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A MODEL OF BANKING COMPETITION**
- Finnish experiences during the deregulation of financial markets

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ABSTRACT: The aim of the study was to form a banking competition model by means of which features of competition and monetary-policy regulation typical of the period of deregulation can be analysed. The goal was in particular, to construct a model which would take the structural features of banking into consideration. It was also considered important to build a model by means of which competition between more than two banks could be simulated numerically.

The model considers, on the basis of competitive equilibrium solutions (Nash-Cournot equilibrium), competition between several banks for market shares. The model considers the household sector and the corporate sector as separate market segments. Deposit retention plays a central role in the household sector. The impacts of differences in operating costs and returns on market shares are also analysed by the model. Judging from the model, the structural change in the banking sector may amount to changes in market shares.

KEYWORDS: Banking competition, deregulation, Finnish financial markets

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TIIVISTELMÄ: Työn tarkoituksena on ollut tutkia Suomen pankkikilpailun ja myös rahapoliittisen ohjauksen piirteitä rahoitusmarkkinoiden säännöstelyn purkautumisen aikana. Erityisesti haluttiin rakentaa malli, jossa voitaisiin simuloida numeerisesti usean pankin markkinaosuuskilpailua.

Malli perustuu Nash-Cournot -kilpailutasapainon idealle. Mallissa on erotettu kotitaloussektorilla ja yrityssektorilla käytävä kilpailu toisistaan. Kotitaloussektorin osalta talletuspalautumalla on keskeinen rooli. Kysynnän ei oleteta rajoittavan luottoekspansiota tällä sektorilla. Simulointien avulla on tutkittu myös pankkien välisien kustannus- ja tuottorakennepoikkeamien vaikutuksia markkinaosuuksiin. Mallin valossa voi odottaa pankkisektorin rakennemuutoksen ja kiristyvän kilpailun merkitsevän myös markkinaosuuksien muutospaineita.

ASIASANAT: Pankkikilpailu, deregulaatio, Suomen rahoitusmarkkinat

Paavo Okko - Eero Kasanen

A Model of Banking Competition
Finnish experiences during the deregulation of financial markets

1. INTRODUCTION

The process of change in financial markets has in recent years been analysed in a variety of ways. Of banking competition, too, game-theoretic research, i.a., has been published.[1] A further topic which has been received increasing attention is the efficiency of financial intermediation under changing competitive conditions.[2] The aim of the present study was to form a banking competition model by means of which a picture could be formed of the features of competition and monetary-policy regulation typical of the period of deregulation of financial markets. The goal was in particular, to construct a model which would take the structural features of banking into consideration. It was also considered important to build a model by means of which competition between more than two banks could be simulated numerically, so as to obtain a picture of the features of the Finnish banking market. A central aim has thus been to consider by means of a simulation model the structural challenges arising under the conditions of deregulation of the banking sector.

In Finland, too, an increase in the financial intermediation through markets and a decrease in the interest-rate and other kinds of regulation of banking has been characteristic of the process of change of financial markets. Nevertheless, Finnish financial markets are still rather bank-centred. So far there are experiences of application of the market principle only for a rather short period of time, and features of previous direct rationing are perceptible even in the most recent monetary policy measures. Today the so called administrative interest rate has significance exclusively in the case of traditional tax-free deposits, the rate on interest on which is markedly below that of the funds raised on market terms. It can be maintained, nevertheless, that the deductibility of interest payments in income taxation (up to a specified limit) amounts to subsidizing price formation, so that price formation in accordance with the market principle does not work efficiently even on the credit market side.

Credits to the household sector consist of two main types: consumer credits linked to the (Helibor = Helsinki inter-bank offered rate) market rate and housing credits,

[1] See, e.g., Lehto (1987) and Mustonen (1987).

[2] See, e.g., Alhonsuo (1989) and Vihriälä (1989) and Alhonsuo-Tarkka (1989).

the interest rates on which are slightly lower and linked at least partly to the base rate of the central bank (or are fixed). The bulk of banks' returns other than interest income (i.e., commissions on bank guarantees, income on foreign exchange dealings etc.) is due to the corporate sector. In the case of commercial banks, these other returns currently form a larger income item than interest income. For local banks, interest income means relatively much more (65 to 70%). Banks' activities have also organizationally been diversified for competition in the personal customer sector, on the one hand, and the corporate customer sector, on the other. The administrative interest-rate-formation and the market-based interest-rate-formation sectors are no longer distinctly separate (as they were during the period of transition).

The current situation can be described by saying that success in the household sector will safeguard advantageous funding, and success in it can be secured by granting credits to this sector. The average rate of interest on total funding in Finnish currency was about 7% at the end of 1988,[3] at the same time that the interest rate on standard deposits was 3.75%. Since the beginning of this year, the highest tax free rate of interest on normal-terms deposits has been 3.5% (base rate minus 4 percentages).

Deposit retention plays a central role in the model. It is assumed that there is enough demand for credits (elasticity is infinite) in the household sector, and both credit expansion and deposit expansion are largely determined through credit supply competition between banks. In this respect the model reminds of the credit rationing situation. Recent experiences in Finland suggest, however, that the present after-tax market rate of consumer advances still means a price level at which excess demand for credit prevails.[4] The quite recently concluded agreement between the central bank and the banks on restricting growth in the credit stock is interesting from the viewpoint of the competitive situation. This is because it simultaneously amounts to the fixation of banks' credit market shares.

