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Credit Growth and Moral Hazard

An Empirical Study of the Causes of Credit Expansion by the Finnish Local Banks in 1986–1990

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Abstract

The paper examines the determination of bank lending during the Finnish credit boom of 1986–1990 with the data of 483 savings and cooperative banks. A particular objective is to establish whether bank behaviour is consistent with what is called moral hazard hypothesis, according to which banks expanded risky lending in part to benefit from underpricing of bank liabilities and/or anticipated bank support policies, which would reward capital insufficiency. The results strongly support the moral hazard hypothesis. Growth of lending was, ceteris paribus, negatively associated with bank capital and positively associated with bank costs. Also the behaviour of subordinated debt is consistent with the moral hazard hypothesis. The findings suggest that the cause of such behaviour was underpriced non-deposit liabilities rather than underpriced deposit insurance or anticipation at perverse bank policies. The perverse behaviour was much stronger among the savings banks than among the cooperative banks. According to calculations based on the estimation results, the growth rate of savings bank lending had been 1/3 smaller than the actual growth rate in 1986–1990 in the absence of moral hazard. In the case of the cooperative banks the estimated moral hazard effect is less than 1/10 of the growth rate. Given the clear positive association of the rate of growth of lending during the boom period and the amount of non-performing assets later during the banking crisis, the disproportionary losses of the savings bank group are – in the light of this analysis – largely due to moral hazard. Consequently also most of the government expenditure on bank support appears to be caused by distorted incentives.

Keywords: bank lending, moral hazard, deposit insurance, creditor protection, bank support

Tiivistelmä

Paperissa tutkitaan pankkien luotonannon määräytymistä Suomen luottobuumin vuosina 1986–1990 säästö- ja osuuspankkien 483 havainnosta koostuvalla aineistolla. Erityisesti pyritään selvittämään, onko pankkien käyttäytyminen sopusoinnussa ns. moral hazard -hypoteesin kanssa, jonka mukaan pankit laajensivat riskipitoista luotonantoaan osaksi hyötyäkseen velkojensa alihinnoittelusta ja/tai odottaessaan huonosti harkitun pankkitukipolitiikan palkitsevan pääomavaatimuksen alittamisen. Tulokset tukevat voimakkaasti moral hazard hypoteesia. Luotonannon kasvun ja pankin oman pääoman välillä oli negatiivinen ja luotonannon kasvun ja pankin kustannusten välillä positiivinen riippuvuus. Myös vastuudebetuureja koskevat havainnot tukevat moral hazard -hypoteesia. Eräät seikat viittaavat siihen, että kyse oli pikemminkin rahamarkkinoilta hankitun rahoituksen alihinnoittelusta kuin alihinnoittellusta talletussuojasta tai pankkitukea koskevista odotuksista. Vääränsuuntainen käyttäytyminen oli paljon voimakkaampaa säästöpankeilla kuin osuuspankeilla. Estimointituloksiin perustuvien laskelmien mukaan säästöpankkien luotonannon kasvu olisi jäänyt 1/3 toteutunutta pienemmäksi ilman moral hazardia. Osuuspankkien kohdalla vastaava arvioitu vaikutus oli alle 10 prosenttia luotonannon kasvusta. Kun ottaa huomioon selvän positiivisen yhteyden buumivuosien luotonannon kasvun ja kriisivuosien järjestämättömien luottojen välillä, säästöpankkien suhteettoman suuret tappiot ovat – tämän analyysin valossa – pääosin moral hazardin aiheuttamia. Siten myös pääosa julkisista pankkitukimenoista näyttäisi aiheutuneen vääristyneistä kannustimista.

Avainsanat: Avainsanat: luotontarjonta, moral hazard, talletussuoja, velkojan suoja, pankkituki

Contents

1 Introduction

Bank lending grew very rapidly in Finland in the aftermath of financial liberalization in the late 1980s; the loans oustanding of the deposit banks alone more than doupled from FIM 190 billion at the end of 1986 to FIM 388 billion in the four years time by the end of 1990. During the subsequent depression, the newly extended credit turned out highly risky. A large fraction on bank lending - cumulatively over FIM 100 billion turned non-performing by 1995, and the deposit banks booked credit and guarantee losses for over FIM 70 billion over the period 1991 through 1995.

