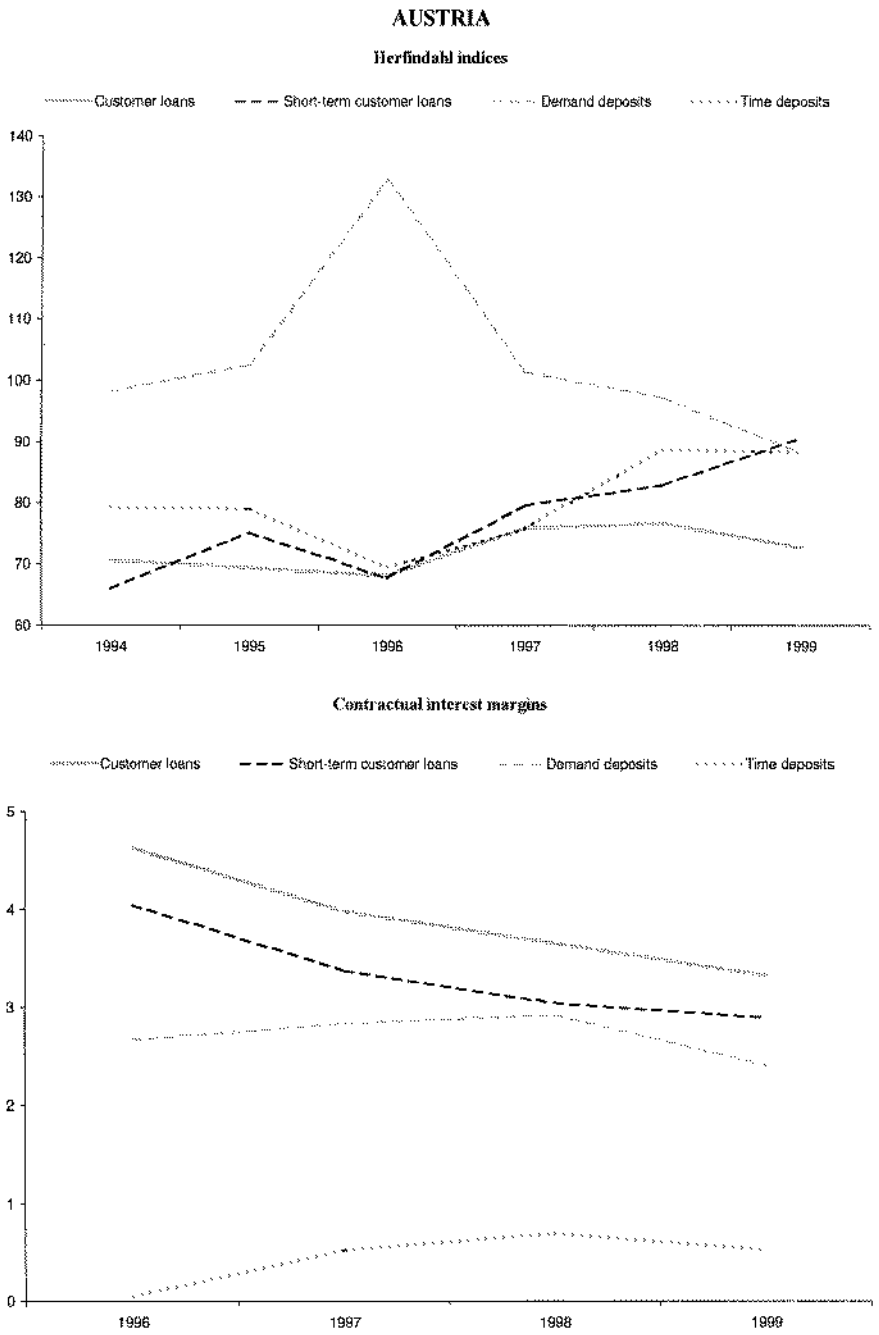


Chart 1. Concentration and retail interest margins in euro area countries.

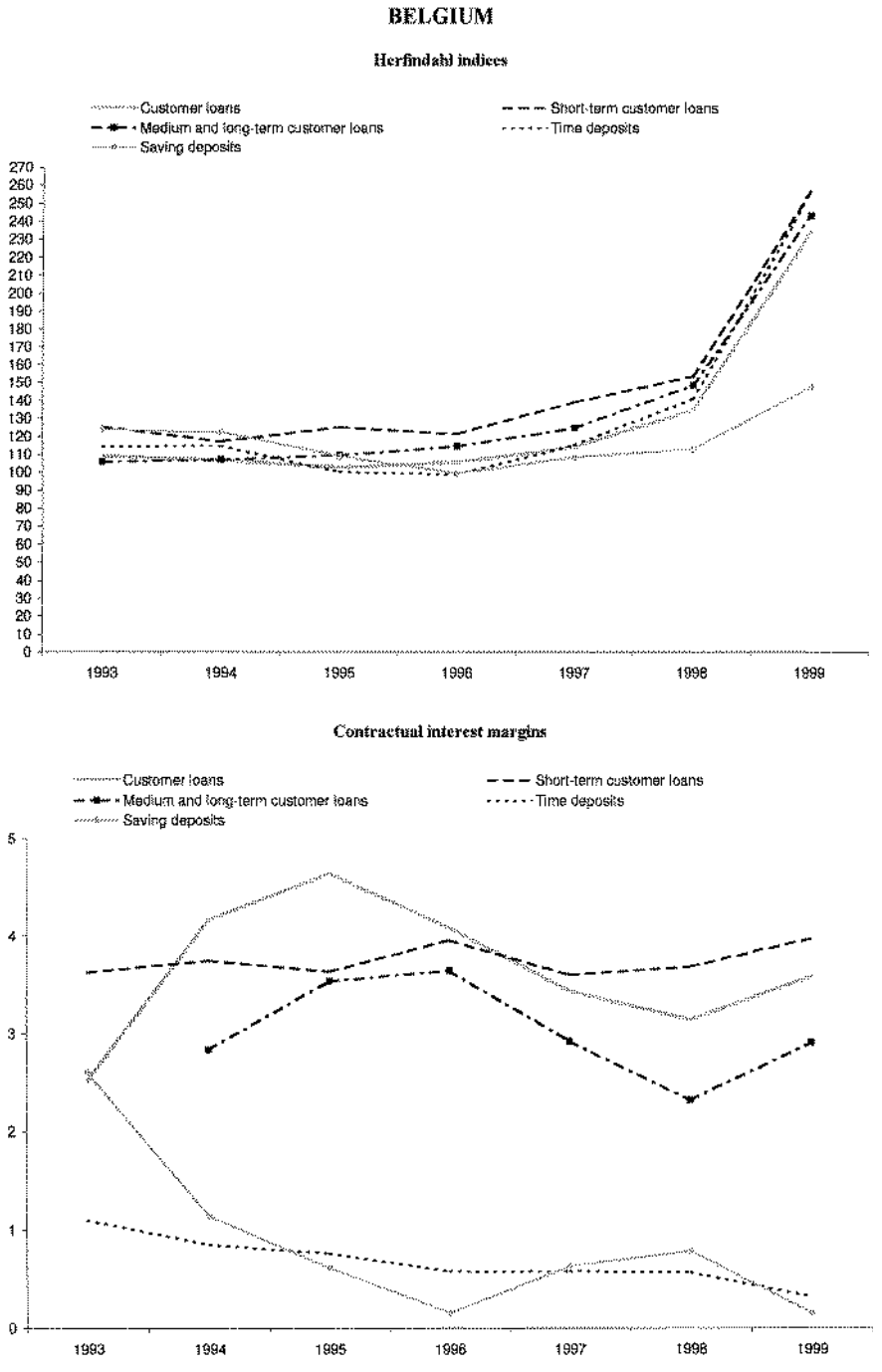
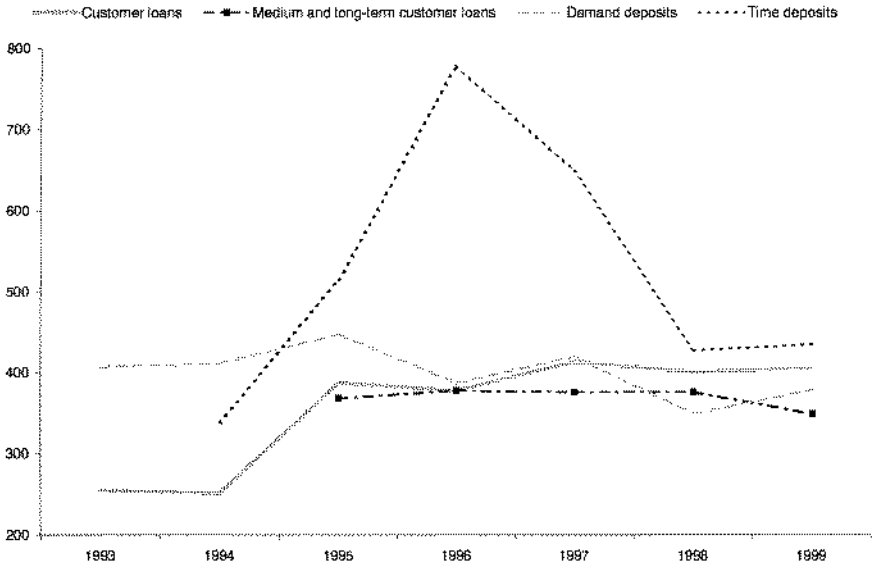