Success in the corporate customer sector will reinforce the banks' returns structure, the interest margin contracting along with competition.[5] In this sector it is necessary for the banks to be able to develop services (corporate financing, foreign operations, new forms of financial investments, etc.) in order to increase

[3] See Vihriälä (1989).

[4] The nominal annual growth rate of bank lending was about 25% in 1988; see e.g., Bank of Finland (1989), p. 33.

[5] In the case of new credits, at least, the interest margin seems to have decreased since the deregulation on interest rates; Vihriälä (1989), p. 84. It is expected to decrease further, as a result of competition.

their returns other than interest income. The marketing expenditures included in the model have reference to precisely this kind of activity. Also, variable operating costs have been included in the model, in order to make it possible to simulate the effects of the cost structure.

The principal instrument employed by the central bank in its monetary policy, i.e., the cash reserve deposits and the money market rate of interest, are involved in the model. It may thus also be used to examine the effects of monetary policy on credit and deposit expansion and on competitive relations between the banks.

2. THE BANK COMPETITION MODEL

21. The nature of the model and the assumptions involved

A bank competition model possessing features already described above was constructed in such a way that, in the case of each bank, the sectors of banking business were assumed to be the household sector, on the one hand, and the corporate sector, on the other. In the first sector the banks are competing by means of lending. The average interest rate level is determined by the market, despite the fact that price may still to some extent vary from customer to customer. The demand for credit is not assumed to limit credit expansion. A so-called deposit retention effect is associated with credits, and in the basic form of the model it is assumed to be typical of the whole bank system and equal in strength for each individual bank. The lending rate for the corporate sector is also a market price, but banks are assumed to be able to charge different prices for the banking services rendered to this sector, because the services they offer also display qualitative variation.

Basically in this model, competition relates to deposit market shares and shares in the corporate sector. In the corporate sector the market under competition thus involves, as a matter of fact, also things other than credit. It includes the sale of services, which leads to returns additional to interest income. The total credit stock in the corporate sector is assumed to be an exogenous and (on basis of the interest rate and other similar factors) predictable variable. The model includes no explicit demand function for the market.

Alternative assumptions of the nature of competition can be made in the model, regarding the sensitivity of the market shares to changes in the competition parameters (if $a^{D,L} = 0$, the old market shares will dominate and if $a^{D,L} = 1$, the initial market shares do not restrict the final outcome at all).

Banks differ from each other with respect to their initial market shares, cost structures and returns. The costs consist of the variable costs dependent on the amounts of credit, the marketing expenditures and fixed costs. Simulation experiments have also been made with bank-specific deposit retention functions and with bank-specific average deposit rates.

In building this model the intention was to make it possible at least roughly to utilize empirical input data of kind that would justify considering the simulations to reflect main structural features of the Finnish banking market. The results thus admit interpretations related to Finland. This has been a more important objective than, say the analysis of game-theoretic structures.

22. The structure and solution of the model

The balance of bank i is written in a simplified form as:[6]

$$L_i^Y + L_i^K + k\,D_i = D_i + R_i\,. \qquad (1)$$

On the asset side of the balance, only the advances to the household and the corporate sector and the cash reserve deposits are considered. The liabilities side reduces to traditional deposits and net borrowing from the money market, the latter meaning the net amount of money market items (R_i).[7] It also includes the possible central bank debt.

The deposit retention function ties advances and deposits to each other:

$$D^K = D_0 + d\sum L_j^K \qquad (2)$$

The instruments of competition for deposits consist of the initial market shares and the advances to the household sector:

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[6] For the theory of bank models, see, e.g., Tobin (1982). For analyses of a single-bank case meant for Finnish conditions, see, e.g., Okko (1987) and Airaksinen (1987).

[7] This kind of situation has been typical at least for banks other than Postipankki; see, e.g., Airaksinen (1987).

$$D_i = \left[a^D m_i^D + \left(1-a^D\right) \frac{L_i^K}{\Sigma L_j^K} \right] D^K \quad . \qquad (3)$$

The instruments of competition for corporate sector customers consist of the initial market shares in the corporate sector:

$$L_i^Y = \left[a^L m_i^L + \left(1-a^L\right) \frac{M_i}{\Sigma M_j} \right] L^Y \quad . \qquad (4)$$

For the profit of bank i we have:

$$\Pi_i = \left(r_L^Y + p_i^Y\right) L_i^Y + r_L^K L_i^K - r_D D_i - r_R R_i + r_k k D_i - M_i - c_i\left(L_i^Y + L_i^K\right) - f_i \qquad (5)$$

The parameters involved in the above expressions are as follows:

r_L^Y = the lending rate in the corporate sector (a market price)

p_i^Y = commissions and the other returns (in relation to the corporate lending)

r_L^K =the lending rate in the household sector (a market price)

r_D =the deposit rate (tax free deposits)

r_R =the cost of acquisition of money market funds (money market rate=Helibor)

r_k =the cash reserve deposit rate

k =the cash reserve requirement $(1 > k > 0)$

c_i = variable operating costs of bank i in relation to advances (marketing costs are excluded)