Although many factors contributed to the general economic boom of the late 1980s and the subsequent depression, there are reasons to believe that highly aggressive lending policies by at least a part of the banking system were an important element - and potentially even a cause of the overheating, see Vihriälä (1996a). At any rate, there is a clear negative bank level relationship between the rate of growth of lending in the 1980s and the subsequent asset quality (Solttila and Vihriälä 1994).

Literature contains several stories, which explain why banks' lending policies might vary and in particular result in "excessive" risky lending. Vihriälä (1996b) elaborates perhaps the most prominent such explanation, moral hazard caused by underpriced bank refinancing and/or inadequate capital regulation. At least since Merton (1977) underpriced funding combined with weak capital has been regarded as a potentially important reason for banks to take "excessive" risks. Most accounts of the thrift institution crisis of the 1980s in the United States name moral hazard associated with the flat-rate deposit insurance system as a central cause of the highly risky portfolios chosen by many of the savings and loan institutions that eventually failed. Also in the context of the Nordic banking crises of the 1990s, moral hazard associated with the public safety net has been named as one of the main culprits (eg. Koskenkylä and Vesala 1994).

Despite the strong theoretical case, empirical evidence about the role of moral hazard is rather ambiguous. While eg. Keeley (1990) finds evidence of moral hazard leading excessive risk taking by American banks in the 1980s, several studies fail to detect such effects.[1] No studies on European data seem to exist.

The recent Finnish banking history is a very interesting test case of the moral hazard hypothesis. First, as in the neighbouring Sweden and Norway, the banking crisis in Finland is a first-order event in that the risks the banks took in the late 1980s led a significant part of the banking system to loose all of its capital during the depression of 1991 through 1993. Second, given the large number of individual banking institutions with widely varying capital positions, costs and observed lending behaviour but essentially the same regulatory environment, reliable statistical analysis should be possible to discriminate between various hypotheses. Thus if the moral hazard hypothesis is of practical importance rather than just a theoretical footnote, it should show up in the data. Finally, given the importance of banks in financial intermediation in Finland, any factor that helps to explain the behaviour of banks also contributes to understanding of the emergence and evolution of perhaps the most

[1] Apart from Keeley, also Wheelock (1992) with a data set on American depostory institutions of the 1930s and Park (1994) on American banks of the 1980s find support for the moral hazard hypothesis. In contrast, Furlong (1988), Schrieves and Dahl (1992), and Randall (1993) provide evidence which does not support the moral hazard hypothesis.

spectacular boom-bust period in the industrialized market economies since the Great Depression.

This paper aims at testing the moral hazard hypothesis as an explanation of lending growth of the Finnish banks in the late 1980s. More specifically the analysis focuses on the lending behaviour of the cooperative banks and savings banks in the period between the end of 1986 and the end of 1990. It is the period following the main measures of deregulation in the financial markets and a period coinciding with an exceptionally rapid growth of credit and GDP. The two banking groups represented over half of the Finnish banking market in the end of the 1980s. Furthermore, the savings bank group was the most expansionary among the banks in the 1980s and accounts for a disproportionately large share of the total losses during the crisis period.[2]

The analysis seeks to establish whether the bank-wise variation in bank lending is consistent with the moral hazard hypotesis. The analysis is thus partial in the sense that no attempt is made to examine factors which have been common to all banks. In particular all macroeconomic factors are left out of the analysis as are such explanations of the banks supply behaviour, which are essentially the same for all banks. Thus common misperceptions about the risks involved in lending are not considered.

The analysis is based on the simple value maximization model designed to fit the external circumstances of the Finnish local banks in Vihriälä (1996b). The results obtained will be interpreted primarily in the light of this model. However, when assessing the results I will also discuss the limitations of the benchmark model and speculate about alternative explanations for the findings.

2 Moral hazard: what is it and how to test for it?

The moral hazard argument says essentially that if the price a borrower pays for the borrowed funds does not incorporate a fair default premium, the borrower has an incentive to use the funds to "too risky" investments: Under limited liability, the borrower need not pay for the funds, if the outcome of the risky investment is bad, but she obtains all of the returns exceeding the contractual commitment vis-à-vis the lender. Thus an investment with the same expected return but with more return variability yields a higher expected return to the borrower.