Chart 1 (*continued*)

FINLAND

Herfindahl indices



Contractual interest margins

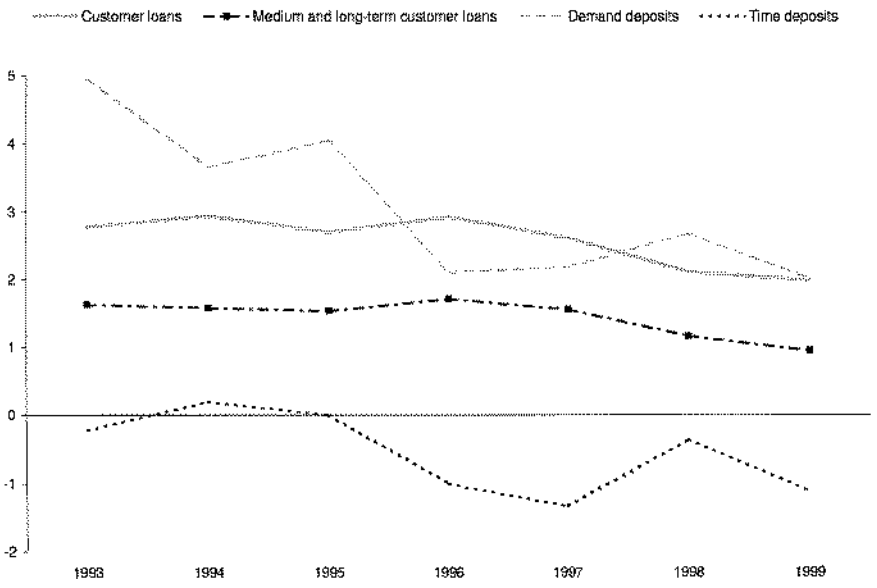


Chart 1 (*continued*)

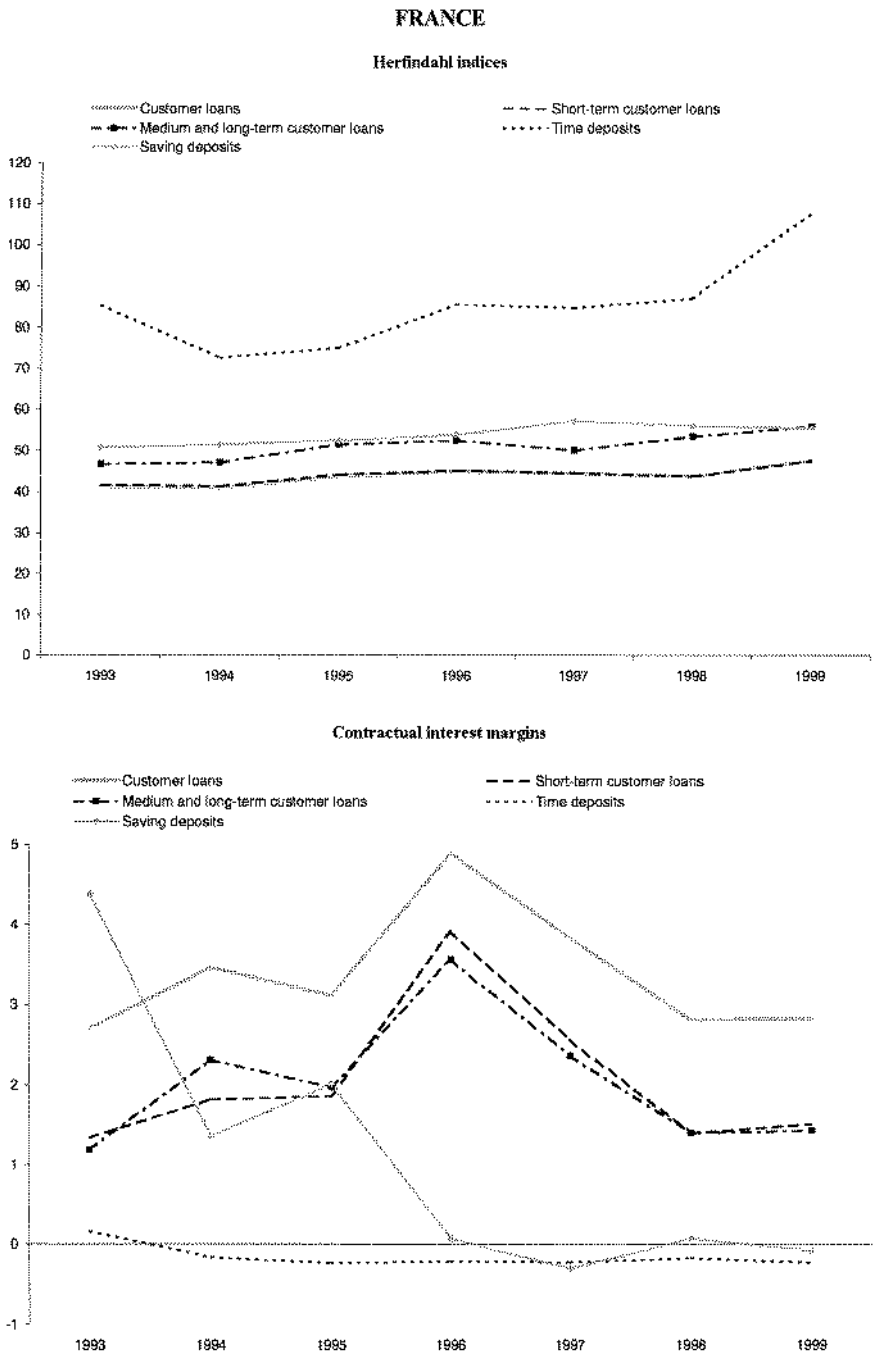
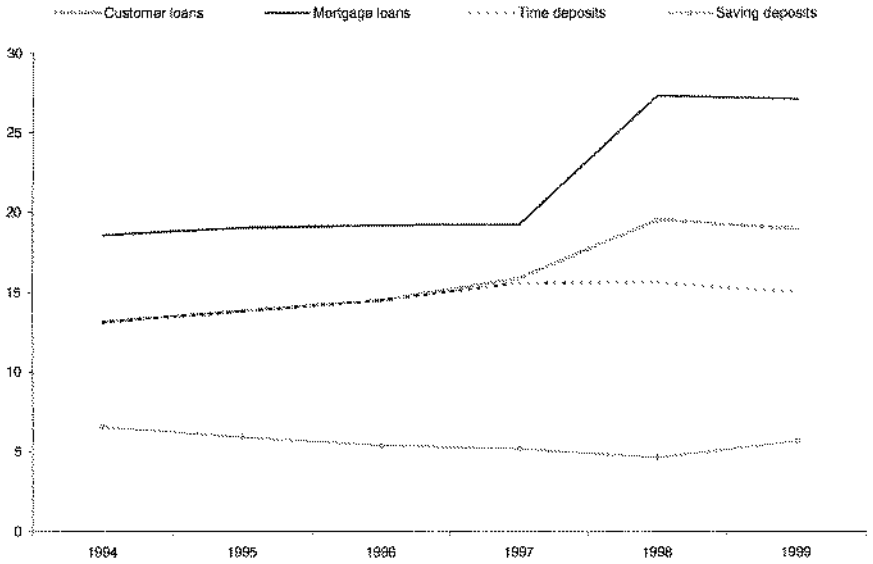


Chart 1 (*continued*)