D_0 = autonomous deposits of the household sector

d =the deposit retention parameter (concerning the total banking sector)

f_i = fixed costs of bank i

a^D =the rigidity parameter of change in deposit market shares $(1 \geq a^D \geq 0)$

a^L =the rigidity parameter of change in market shares of advances to the corporate sector $(1 \geq a^L \geq 0)$

m_i^D = the initial deposit market share of bank i

m_i^L = the initial market share of bank i in advances to the corporate sector

L^Y = the anticipated amount of corporate sector credit at the end of the period

The decision variables of bank i:

L_i^K = advances to the household sector

M_i = marketing expenditure on competition for corporate customers

Auxiliary variables:

$L^K = \sum L_j^K$ = the total amount of credits granted to the household sector

R_i = funding from money market

D^K = the total amount of deposits at the end of the period

D_i = deposits of bank i

L_i^Y = the amount of credits granted (and banking services sold) to the corporate sector

M = the total of banks' marketing expenditures

$j = 1...n$.

From (1) to (5) the profit of bank i can be solved as a function of the decision variables (6):

$$\Pi_i = r_i^Y\left[a^L m_i^L + (1-a^L)\frac{M_i}{\sum M_j}\right]L^Y + r_i^K L_i^K - r^D\left[a^D m_i^D + (1-a^D)\frac{L_i^K}{\sum L_j^K}\right]\left(D_0 + d\sum L_j^K\right) - M_i - f_i$$

where:

$$r_i^Y = r_L^Y + p_i^Y - c_i - r_R \qquad (7)$$

$$r_i^K = r_L^K - r_R - c_i \qquad (8)$$

$$r^D = r_D - k\,r_k - r_R(1-k). \qquad (9)$$

Finally, (6) can be written in the simplified form:

$$\Pi_i = \alpha_i \frac{M_i}{\sum M_j} + \beta_i L_i^K + \gamma_i \sum L_j^K + \delta \frac{L_i^K}{\sum L_j^K} - M_i - \varepsilon_i \qquad (10)$$

where:

$$\alpha_i = r_i^Y\left(1\text{-}a^L\right) L^Y \qquad (11)$$

$$\beta_i = r_i^K - r^D\left(1\text{-}a^D\right) d \qquad (12)$$

$$\gamma_i = -r^D a^D m_i^D d \qquad (13)$$

$$\delta = -r^D\left(1\text{-}a^D\right) D_0 \qquad (14)$$

$$\varepsilon_i = r_i^Y a^L m_i^L L^Y - r^D a^D m_i^D D_0 - f_i \quad \text{(involving constants).} \qquad (15)$$

The condition of optimum solution (competitive equilibrium) for the banks are:

$$\frac{\partial \Pi_i}{\partial L_i^K} = \left(\beta_i + \gamma_i\right) + \delta \frac{\sum_{j \neq i} L_j^K}{\left(\Sigma L_j^K\right)^2} = 0 \quad \text{, for all i and} \qquad (16)$$

$$\frac{\partial \Pi_i}{\partial M_i} = \alpha_i \frac{\sum_{j \neq i} M_j}{(\Sigma M_j)^2} - 1 = 0 \quad \text{, for all i.} \qquad (17)$$

By summing over all banks we obtain from (16) the total advances to the household sector, involved in the equilibrium solution:

$$L = \Sigma L_j^K = \frac{-\delta\,(n - 1)}{\Sigma\left(\beta_j + \gamma_j\right)} \quad , \qquad (18)$$

whence, further, we obtain the household-credit market shares:

$$\frac{L_i^K}{L} = \left(\frac{\beta_i + \gamma_i}{\delta}\right)\left(\frac{-\delta(n-1)}{\Sigma\left(\beta_j + \gamma_j\right)}\right) + 1. \qquad (19)$$

Correspondingly, from (17) the total marketing expenditures in the corporate sector is obtained by summing:

$$M = \Sigma M_j = \frac{n - 1}{\Sigma\left(\frac{1}{\alpha_j}\right)} . \qquad (20)$$

From this, the marketing expenditures share of bank i is obtained:

$$\frac{M_i}{M} = 1 - \frac{n - 1}{\alpha_i \Sigma\left(\frac{1}{\alpha_j}\right)}. \qquad (21)$$

Corporate sector credit market shares are then determined correspondingly, in equilibrium, as the ratio of the initial market share to the marketing expenditures:

$$L_i^Y = \left[a^L m_i^L + \left(1\text{-}a^L\right)\left(\frac{M_i}{M}\right)\right] L^Y. \qquad (22)$$

With a view to analysing the nature of the competition solutions, the computation the each bank's deposit stock is included in the simulation programme:

$$D_i = \left[a^D m_i^D + \left(1\text{-}a^D\right)\left(\frac{L_i^K}{L}\right)\right](D_0 + dL) \qquad (23)$$

and its funding from the money market, which can be solved from the balance sheet:

$$R_i = L_i^Y + L_i^K + k\,D_i - D_i\ . \qquad (24)$$

In order to find out the nature and contents of the equilibrium solution obtained, the banks' profits, i.a., are included in the output data (see Appendix 1).