When applied to banking, the moral hazard story typically singles out flat-rate deposit insurance as the reason for the underpricing of funds. Given the guarantee by the deposit insurance scheme, the depositor need not - and due to competition cannot - demand a (sufficient) default premium. If the price the bank pays for the insurance policy does not properly take into account the riskiness of the bank's portfolio, equity

[2] The aggregate net loss (profit/loss after extraordinary items and direct taxes) of the deposit bank sector in the period 1991 through 1995 was some FIM 62 billion (savings banks and Skopbank consolidated). Of this the savings bank group account for FIM 36 billion. The regulatory capital was FIM 54 billion and FIM 10 billion for all banks and the savings bank group, respectively, at the end of 1990. The banking system has thus lost in the aggregate all of its capital, the savings bank sector doing so several times over. Furthermore, some losses are still pending for the savings bank sector, which account for some FIM 70 billion of the total bank support commitment of the authorities of FIM 82 billion (including guarantees of FIM 31 billion) at the end of 1995.

holders benefit in expected value sense from increasing the riskiness of bank portfolio. The incentive for high risk is the stronger, the less there is equity in the bank. Thus banks that have low net worth are particularly likely to take on high risks, to "play gamble for resurrection". As almost all existing formal deposit insurance schemes are flat-rate, the potential for moral hazard induced by deposit insurance is rather universal.[3]

But deposit insurance need not be the only reason for underpriced bank funding. In many countries bank creditors have often been bailed out by the authorities even in the absence of any formal guarantees. An implicit creditor protection policy has existed. It is quite natural that such policies have been taken into account in the pricing of bank debt. As a consequence, bank debt may have been underpriced relative to the failure risk, and exactly the same sort of incentive for taking excessive risks has been created as with the flat-rate deposit insurance.

Regulation seeks to alleviate moral hazard in banking by setting minimum standards for bank capital and by constraining banks' asset and liability choices. Supervisory authorities typically have powers to penalize the banks that do not meet the requirements, and in the extreme close the substandard banks. But of course supervision may fail to constrain risk taking effectively. And in the extreme misconceived bank support may perversely reward capital inadequacy rather than penalize for it.

Empirically credit risk of lending is the main risk element that has influenced the Finnish banks' (and in general the Nordic banks') profitability and solvency in the recent banking crisis. An empirical analysis suggests furthermore that the extent of credit expansion during the boom years had a strong negative impact on asset quality (Solttila and Vihriälä 1994). Thus the extent of credit expansion in a given period of time appears to be the main determinant of bank risk.

The model in Vihriälä (1996b) describes how the extent of risky lending depends on bank characteristics and demand conditions under different pricing principles of marginal bank funding and under varying stiffness of capital regulation.

The model assumes that equity and deposits and their costs are exogenous, but the bank can choose the amount money market debt and subordinated debt so as to finance the preferred amount of risky loans subject to a declining demand schedule. The bank is subject to a capital requirement, and the owners are penalized for a failure to meet the requirement by a non-pecuniary cost. Although equity is exogenous, the bank can augment its regulatory capital through issuing fairly priced subordinated debt (up to a maximum set by regulation) and thereby diminish the expected penalty from capital insufficiency at any given level of lending.

The solutions of the model are of two principal type. A bank that faces sufficient demand for loans borrows in the money market but does not invest in bonds. This type of bank can be assumed to be representative in the period of interest, as the Finnish banks on average borrowed heavily in the money market. A second type of solution obtains, when demand for loans is so small that the relevant choice for the bank is how to allocate exogenously given capital and core deposits between risky

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[3] An exception is the United States where the FDIC insurance premium is currently tied to bank risk, but even there the maximum price difference is only 8 basis points, see Berger et. al. (1995). Also some other countries have introduced a risk-related insurance premium or are in the process of doing so (Norway, Sweden). In Finland the deposit insurance premia are flat-rate, although the legislation would allow risk based premia as well.

lending and safe bonds. In this case no money market funding is used. According to the model the behaviour of these types of banks can differ a great deal depending on the level of loan demand and other parameters.

Bank behaviour in the more relevant case of positive money market funding is more straigthforward, although it depends crucially on the pricing of money market debt and the stringency of capital regulation. The comparative statics of bank lending with respect to the exogenous variables of the model are summarized for this type of bank in Table 1.