GERMANY

Herfindahl indices



Contractual interest margins

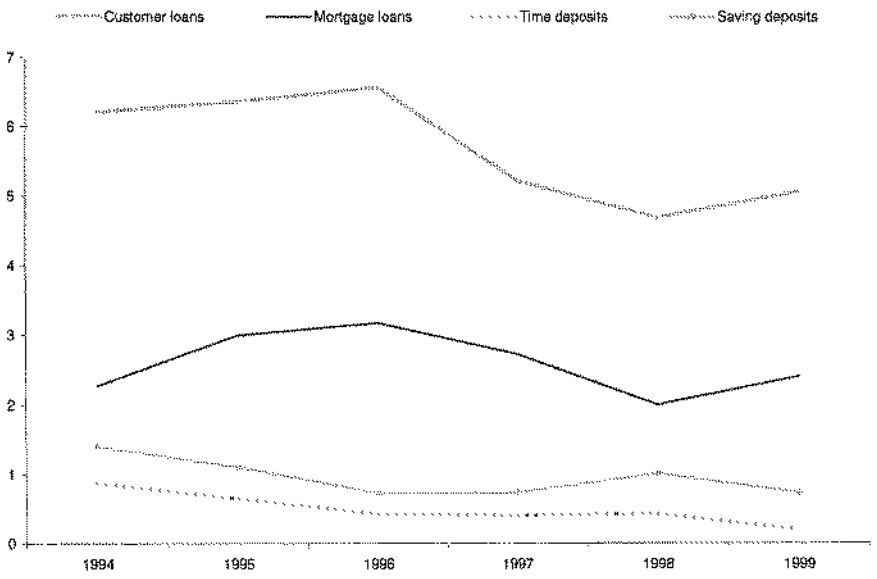


Chart 1 (*continued*)

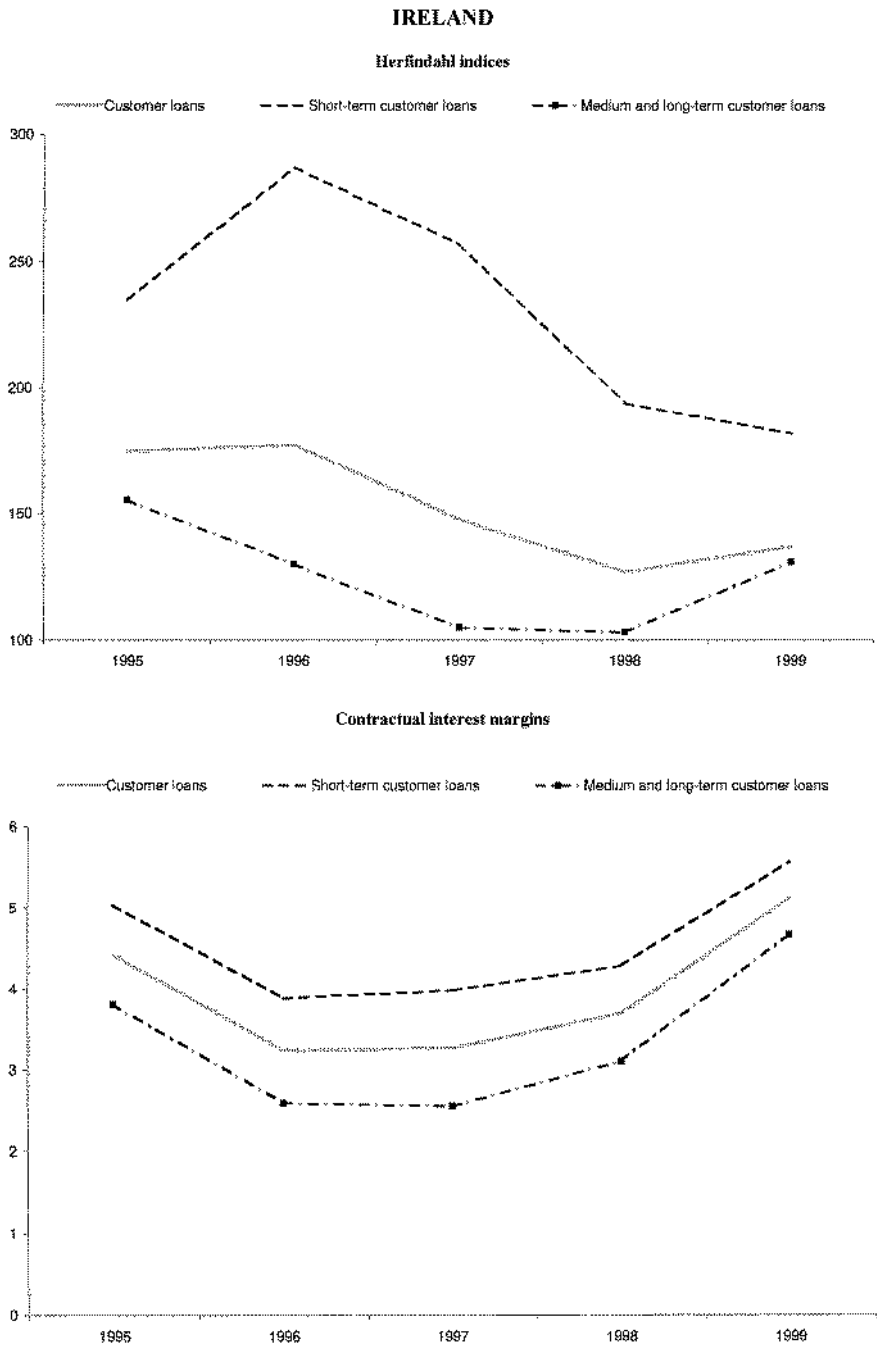


Chart 1 (*continued*)

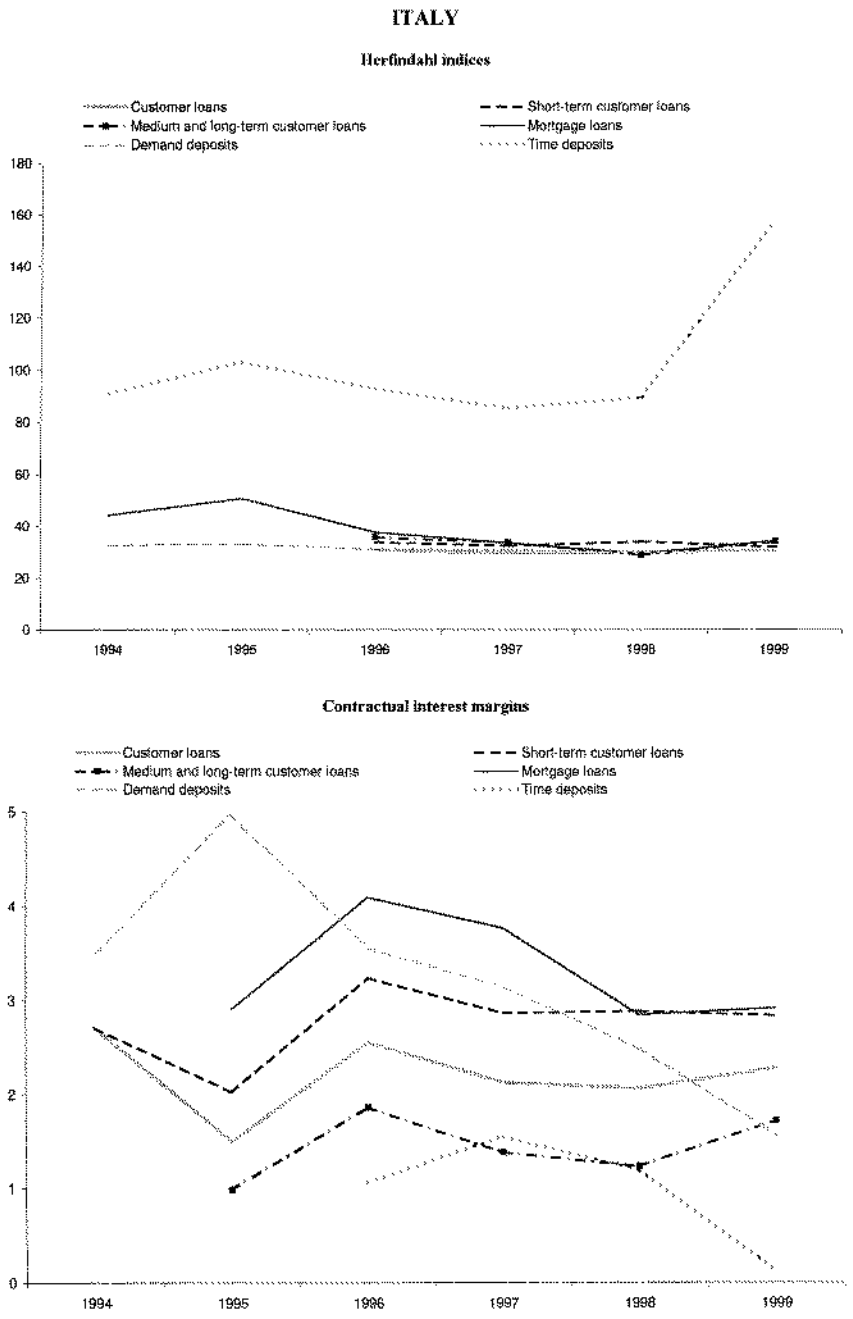


Chart 1 (*continued*)