In spite of the simplifications made, the model includes many features interesting from the viewpoint of banking competition. The intention has been to use it particularly as means of numerical simulations. This is why analytical interpretations of the optimization solutions are not very largely dealt with here, but instead, certain observations on the numerous simulations performed will be presented.

3. ON FEATURES OF BANKING COMPETITION IN THE LIGHT OF NUMERICAL RESULTS

31. General features of the model from the viewpoint of the determination of market shares

The general assumptions of central importance include one concerning the friction associated with changes in the market shares, or the rigidity parameters (a), and, as regards the household sector, the one concerning the strength of deposit retention. The first can be interpreted as associated with the length of time horizon: if a is close to unity, this means a short-term assumption, because the initial market shares will predominate; and if a = 0, long-term analysis is concerned, since competition will divide the market without the burden of history. Particularly with regard to the corporate sector the behaviour of the model is clear-cut in this respect. As for the household sector, the matter is complicated by the strength of deposit retention, which is co-determined by the behaviour of the customers and the character of the credit markets.

Let us consider first the impact of the rigidity parameter in the case of corporate sector. On the assumption that interest income and other returns and costs are same for all banks, the model ends in an equal division of the market between the banks in the long run (a=0), as is seen from Figure 1. In the figure, the case of four banks in considered, where the market shares finally settle at the 25% level.

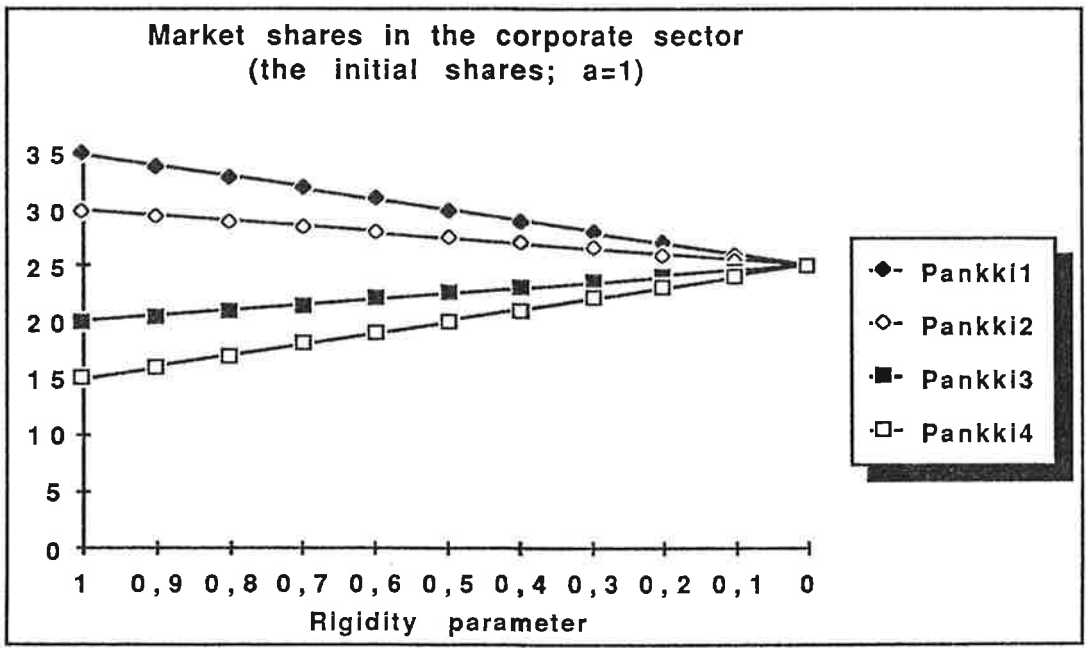

Figure 1. Corporate sector market shares as a function of the rigidity parameter

In the case of household sector the division of the market is as stated above, essentially affected not only by the rigidity parameter but also by the assumption to be made about the strength of deposit retention. This is because *an equal division of the market will invariably result*, according to the model, *if either the rigidity parameter or deposit retention is equal to zero*. This, too, relates to the cases where the banks' cost and return structures are identical, as was also assumed above. The result of a certain simulation of a four-bank case is illustrated in Figure 2. What is concerning is the division of the household sector credit market between the banks. The initial market shares used as input data thus relate to deposit market shares.

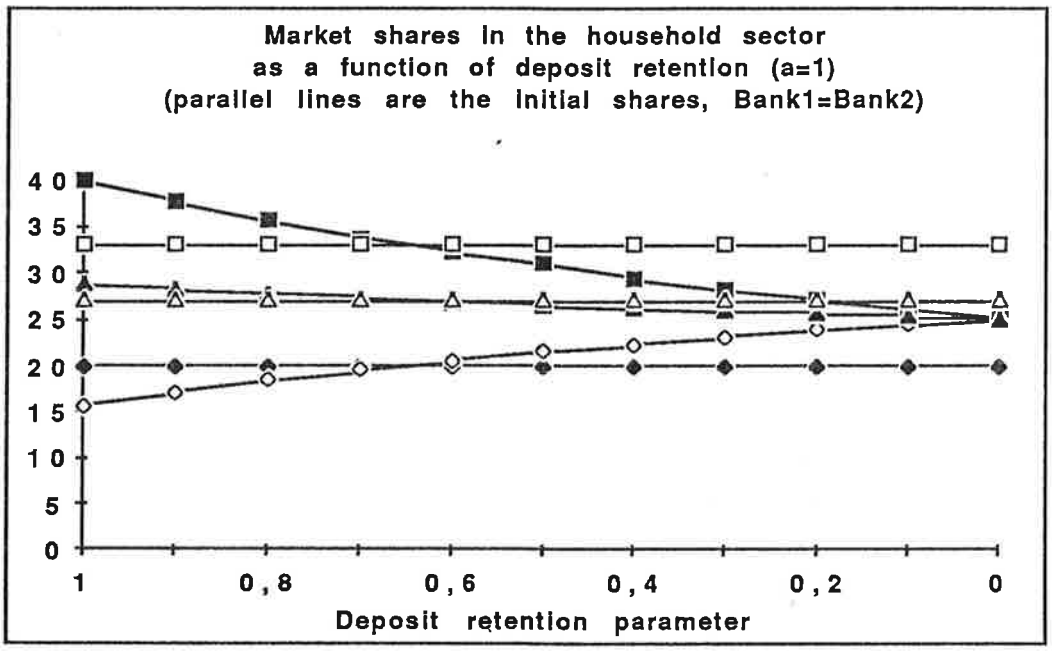

Figure 2. Market shares in the household sector as a function of the deposit retention parameter

The result is unexpected in the sense that, even if the rigidity parameter were close to unity, a high value of deposit retention will tend increase the initial market share differences. The banks that are initially below the final equilibrium level (here, 25%) will fall lower still and those that are initially above it will rise higher. These solutions are "unrealistic", however, because of the values of the other variables involved are not all feasible. If either the rigidity parameter or (as in the figure) deposit retention is approaching zero, an equal-division situation result. In the figure four banks are dealt with in such a way that banks 1 and 2 are equal in size, the initial deposit market shares being 20%, 20%, 27% and 33% respectively.

32. On the nature of competition for the household sector market shares

It he basic solution of the model deposit retention is postulated to be the same in the whole banking sector. Of significance for bank competition are, however, the possible differences between the banks in this respect. Results of two simulations in five-bank case are set out in Appendix 1. In the first, deposit retention is a branch-specific parameter and has the value of 50% (rigidity being also 50%). In the second case (solution II) the d parameter is bank-specific, and it has been assigned values equal to those of the banks' initial deposit market shares. This would, as matter of fact, be consistent with a kind of probability interpretation of how often the credit granted is eventually likely to return to the bank's own accounts as deposits. The assumption used in these simulations about market shares and interest rates and the estimates made of returns other than interest income and variable costs are based roughly on the circumstances that prevailed in Finland at the end of 1988 (particularly interest rates) and during 1987 (particularly market shares). Nevertheless, we do not actually want to name the banks and bank groups in this context, since observational data do not individualize them exactly enough. We regard the results as interesting, however, and we believe that orienting conclusions concerning bank competition in Finland can be drawn from the model.

The results concerning the market shares in the household sector, set out in the Appendix can be summarized as follows:

	Initial shares	Solution I ($d_i = 0.5$)	Solution II ($d_i = m_i^D$)
Bank 1	18	18.63	17.32
Bank 2	17	17.95	16.17
Bank 3	29	26.15	31.05
Bank 4	25	23.41	25.82
Bank 5	11	13.85	9.65
	100 %	100 %	100 %

In all simulations the rigidity parameter of the market is equal to 0.5. It is seen that, in this case too, if deposit retention has been the same value for all banks, competition tends to shift the market shares toward an equal-division situation (here, 20%). The shift is in the same direction both in the credit market shares presented in the table and in the final deposit market shares obtained from the model. On the other hand, if the value of the deposit retention parameter depends on the size of the bank (Solution II: the deposit retention coefficient is postulated to be equal to the initial market share), competition will increase the difference in size between

the banks. Judging by certain empirical studies, distinct differences are likely to exist between banks in deposit retention.[8] Employing retention coefficients consistent with the results of Vihriälä (1988) - i.e., 34%, 36%, 0%, 0%, and 17% - we get (in the case of identical cost structures and when the rigidity parameter is equal to 0.5) the following credit market shares:

			Initial deposit market shares
Bank 1	("Union Bank of Finland")	36.18%	18.0%
Bank 2	("Kansallis-Osake-Pankki")	37.81%	17.0%
Bank 3	("Savings bank group")	3.55%	29.0%
Bank 4	("Cooperative banks")	3.55%	25.0%
Bank 5	("Postipankki")	18.90%	11.0%

Concerning local banks these results are far from the real situation. However, we can see that the credit market shares will distinctly grow increasingly proportional to the respective retention coefficients. The deposit market shares will change in the same direction though not quite so strongly.