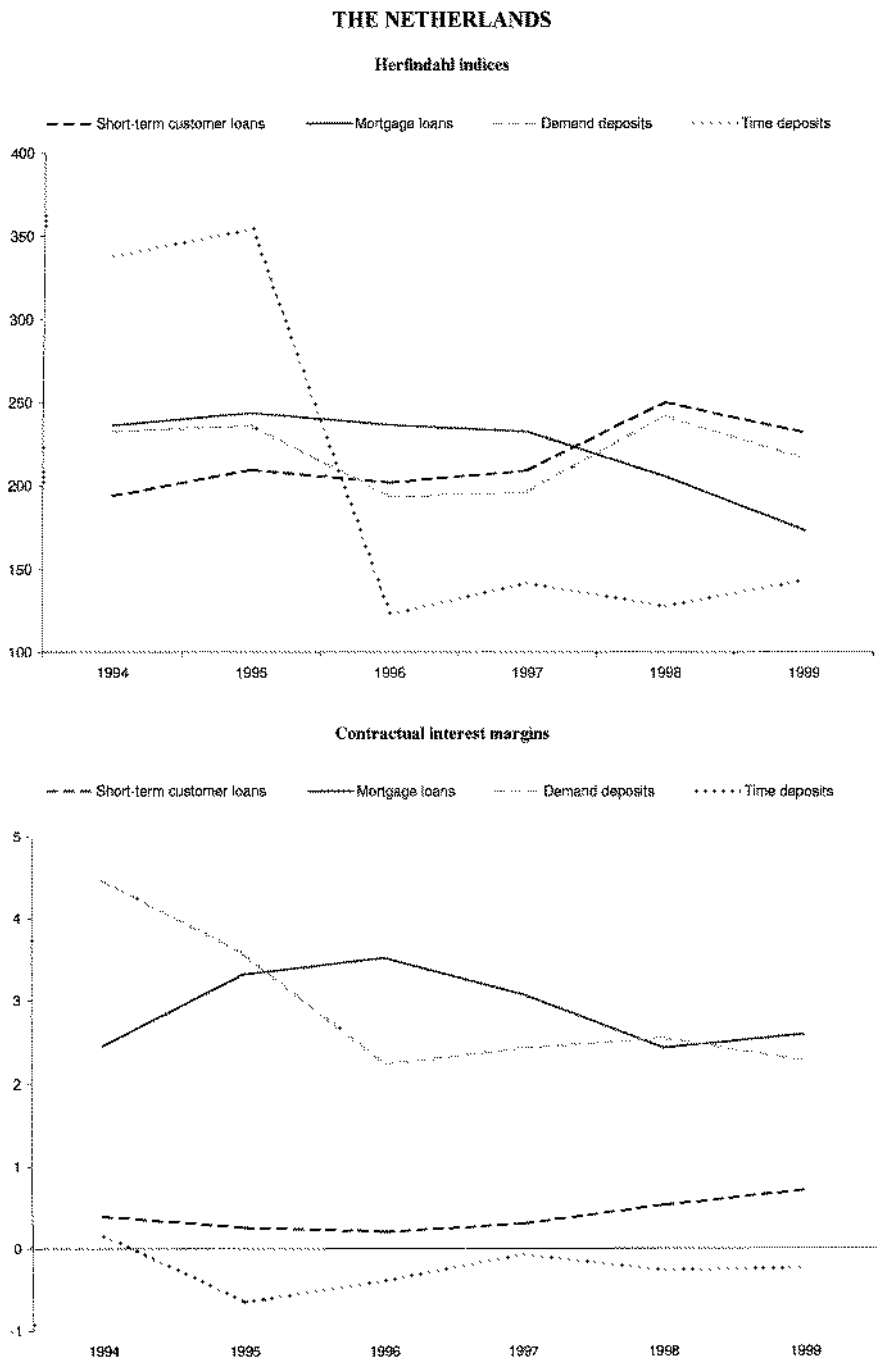


Chart 1 (*continued*)

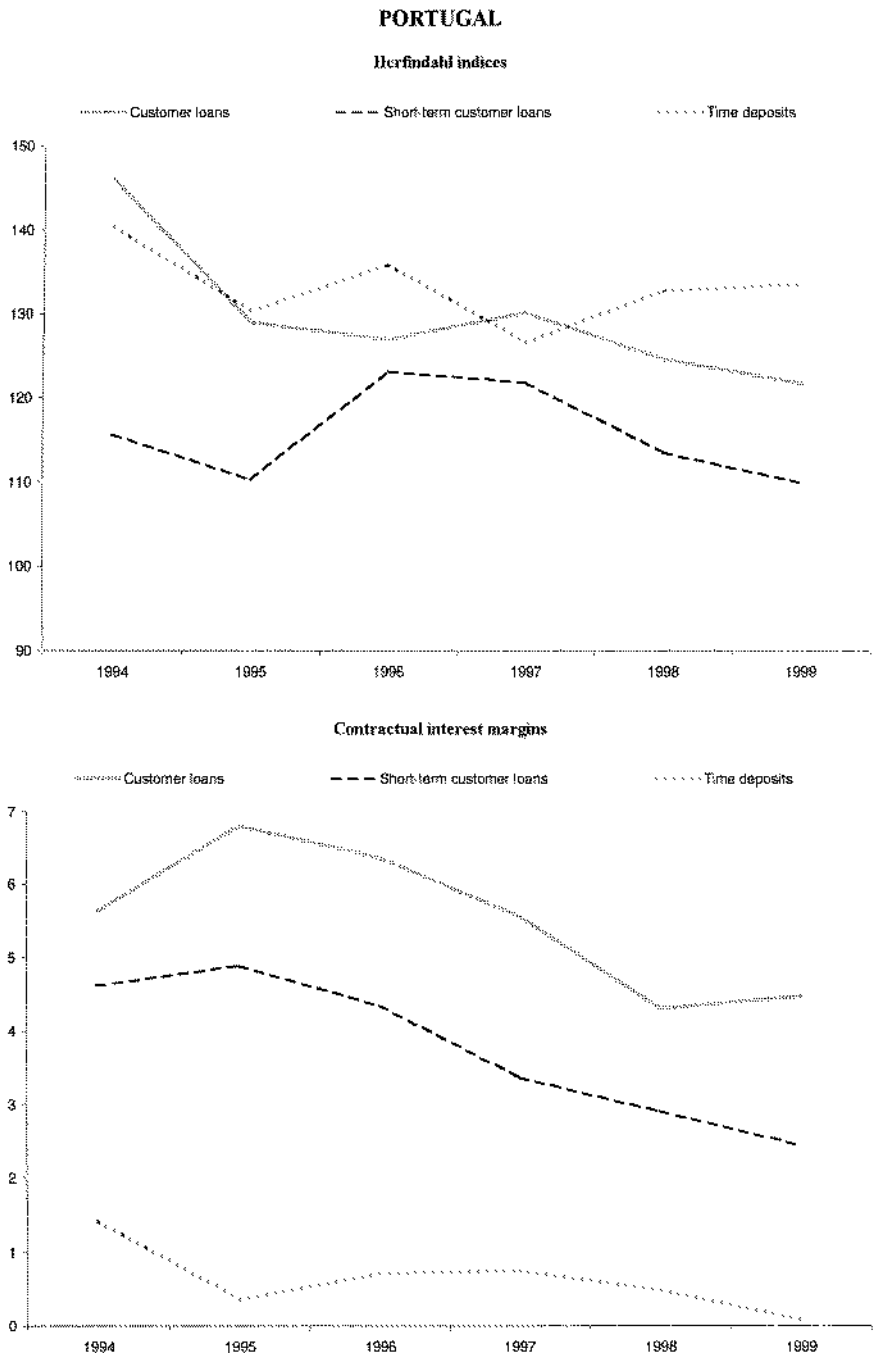


Chart 1 (*continued*)