33. The impact of differences in costs and returns on competition

Next the assumption of identical cost structures will be abandoned. Judging from the model, the bank whose variable costs in relation to its credit stock are advantageous will increase its market shares, as is apparent from Figure 3.

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[8] See Vihriälä (1988), p. 84. In SYP, KOP and Postipankki deposit retention had the values 0.34, 0.36 and 0.17 respectively, whereas for local banks (savings banks and cooperative banks) it was even negative.

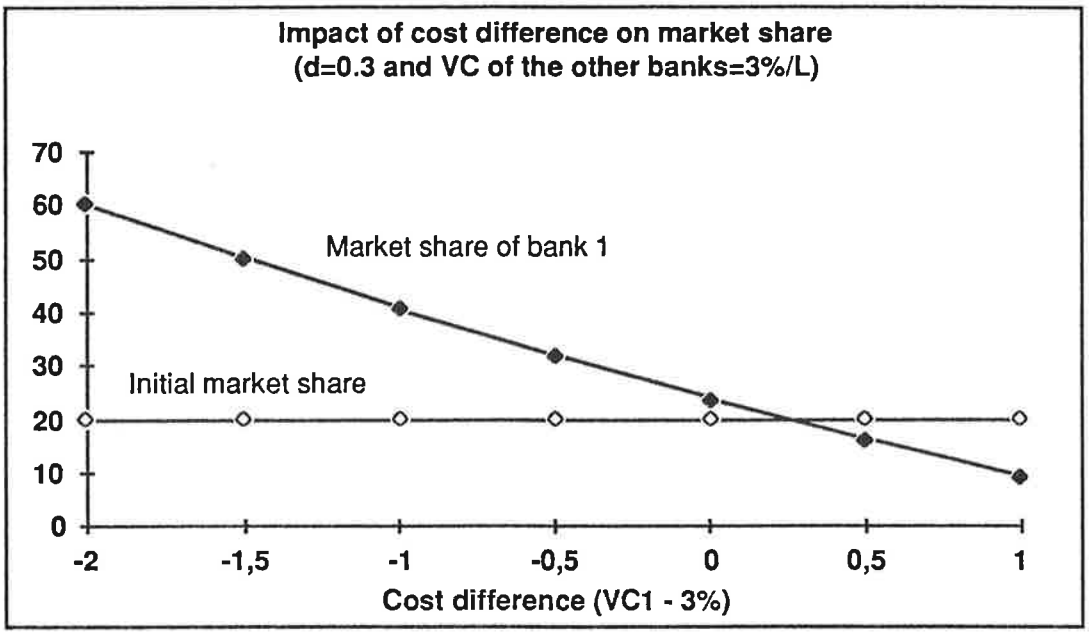

Figure 3. The impact of cost difference on market share

The analysis relates to the household sector market share. The branch-specific deposit retention coefficient is 0.3 and the "propensity to compete" of the market (a) is 0.5. The cost advantage tends rather strongly to raise the market share.

Also, if the returns other than interest income differ in one bank from their general level, this will affect, according to the model, fairly sensitively this bank's corporate sector market share. The direction of this effect is somewhat surprising, as returns that are higher than those of other banks tend to increase this bank's market share. In the model, the size of the corporate sector credit market is exogenously given, so that no demand-side counter-reaction is possible in it, but instead, high returns will increase the bank's competitive power. Figure 4 also reveals that the impact of the difference in returns is the stronger, the less rigid the market is assumed to be.

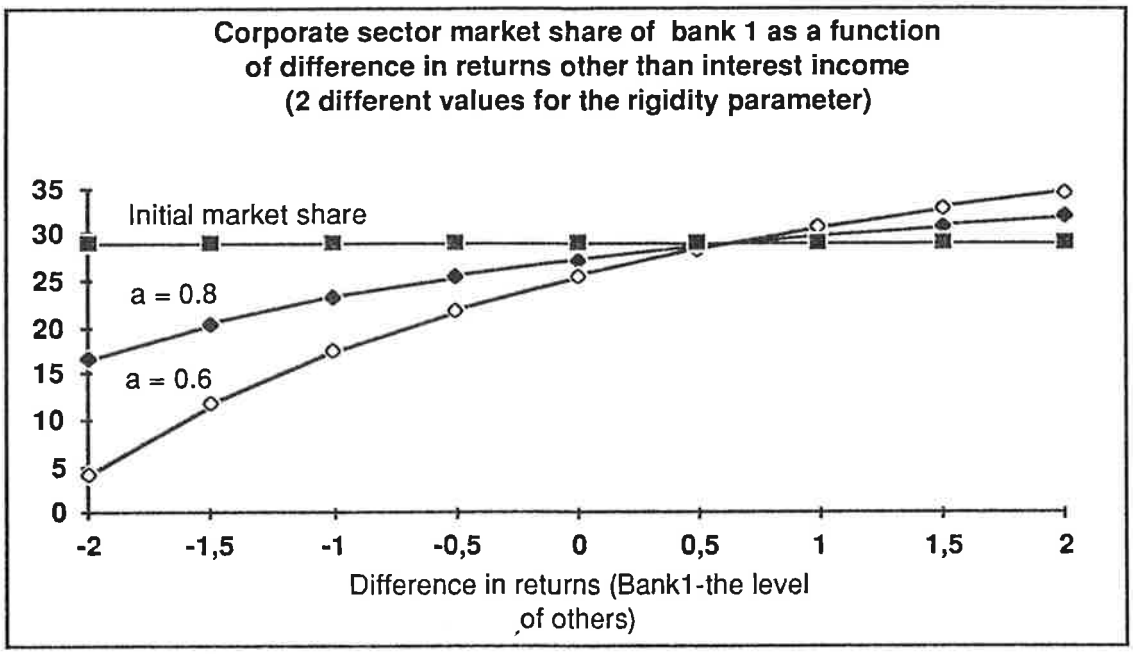

Figure 4. The impact of difference in returns on the corporate sector market share

The interest rate and cost data used in the simulation were here the same as those used in calculations related to the household sector set out in the table presented above. The mutual relationships among the various interest rate and cost factors have a bearing on this result. Also generally, the model cannot produce a solution in a situation where the sum of the amount of interest on corporate credits and other returns is accurately equal to the sum of money market interest rate and variable costs. In the above case the sum of the return side invariably exceeds the sum of costs, or $\left(r_L^Y + p_i\right) > \left(r_R + c_i\right)$. In the opposite case a positive deviation of other returns amounts to a decline in the market share, but here we are consequently no longer in the area of feasible solutions.

34. On the effects of monetary policy on competition

A rise in the money market interest rate tends, according to the model, to slightly reduce the differences between market shares (c.p.). When the data presented in the table above for the household sector are kept unchanged, except that the Helibor rate is raised, the market shares will grow slightly more equal. On the corporate sector side, the money market rate does not affect the market shares, providing that the other cost and return factors are identical. The raising of the cash reserve

requirement has similar effects in both sectors. Consequently, judging from this model, it would not make much differences from the point of view of the competition for market shares whether credit expansion were restrained by interest rate or cash reserve policy or, say, by an agreement meant to restrict credit expansion through fixing the market shares. The effects on the profitability side have not, however, been sufficiently analysed here. These effects would grow increasingly accentuated if the cash reserve deposits were made non-interest bearing, as has in recent times been proposed.

4. CONCLUDING REMARKS

The model developed here considers, on the basis of competitive equilibrium solutions (Nash - Cournot equilibrium), competition between several banks for market shares. At this stage the study does not involve an explicit market form analysis by means of, for instance, the theory of games or price theory. It has been regarded as important here to examine the sector-specific nature of banking competition and to analyse competition by means of numerical simulations.

The simulations have shed light on the increasing returns to scale in the household sector and on the significance of the cost and return structures generally. The increasing competitiveness of financial markets is likely to lead to a further decline in interest income and rise in the share of other return items. Judging from the model, competition in the area of cost and return factors may amount to increasingly notable changes in market shares. Because of the oligopolistic character of the banking branch, the efforts to defend and increase market shares will no doubt also in the future be among the features characteristic of the banking sector.

REFERENCES

Airaksinen, Timo (1987), Mitä talletusten verollistaminen vaikuttaisi pankkien käyttäytymiseen ja kannattavuuteen, Summary: Effects of taxation of bank deposits on the behaviour and profitability of banks, The Finnish Economic Journal 4:1987.

Alhonsuo, Sampo (1989), Rahoitus- ja pankkitoiminnan tehokkuus Suomessa, Suomen Pankin keskustelualoitteita 4/89.

Alhonsuo, Sampo - **Tarkka**, Juha (1989), Productivity and efficiency in Finnish banks, Bulletin, Bank of Finland, April 1989.

Bank of Finland, Bulletin, Charts, April 1989.

Lehto, Eero (1987), Oligopolistinen pankkikilpailu, erityisesti Suomen rahoitusmarkkinoilla, Suomen Pankki D:65, Helsinki 1987.

Mustonen, Jussi (1987), Oligopolistisesta pankkikilpailusta ja luotontarjonnasta epävarmuuden vallitessa, Elinkeinoelämän Tutkimuslaitos, C 44, Helsinki 1987.

Okko, Paavo (1987), Pankin korkokilpailukuvystä eri asiakassektoreilla, käsikirjoitus 1987.

Vihriälä, Vesa (1988), Pankkiluottojen koronmuodostus, Korkojen määräytyminen Suomessa, Suomen Pankki D:67, Helsinki 1988.

Vihriälä, Vesa (1989), Pankkien marginaali ja kilpailu, The Finnish Economic Journal 1989:1.

Tobin, James (1982), The Commercial Banking Firm: A Simple Model, Scandinavian Journal of Economics 4/1982.