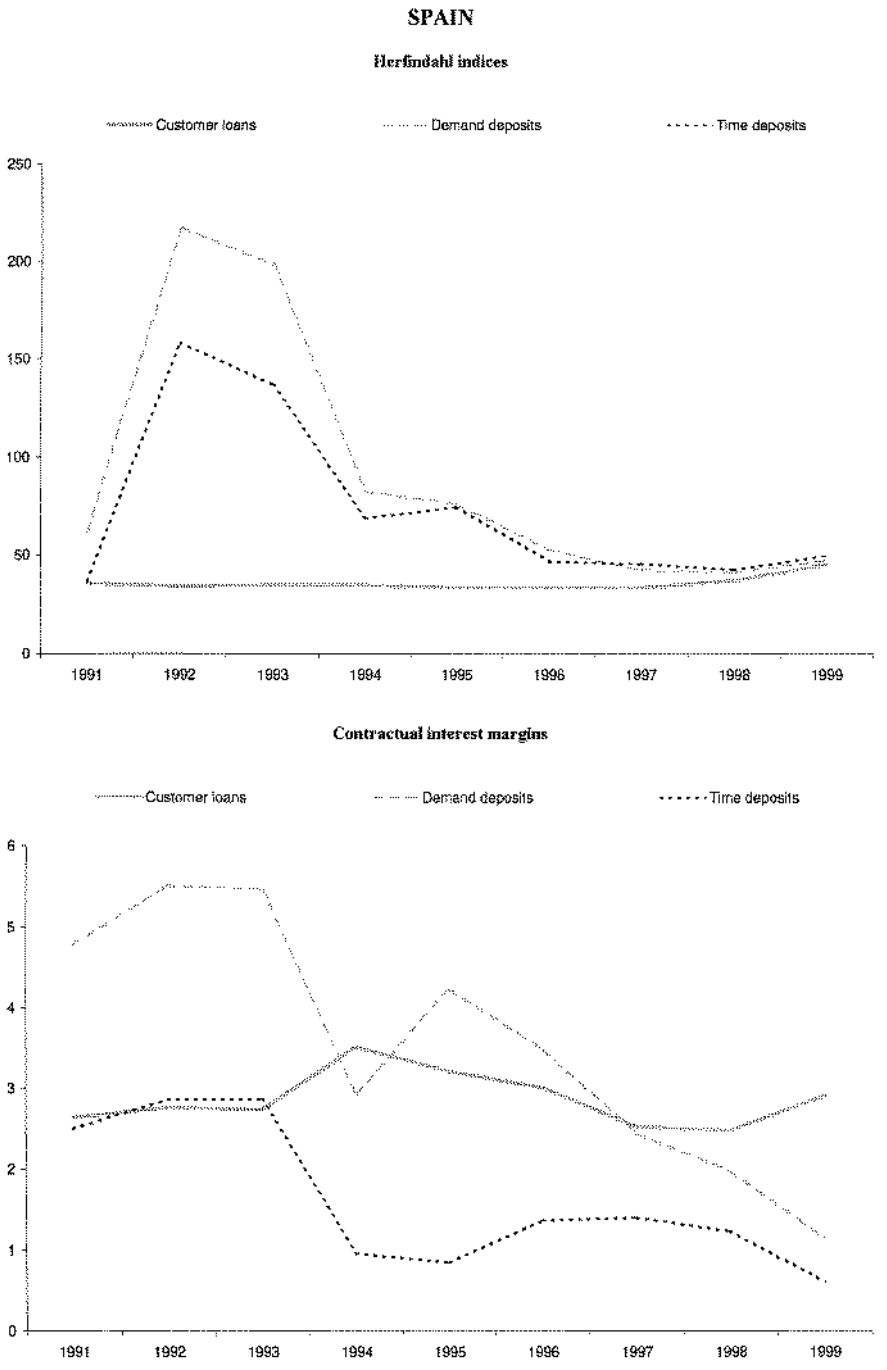


Chart 1 (*continued*)

Table 4
Share of products in percent of total assets, 1998[a]

	Loans			Deposits			
	Customer	Short term	Medium and long term	Mortgages	Demand	Time	Savings
AT	43.3	15.5	27.7	n.a.	8.5	20.1	3.9
BE	34.2	8.4	25.8	n.a.	8.8	26.2	14.1
FI	52.2	16.4	35.8	n.a.	25.9	15.3	n.a.
FR	34.5	n.a.	n.a.	n.a.	7.9	9.1	10.5
DE	50.8	n.a.	n.a.	14.6	8.5	17.4	11.6
IR	42.5	15.7	25.5	n.a.	26.2	8.5	n.a.
IT	50.6	27.6	16.8	14.7	21.2	6.7	3.6
NL	54.6	19.7	27.8	3.6	14.4	10.6	1.2
PT	38.0	12.2	25.8	n.a.	17.1	27.1	7.4
ES	47.6	n.a.	n.a.	n.a.	20.8	29.8	2.3

[a] Figures not strictly comparable across countries.

The main question that this paper attempts to investigate is the relationship between market concentration and contractual interest margins. The interest rate data shown in Chart 1 shows a distinct downward trend for most countries during the sample period. This largely reflects the increasing certainty of introducing a common currency in the sample countries and the lower expected level and volatility of inflation associated with this process.

A comparison of Chart 1 allows us to make a first cut at investigating, whether higher concentration is generally associated with higher margins (structural performance hypothesis) or if higher concentration is associated with lower margins (efficient structure hypothesis). For the three loan products it appears that higher concentration is generally associated with higher margins, which would suggest that, at least in some cases, banks appear to behave less competitively in a more concentrated market. For any of the deposit markets, no clear patterns are apparent. In order to perform a simple check whether indeed loan and deposit markets behaved differently during the sample period, we calculated simple correlation coefficients between the contractual interest margins and the Herfindahl indices. While we found that interest margins and the Herfindahl index had a correlation coefficient of -0.12 overall, the figure was $+0.2$ for loans and -0.3 for deposits. [11] Concentration may have had a different effect on loan markets than on deposit markets. This question will be explored in greater detail below (Tables 4 and 5). [12]

[11] Note also that the correlation between the Herfindahl index for deposits the Herfindahl index for loans is -0.37. This underlines the need to consider product categories separately in any analysis of the effects of concentration on interest rate margins.

[12] The relative magnitudes of the different products in banks' balance sheet are given in Table 4.

Table 5
Descriptive statistics

Variable	*N*	Mean	Standard deviation	Minimum	Maximum
Total assets (in millions of euros)	246	1,400,052	1,576,640	78,872	6,515,366
Total assets/GDP (%)	246	191.10	57.47	80.35	328.08
Herfindahl index	246	132.62	117.62	4.61	778.14
Interest margin	246	2.39	1.57	−1.33	6.8
Share of problem loans (%)	246	2.25	1.52	0	4.97
Share of problem loans missing	246	0.38	0.49	0	1
Cost to income ratio (%)	246	66.50	17.16	−111.37	98.66
Consumer confidence index	246	−7.13	14.44	−33.92	21.58
Producer confidence index	246	−6.06	10.08	−34.83	18.17
Stock market capitalisation	246	45.92	28.34	15.26	146.79

5. Estimation results

Table 6 displays the results from an estimation of (8) using random effects across markets. [13] Hausman and Lagrange multiplier test statistics suggested that random effects, rather than fixed effects would be the preferred specification. The models 1–3 differ only in that we allow for different slopes across markets. In model 2, we allow for different slopes across broadly defined markets, i.e. across deposit versus loan markets. In model 3, we allow for different slopes across individual categories of deposits and loans. Hence, for example, we allow the effect of concentration on demand deposits to be different from its effect on time deposits and the effect of concentration on mortgage margins to be different from its effect on short-term loans.

As a baseline consider model 1. In model 1 all slopes are restricted to be the same across bank products. We find a weakly positive effect of concentration on interest margins. The coefficient is marginally significant at the 15% level. Overall, it appears concentration tends to increase interest margins, which is in support of the structure performance hypothesis. Most other variables are insignificant, except for the stock market capitalisation and the total assets of the banking system, both of which proxy for the substitutability of bank loans with arms-length finance. Both have the expected sign: The stock market capitalisation is significantly negatively related to contractual margins of banks, suggesting that more developed capital markets result in competitive pressures on the banking system. Similarly, the larger the total assets of the banking system relative to GDP, the more "bank-based" the economy is, and the higher banks' margins would be expected to be. This is what we find. Both coefficients are significant at least at the 5% level.

At the outset of this paper, we hypothesised that different bank products may react differently to a change in the level of concentration in the market. This may have a myriad of reasons, including that economies of scale may be more important for

[13] For descriptive statistics of the dependent variable and all independent variables see Table 5.

Table 6
Estimation results: baseline

	Model 1 product specific effects		Model 2 product specific effects		Model 3 product specific effects	
Herfindahl index	0.0014	(0.0011)				
Herfindahl index: loans			0.005***	(0.001)		
Herfindahl index: deposits			−0.003**	(0.001)		
Herfindahl index: customer loans					0.006***	(0.002)
Herfindahl index: long-term loans					0.001	(0.001)
Herfindahl index: mortgage loans					0.012***	(0.001)
Herfindahl index: short-term loans					0.005***	(0.001)
Herfindahl index: demand deposits					0.007***	(0.0011)
Herfindahl index: savings deposits					−0.014***	(0.004)
Herfindahl index: time deposits					−0.005***	(0.001)
Problem loans	0.084	(0.09)	0.104	(0.09)	0.136*	(0.071)
Problem loans missing	0.071	(0.281)	0.407	(0.266)	−0.227	(0.223)
Cost to income ratio	−0.003	(0.006)	−0.002	(0.006)	−0.002	(0.004)
Producer confidence	0.004	(0.012)	−0.0019	(0.012)	−0.004	(0.009)
Consumer confidence	−0.015	(0.013)	−0.012	(0.013)	−0.023**	(0.01)
Stock market capitalisation/GDP	−0.007***	(0.003)	−0.008***	(0.006)	−0.006***	(0.002)
Total assets/GDP	0.003**	(0.002)	0.003*	(0.002)	0.002*	(0.001)
N	246		246		246	
Wald statistic[a]	64.5***		110.9***		272.8***	
Lagrange multiplier test[b]	2406***		1434***		271***	
Hausman test[c]	0.00		0.00		19.2	

All models were estimated using random effects across markets (i.e. demand, savings and time deposits, and short-term, long-term and mortgage loans). Standard errors in parenthesis were corrected for heteroskedasticity. *, **, *** indicates significance at the 10%, 5%, and 1% level, respectively. The dependent variable is the contractual interest margin in market i and country c. The phrase "Herfindahl index: deposits" represents the Herfindahl index multiplied by an indicator, which takes on 1 if the market is a deposit market (i.e. demand, savings or time deposits). "Herfindahl index: loans" represents the Herfindahl index multiplied by an indicator, which takes on 1, if it is a loan market (i.e. customer, long-term, short-term or mortgages).

[a] Test of joint significance of all independent variables. Test is distributed $\chi^2(k)$, where k is the number of independent variables.

[b] Significance suggests that a random effects model may be more appropriate.

[c] Significance suggests that a fixed effects model may be more appropriate.

some products than others, bank/customer relationships may be more important, and the degree of (unobserved) contestability or regional market barriers may be higher for some bank products than for others. Hence as a first step to analyse this question, in model 2 we allow for different slopes across deposit and loans. We find evidence in favour of the structure performance hypothesis, i.e. the higher concentration is associated with higher margins, for loans, but not for deposits. The coefficient for deposits is negative and significant at the 5% level. Recall that deposit margins were defined as the money market rate minus the deposit rate, i.e. the smaller this difference the more competitive the pricing of the banks. All other coefficients are as in the previous specification.

In model 3 we disaggregate the effects of concentration on interest margins further and allow for differential effects across individual products, not just product categories. That is, we allow slopes of different loan products, such as long-term and short-term loans, to differ from each other. We confirm the result that for loans, increasing concentration may result in less competitive pricing by banks. We find statistically significantly positive coefficients for three out of four loan products. In the case of deposits, margins on demand deposits are also positively affected by concentration. Interestingly, for time and savings deposits we find the opposite: The more concentrated the market, the more competitive bank pricing.

The rejection of the Cournot model for time and savings deposits could suggest that higher concentration has resulted in a more efficient bank structure for these products and could be interpreted as support for the efficient structure hypothesis. However, in general, any reduction in margins due to lower costs should be picked up by our cost measure, rather than by the concentration index. The cost to income ratio, however, is never significant in any of the specifications. Hence, our result could be due to some mismeasurement of in our measure of bank costs. We experimented with a number of alternatives, including the ratio of operating costs to deposits and the ratio of staff and non-staff costs to deposits, but found no change in the results. We cannot exclude the possibility that the negative coefficients on the concentration measure for time and savings deposits is in fact evidence of a more efficient markets structure. On the other hand, we also cannot reject the notion that the contestability of some markets has increased concurrently with the increase in concentration. In that case, the Herfindahl index would in fact proxy for unobservable increases in contestability, due to, say, the introduction of the euro. [14]

Time and savings deposits would be particularly likely candidates for such an increase in contestability, as they may be less local in nature compared to business loans, which often require knowledge of the local market by the lender and may be associated with long-term bank/customer relationships. In this case, borrowers may be locked into a local market and high concentration may enable lenders to collude and exercise their market power. Similarly, in the case of demand deposits, which largely are held for transaction purposes, geographic proximity may play a role and, hence, it may be quite costly for banks' clients to shop for better rates outside their immediate geographic area.

The estimated differences in interest rates are substantial. Average contractual rates on customer loans in a banking market with a Herfindahl index of 300 (e.g. The Netherlands or Finland) are estimated to be about 120 basis points higher than in a market with a Herfindahl index of 100 (Portugal, Spain or Belgium). The difference would be 100 basis points for short-term loans and 240 basis points for mortgages. Demand deposits would be remunerated with an interest rate that is 140 basis points lower in the more highly concentrated market. In contrast, higher concentration in savings and time deposits result in 280 basis points higher remuneration of

[14] Reverse causality may be at play here, in the sense that the unobserved increase in contestability has resulted in greater mergers and higher concentration.

savings deposits and 100 basis points for time deposits. Given the substantial variation in concentration across the euro area, these figures are in line with estimates for the US in Berger and Hannan (1989) who found that deposit rates may be higher by as much as 100 basis points in more concentrated markets.

The differentiated results for different parts of banks' balance sheets also permit a re-interpretation of the mixed evidence of the effect of concentration on the speed of monetary policy transmission (e.g. Hannan and Berger, 1991; Cottarelli and Kourelis, 1994; Mojon, 2000). Given the substantial differences in concentration of different items of banks' balance sheets, the broad brushed concentration indices used in the previous literature [15] almost certainly were a poor indicator of concentration relevant for the pass through to a specific interest rate. In addition, the rejection of the Cournot model for time and savings deposits in this paper complements Mojon's (2000) finding that deregulation matters for monetary transmission to deposits, but not to lending rates. The results presented here would suggest that competition has been adversely affected by concentration in lending markets, offsetting the effect of deregulation. In contrast, for deposits, the increasing concentration has not had this effect and deregulation appears to have had the desired effect of increasing competition. Hence, deregulation is found to have some effect on the speed of monetary policy transmission in case of deposits, but not loans.

6. Robustness and extensions

The previous specifications have been estimated with product specific effects. While our specification tests did not reject the model, we were concerned that our estimates at least in part could be driven by country specific differences, for example in the regulation of banks, tastes and other factors. Hence, we re-estimated the models 2 and 3 with country specific effects. These results are reported in Table 7 (models 4 and 5). Note that the insignificance of the Lagrange Multiplier tests suggests that in case of country specific effects, the model should be estimated with fixed effects. This finding is quite intuitive and simply points to structural country specific differences that remained constant throughout our relatively short sample period. The results are strikingly similar to those obtained before, not only in terms of econometric significance, but also in terms of economic magnitude. As a further robustness test, we estimated a two factor random effects model, allowing for random effects both across markets and countries (model 6). Again, we find results that are virtually indistinguishable from those obtained previously.

We also wanted to examine the role of the control variables more closely, especially those for demand conditions. We found the weak effect of the consumer and producer confidence indices in the previous specifications quite puzzling. We were concerned that the failure to properly account for demand conditions may have

[15] Cottarelli and Kourelis (1994), for example, use the market share of the five largest banks.