Banking model

Appendix 1

Simulation 1

	A	B	C	D	E
1	**Data for banking sector**		**Data for separate banks**		
2	Lending rate, corporate secto	10,00%	Bank	Deposit rate	Other retu
3	Lending rate, household secto	10,00%	Bank 1	4,00%	8,00%
4	Helibor (rR)	11,00%	Bank 2	4,00%	8,00%
5	Cash reserve deposit rate (r)	7,75%	Bank 3	4,00%	8,00%
6	Cash reserve requirement (k)	7,80%	Bank 4	4,00%	8,00%
7	Rigidity (HH-sector)	50,00%	Bank 5	4,00%	8,00%
8	Deposit retention (for all bank	50,00%			
9	Rigidity (C-sector)	50,00%			
10	Total advances to C-sector (LY	100,000			
11	Autonomous deposit stock	100,000			

	F	G	H	I	J
1			**Intermediate results**		
2	Variable cost	t shares (Dep	t shares (C-s	C-sector	ending shares (HH
3	3,00%	18,00%	29,00%	24,50%	18,63%
4	3,00%	17,00%	27,00%	23,50%	17,95%
5	3,00%	29,00%	15,00%	17,50%	26,15%
6	3,00%	25,00%	18,00%	19,00%	23,41%
7	3,00%	11,00%	11,00%	15,50%	13,85%
8		100,00%	100,00%	100,00%	100,00%
9					
10					
11					

Banking model (separate di)

S	T	U	V
Marketing input(Mi)	Household loans(LKi)	Corporate loans(LY	Deposits(Di)
0,320	14,709	24,500	20,358
0,320	13,735	23,500	18,979
0,320	26,376	17,500	37,422
0,320	21,931	19,000	30,805
0,320	8,193	15,500	11,287
1,600	84,944	100,000	118,852

W	X	Y	Z
		Final market shares	
oney market borrowing(	Profit(Pi)	Corporate sector	Household sector
20,439	1,445	24,50%	17,32%
19,736	1,351	23,50%	16,17%
9,373	1,850	17,50%	31,05%
12,529	1,641	19,00%	25,82%
13,286	0,734	15,50%	9,65%
75,363	7,021	100,00%	100,00%

Banking model (separate di)

Simulation 2

	A	B	C	D	E
1	**Data for banking sector**				**Data**
2			Bank	Deposit retentio	Lending rate
3	Lending rate, corporate sector	10,00%	Bank 1	18%	10,00%
4	Helibor (rR)	11,00%	Bank 2	17%	10,00%
5	Cash reserve deposit rate (r)	7,75%	Bank 3	29%	10,00%
6	Cash reserve requirement (k)	7,80%	Bank 4	25%	10,00%
7	Rigidity (HH-sector)	50,00%	Bank 5	11%	10,00%
8	Deposit retention (column D)	0,00%			
9	Rigiduty (C-sector)	50,00%			
10	Total advances to C-sector LY)	100,000			
11	Autonomous deposit stock	100,000			

	F	G	H	I	J	K
1	**for separate banks**					**Intermediate resul**
2	Deposit rate	Other retur	ariable cost	sit market sh	shares (C-s	C-sector
3	4,00%	8,00%	3,00%	18,00%	29,00%	24,50%
4	4,00%	8,00%	3,00%	17,00%	27,00%	23,50%
5	4,00%	8,00%	3,00%	29,00%	15,00%	17,50%
6	4,00%	8,00%	3,00%	25,00%	18,00%	19,00%
7	4,00%	8,00%	3,00%	11,00%	11,00%	15,50%
8				100,00%	100,00%	100,00%
9						
10						
11						

	L	M	N	O	P	Q
1	**ts**					
2	ng shares (HH-se	[x]	Alfa	Beta	Gamma	Delta
3	17,32%	-0,067	2	-0,034	0,00109	3,37325
4	16,17%	-0,07	2	-0,034	0,00097	3,37325
5	31,05%	-0,07	2	-0,03	0,00284	3,37325
6	25,82%	-0,07	2	-0,032	0,00211	3,37325
7	9,65%	-0,067	2	-0,036	0,00041	3,37325
8	100,00%					
9			ΣAlfa	2,500		
10			ΣBeta&Gamm	-0,159		
11						

Banking model

	K	L	M	N	O
1					
2	[x]	Alfa	Beta	Gamma	Delta
3	-0,067	2	-0,023	0,00304	3,37325
4	-0,07	2	-0,023	0,00287	3,37325
5	-0,07	2	-0,023	0,00489	3,37325
6	-0,07	2	-0,023	0,00422	3,37325
7	-0,067	2	-0,023	0,00186	3,37325
8					
9		ΣAlfa	2,500		
10		ΣBeta&Gamm	-0,099		
11					

	Q	R	S	T
1				
2	Marketing input(Mi)	Household lending(LKi)	Corporate loans(LY	Deposits(Di)
3	0,320	25,448	24,50	30,825
4	0,320	24,516	23,50	29,409
5	0,320	35,706	17,50	46,400
6	0,320	31,976	19,00	40,736
7	0,320	18,921	15,50	20,913
8	1,600	136,565	100,00	168,283
9				
10				
11				

	U	V	W	X
1			Final market shares	
2	ney market borrowing(	Profit(Pi)	Corporate sector	Household sector
3	21,528	1,722	24,50%	18,63%
4	20,901	1,623	23,50%	17,95%
5	10,425	2,082	17,50%	26,15%
6	13,417	1,909	19,00%	23,41%
7	15,139	0,954	15,50%	13,85%
8	81,409	8,291	100,00%	100,00%
9				
10				
11				

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