Table 7
Estimation results: robustness and extensions

	Model 4 country specific effects		Model 5 country specific effects		Model 6 product and country specific effects	
Herfindahl index: loans	0.005***	(0.001)				
Herfindahl index: deposits	−0.001	(0.001)				
Herfindahl index: customer loans			0.007***	(0.001)	0.007***	(0.002)
Herfindahl index: long-term loans			0.001	(0.001)	0.001	(0.001)
Herfindahl index: mortgage loans			0.011***	(0.002)	0.012***	(0.001)
Herfindahl index: short-term loans			0.005***	(0.001)	0.005***	(0.001)
Herfindahl index: demand deposits			0.007***	(0.001)	0.007***	(0.001)
Herfindahl index: savings deposits			−0.01***	(0.003)	−0.014***	(0.004)
Herfindahl index: time deposits			−0.005***	(0.001)	−0.005***	(0.001)
Problem loans	−0.027	(0.093)	0.090	(0.081)	0.136**	(0.071)
Problem loans missing	−0.306	(0.298)	0.095	(0.264)	0.228	(0.223)
Cost to income ratio	−0.0002	(0.006)	−0.002	(0.004)	−0.002	(0.005)
Producer confidence	0.014	(0.014)	−0.006	(0.01)	−0.004	(0.009)
Consumer confidence	−0.018	(0.013)	0.009	(0.012)	−0.023**	(0.01)
Stock market capitalisation/GDP	−0.009***	(0.003)	−0.007***	(0.002)	−0.006**	(0.002)
Total assets/GDP	0.002	(0.002)	0.002*	(0.001)	0.002*	(0.001)
N	246		246		246	
Wald statistic[a]	131.3***		326.6***		272.8***	
Lagrange multiplier test[b]	1.27		0.41			
Hausman test[c]	16.2		13.8			

Models 4 and 5 were estimated using fixed effects across countries, Model 6 is a two factor random effects model with effects across markets and countries. Standard errors in parenthesis were corrected for heteroskedasticity. *, **, *** indicates significance at the 10%, 5%, and 1% level, respectively. The dependent variable is the contractual interest margin in market i and country c. The phrase "Herfindahl index: deposits" represents the Herfindahl index multiplied by an indicator, which takes on 1 if the market is a deposit market (i.e. demand, savings or time deposits). "Herfindahl index: loans" represents the Herfindahl index multiplied by an indicator, which takes on 1, if it is a loan market (i.e. customer, long-term, short-term or mortgages).

[a] Test of joint significance of all independent variables. Test is distributed $\chi^2(k)$, where k is the number of independent variables.

[b] Significance suggests that a random effects model may be more appropriate.

[c] Significance suggests that a fixed effects model may be more appropriate.

generated some spurious results. In order to refine our analysis, in model 7 in Table 8, we allow the slopes of all other control variables to differ for deposits and loans. [16] We are especially curious whether the effect of demand conditions differs for the two product categories. We argued in Section 3 that consumer and producer confidence indices should generally be associated with a higher demand for loans and deposits (hence higher margins). Model 7 suggest, however, that higher producer confidence is associated with lower deposit margins and has no significant effect on loan

[16] We did not allow for different slopes across deposits and loans for our measure of risk, as we were faced with a lot of missing values for this variable and did not want to stretch the data too far.

Table 8
Estimation results: the role of demand proxies

	Model 7 product specific effects		Model 8 product specific effects		Model 9 product and country specific effects	
Herfindahl index: loans			0.0036***	(0.001)	0.003***	(0.001)
Herfindahl index: customer loans	0.006***	(0.002)				
Herfindahl index: long-term loans	0.0012	(0.002)				
Herfindahl index: mortgage loans	0.009***	(0.002)				
Herfindahl index: short-term loans	0.003*	(0.002)				
Herfindahl index: demand deposits	0.008***	(0.001)	0.009***	(0.001)	0.009***	(0.001)
Herfindahl index: savings deposits	−0.002	(0.003)	−0.002	(0.004)	−0.002	(0.004)
Herfindahl index: time deposits	−0.003***	(0.001)	−0.003***	(0.001)	−0.003***	(0.001)
Problem loans: loans	0.151*	(0.080)	0.021	(0.060)	0.060	(0.079)
Problem loans: deposits	−0.027	(0.079)	−0.04	(0.091)	−0.076	(0.069)
Problem loans missing	−0.106	(0.211)	−0.051	(0.219)	−0.425**	(0.189)
Cost to income ratio			−0.003	(0.005)	−0.003	(0.005)
Cost to income ratio: loans	−0.007	(0.006)				
Cost to income ration: deposits	−0.003	(0.008)				
Producer confidence: loans	−0.003	(0.013)			0.001	(0.014)
Producer confidence: customer loans			−0.01	(0.020)		
Producer confidence: long-term loans			0.039*	(0.023)		
Producer confidence: mortgage loans			0.005	(0.026)		
Producer confidence: short-term loans			0.025	(0.022)		
Producer confidence: deposits	−0.027**	(0.012)				
Producer confidence: demand deposits			−0.020	(0.020)	−0.018	(0.020)
Producer confidence: savings deposits			−0.061**	(0.026)	−0.059***	(0.027)
Producer confidence: time deposits			−0.020*	(0.012)	−0.017	(0.012)
Consumer confidence: loans	−0.034***	(0.013)			−0.027**	(0.013)
Consumer confidence: customer loans			−0.056***	(0.017)		
Consumer confidence: long-term loans			−0.019	(0.018)		
Consumer confidence: mortgage loans			−0.032**	(0.016)		
Consumer confidence: short-term loans			0.051***	(0.016)		
Consumer confidence: deposits	0.015	(0.013)				
Consumer confidence: demand deposits			−0.062***	(0.017)	−0.066***	(0.017)
Consumer confidence: savings deposits			0.027	(0.026)	0.024	(0.027)
Consumer confidence: time deposits			0.02**	(0.01)	0.013	(0.011)
Stock market capitalisation/GDP: loans	−0.008***	(0.003)	−0.008***	(0.003)	−0.010***	(0.003)
Stock market capitalisation/GDP: deposits	−0.006**	(0.003)	−0.006***	(0.002)	−0.005**	(0.002)
Total banking assets/GDP: loans	0.006***	(0.002)	0.006***	(0.001)	0.006***	(0.001)
Total banking assets/GDP: deposits	−0.003	(0.002)	−0.001	(0.002)	−0.000	(0.001)
N	246		246		246	
Wald statistic[a]	533.2***		622.9***		601.8***	

(*continued on next page*)

Table 8 (*continued*)

	Model 7 product specific effects	Model 8 product specific effects	Model 9 product and country specific effects
Lagrange multiplier test[b]	45.4***	31.2***	
Hausman test[c]	408.4***	22.6	

Models 7 and 8 were estimated using random effects across products, Model 9 is a two factor random effects across markets and countries. Standard errors in parenthesis were corrected for heteroskedasticity. *, **, *** indicates significance at the 10%, 5%, and 1% level, respectively. The dependent variable is the contractual interest margin in market i and country c. The phrase "Herfindahl index: deposits" represents the Herfindahl index multiplied by an indicator, which takes on 1 if the market is a deposit market (i.e. demand, savings or time deposits). "Herfindahl index: loans" represents the Herfindahl index multiplied by an indicator, which takes on 1, if it is a loan market (i.e. customer, long-term, short-term or mortgages).

[a] Test of joint significance of all independent variables. Test is distributed $\chi^2(k)$, where k is the number of independent variables.

[b] Significance suggests that a random effects model may be more appropriate.

[c] Significance suggests that a fixed effects model may be more appropriate.

margins. For consumer confidence we find the reverse, i.e. a significant negative relationship in loan margins and no relationship to deposit margins. For some other control variables we find some interesting and intuitive differences for loans and deposit margins. For example, the share of total assets of the banking system in GDP, which we used as a proxy for the degree of "bank dependency" of the economy, is only significantly related to loans and not to deposits. It appears, and this is perfectly consistent with the other findings in this paper, that banks can extract higher margins in loan markets, if firms have less access to alternative, non-bank sources of finance. Finally, even when allowing for different coefficients for loans and deposits, we still do not find costs as measured by the cost to income ratio to matter for margins in either product category. [17]

To disentangle the effect of demand conditions on margins further, we allowed for different slopes by individual markets for consumer and producer confidence in model 8. In order to save on degrees of freedom, we permit different slopes in the Herfindahl index across products only for deposits (where we found these differences to be important) and also eliminate the differential slopes for the cost to income ratio. We continue to find largely insignificant effects of producer confidence on loans. [18] In the case of deposits, we find that higher producer confidence is associated with lower margins of savings and time deposits. If we assume that higher producer confidence is associated with more profitable investment opportunities, the result suggests that firms retain funds in relatively liquid time and savings deposits and withdraw them to invest at a time when they are more confident. In case of consumer confidence, our results suggest that high consumer confidence is associated with lower demand for mortgages, and higher demand for short-term loans, as well

[17] We again experimented with different cost measures, including the ratio of operating costs to deposits, but found similar results and unchanged coefficients on the Herfindahl index.

[18] Higher producer confidence is significantly related to higher margins for long-term loans.

Table 9
Estimation results: interest rate dynamics

	Model 10 product specific effects		Model 11 product specific effects	
Herfindahl index: loans	0.003***	(0.001)	0.002**	(0.001)
Herfindahl index: demand deposits	0.006***	(0.001)	0.006***	(0.001)
Herfindahl index: savings deposits	−0.003*	(0.002)	−0.004	(0.002)
Herfindahl index: time deposits	−0.003***	(0.001)	−0.004***	(0.001)
Treasury bill rate	0.226***	(0.038)		
ΔTreasury bill rate	−0.123*	(0.063)		
ΔTreasury bill rate$_{t-1}$	0.025	(0.066)		
Government bond rate			0.243***	(0.053)
ΔGovernment bond rate			−0.067	(0.07)
ΔGovernment bond rate$_{t-1}$			−0.129*	(0.634)

Standard errors in parenthesis were corrected for heteroskedasticity. *, **, *** indicates significance at the 10%, 5%, and 1% level, respectively. The dependent variable is the contractual interest margin in market i and country c. The model contains the same independent variables as model 8. Full results are available from the authors upon request.

as lower demand for demand deposits, and higher demand and time deposits. All of these effects are significant at least at the 5% level.

Finally, one could argue that our finding of higher concentration being associated with higher lending margins, but not associated with higher time and savings deposit margins might be the spurious consequence of neglecting interest rate dynamics in the estimation. This possibility arises because during the period under study (1993–1999) the levels of interest rates were falling in most countries in the euro area. [19] In the literature, it is often found that in the context of falling market rates, retail deposit rates generally fall rapidly, but lending rates are reduced only slowly (see e.g. Hannan and Berger, 1991). This could have resulted in a widening of lending margins over time. As concentration was also generally increasing during the same period, our estimates may suffer from some spurious correlation. [20] Given our short panel and our use of annual balance sheet variables, we did not attempt to fully recover interest rate dynamics. Instead, we included the level, change and lagged change of a market interest rate as independent variables and re-estimated the model. If our coefficients indeed suffer from spurious correlation of the sort outlined above, they should be significantly reduced, as the additional explanatory variables should pick up the downward trend in the level of interest rates. Table 9 presents the results for this exercise using the treasury bill rate or the long-term government bond rate as indicators of market rates. We report only coefficients relating to

[19] This falling trend in the levels of rates was a consequence of the convergence of rates to the lower German level in the wake of the introduction of the common currency.

[20] This argument, of course, ignores the fact that our data set encompasses not only time series, but also cross-sectional variation. It turns out that in all models reported in Tables 6–8, the cross-sectional explanatory power is quite high (generally higher than the time series dimension), which could be taken as preliminary evidence against this point.

concentration and to the new independent variables for brevity. We find that our results are robust to controlling (at least in this relatively crude way) for the downward interest dynamics during our sample period. [21]

In summary, our two main results, namely that higher concentration in loan markets and in demand deposits may be associated with collusion and non-competitive behaviour, and that we find no evidence of that in time and savings deposits, are robust to more careful specifications of demand conditions and other control variables.

7. Conclusion

The recent wave of mergers in the euro area raises the question, whether the increase in concentration has at least in part offset the increase in competition in European banking through deregulation. We test this question by estimating a simple Cournot model of bank pricing. We construct country and product specific measures of bank concentration and relate them to their corresponding contractual interest rate. We find that concentration may have substantially different effects, depending on the type of product under consideration. Moving from a moderately concentrated banking market (e.g. Belgium) to a highly concentrated one (e.g. The Netherlands), for loans our results suggest that increasing concentration has increased banks' margins by 100–200 basis points, controlling for a wide variety of other factors. This supports the structure performance hypothesis, which suggests that higher market concentration will result in collusion. A similar result is obtained for demand deposits, where higher concentration is also associated with higher margins. In contrast, for savings and time deposits, we find that higher concentration (again comparing Belgium to The Netherlands) results in margins, which are 100–200 basis points lower in more concentrated markets.

Why do we find these differences in the response to increases in concentration? Our data only give limited insights regarding this question, but a number of points appear plausible given our econometric results. Concentration in the market for demand deposits may result in less favourable terms for the customers, as demand for demand deposits may largely be determined by geographical proximity. Hence, it is relatively costly for firms and households to shop around for demand deposits outside their local market. Concentration in the market for loans may insofar enable banks to collude, as loans may be a particularly information intensive product (e.g. Caminal and Matutes, 1997; Fischer, 2000). If banks particularly familiar with the local economy have a comparative advantage in generating this information, they may use this advantage to extract rents from borrowers. Alternatively, the higher

[21] Also, the coefficients on the interest rate variables are quite plausible, as a higher level of interest rates is associated with larger margins and a downward adjustment of market interest rates is also associated with higher margins. This is in line with the previous literature (i.e. Hannan and Berger, 1991) in the sense that it points towards a sluggish adjustment of retail rates when market rates are falling.

margins may reflect that firms with lower quality may have access to credit in a more concentrated market, as was pointed out in Peterson and Rajan (1995). Hence, the higher interest rates may not necessarily suggest collusion, but may reflect differences in credit quality that we are unable to fully control for.

Finally, we would argue that the reason we find no evidence of collusion in more concentrated markets for savings and time deposits relates to their nature as investments. Unlike demand deposits, savings and time deposits do not require geographical proximity of the supplier, rather firms and households may be willing to incur the relatively small costs of shopping outside their local market for higher interest rates. For these bank products, therefore, contestability, which are not able to explicitly measure and which may be positively correlated with concentration, may play a much greater role.

While the annual frequency of balance sheet variables, which we used to calculate our measures of concentration and the relatively short time series dimension of our data did not permit us to conduct tests of the effect of concentration on monetary policy transmission, we would argue that the results can at least in part shed some light on the mixed previous evidence on the topic (Hannan and Berger, 1991; Cottarelli and Kourelis, 1994; Mojon, 2000). One, our results suggest that measures of concentration need to be more differentiated, in particular by product category. Second, the differential effects of concentration on retail interest rate margins suggest in turn that increases in concentration may affect the speed of monetary policy transmission to different retail interest rates quite differently. Our findings would imply that, ceteris paribus, the transmission to lending rates may become increasingly more sluggish as concentration increases, while no such effect should be observable to time and savings deposits.

While we find our results quite plausible, the level of disaggregation of the data does not permit formal tests in this regard. Nevertheless, they are strongly suggestive that it may be important to analyse credit and deposit markets in a more differentiated fashion. Broad statements that banks operate in a more or less competitive environment almost surely will need to be differentiated. This paper suggests that the ongoing process of consolidation in the banking systems in the euro area countries may substantially reduce competition, especially in product markets where geographic proximity or informational asymmetries are important, while contestability may have substantially increased in others.

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Appendix A. Intermediate steps in obtaining Eq. (7a) from Eq. (6)

Recall that the first order condition from the bank's profit maximisation problem was

$$\frac{\partial \Pi_k}{\partial r_k} = (1-\mu_k)L_k + (1-\mu_k)r_k \frac{\partial L_k}{\partial r_k} - \frac{r_D}{(1-\alpha_k)} \frac{\partial L_k}{\partial r_k} = 0.$$

Using (1b) we obtain

$$\frac{\partial \Pi_k}{\partial r_k} = (1-\mu_k)L_k + (1-\mu_k)r_k\left(-b - \frac{B}{n^2}\right) - \frac{r_D}{(1-\alpha_k)}\left(-b - \frac{B}{n^2}\right) = 0.$$

Invoking the equilibrium condition (2) and assuming symmetry (i.e. identical sized banks) we obtain

$$\frac{\partial \Pi_k}{\partial r_k} = (1-\mu_k)\frac{(B_0 - r_k B)}{n} + (1-\mu_k)r_k\left(-b - \frac{B}{n^2}\right) - \frac{r_D}{(1-\alpha_k)}\left(-b - \frac{B}{n^2}\right) = 0.$$

Rearranging yields

$$r_k(1-\mu_k)\left(b + \frac{B}{n^2} + \frac{B}{n}\right) = (1-\mu_k)\frac{B_0}{n} + \frac{r_D}{(1-\alpha_k)}\left(b + \frac{B}{n^2}\right).$$

By multiplying both sides with n and solving for r, we obtain Eq. (7a) in the paper:

$$r_k = \frac{B_0}{(nb + B + B/n)} + \frac{r_D}{(1-\mu_k)(1-\alpha_k)} \frac{(nb + B/n)}{(nb + B/n + B)}.$$

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