Table 1. **Comparative statics of lending**

Penalty for capital insuffi-ciency	Pricing of non-deposit funding	Penalty	Required capital ratio	Equity capital	Deposit rate	Amount of deposits	Demand	Borrower quality
Positive	fair	-	-	+	-	+	+(-)	+
	fixed	-	-	+/-	+(-)	+/-	+(-)	+(-)
Zero	fair	..	0	0	0	0	+(-)	+
	fixed	..	0	+/-	+	+/-	+(-)	+(-)
Negative	fair	-	+	-	+	-	+(-)	+(-)
	fixed	-	+	+/-	-	+/-	+(-)	+(-)

+/-: both possible depending on circumstances
+(-): both possible, but + more likely

If the relevant marginal liability is fairly priced, or the penalty for not meeting the capital requirement (ex post) so stiff that it simulates unlimited liability of the equity holders, no moral hazard exists, and bank lending increases with the exogenous amount of equity (K) and decreases with costs (R^D). Although the cost variable R^D in Table 1 strictly speaking is the average cost of the exogenous deposits, it can be interpreted as any cost element such as the total costs of banking premises, equipment and labour input to the extent these are exogenous in the relevant time horizon.

However, if pricing of bank liabilities is not fully fair, or capital regulation is not extremely stiff, perverse effects may emerge. Unresponsive pricing of money market debt implies that higher costs do lead and smaller equity may lead to more lending. And with a sufficient underpricing of the money market debt even an increase in the core deposits D can lead to less lending. Similarily, even under fair pricing of the marginal funding of the bank, qualitatively the same perverse effects emerge, if capital insufficiency is rewarded through ill-conceived bank support policies.

These comparative statics suggest using the empirical relationship between bank costs and capital on the one hand and bank lending on the other hand as a test for the moral hazard hypothesis. Should one find, ceteris paribus, a positive relationship between lending and costs and a negative relationship between lending and capital, the finding would be consistent with the moral hazard hypothesis. No relationship would suggest of a relative unimportance of the consideration of bank default in lending decisions, either because no penalty is associated with capital inssufficiency or because lending is assumed by all relevant agents to be "sufficiently" safe under all relevant circumstances. Finally, a positive relationship between lending and

capital and a negative relationship between lending and costs would suggest that market forces control risk taking through risk premia (or rationing) or that the regulators do so through sufficient penalties on the banks that fail to meet the requirements.

In addition, the issuance of subordinated debt can be informative about the pricing of marginal funds and/or stiffness of capital regulation. Under fair pricing and positive penalties for capital insufficiency, the banks that rely on money market debt also use the maximum allowed amount of subordinated debt. With no penalty for capital insufficiency the amount of subordinated debt in indetermined, and with a negative penalty it is zero. Also underpricing of senior debt can lead to zero optimal subordinated debt.

As with any test situation, the suggested test is conditional on the validity of the theoretical framework from which the hypothesis falls out as a special case.

One potential caveat is that deposits, capital and costs may not exogenous in the relevant decision horizon, which is likely to be the average maturity of loans ie. 3-4 years. Thus a bank that chooses to expand lending, say, in response to high demand may also wish to attract more deposits through higher rates, better transactions services, advertising, which all increase costs. Also seeking new loan customers is likely to increase costs. One might thus observe a positive relationship between lending and costs even though no moral hazard exists.

Actually, the problem of cost endogeneity is not likely to be too serious in the data used in this study. First, most deposit rates were regulated under the period consired in this study, suggesting that the scope for rate competition was small. Second, panel data allows using cost variables dating prior to the period of credit extension studied, which should alleviate any possible simultaneity problems. In any case, the rate and deposit endogeneity can be tested by examining whether bank characteristics affect deposit rates and deposit volumes.

In a sense, capital endogeneity is even less of a problem. First, the banks studied have not been able to use equity type of instruments to raise capital. Second, the issuance of subordinated debt is explicitly analyzed in the theoretical model: the optimal stock is in most situations the (exogenous) maximum amount that can be counted towards regulatory capital. Third, also here one can take advantage of the panel nature of the data set.

Another potential problem of the proposed test (and the underlying theory) is the assumption that the agents know the probability distribution of lending returns. This may not be a valid assumption. All agents may well have a wrong view about the risks, and furthermore the banks may well know more than the investors in bank assets do.

In the particular case of the boom-bust cycle of Nordic banking in the last decade, it has been often argued that no one understood correctly the risks related to lending against real estate security.[4] Expanding lending rapidly may thus have been regarded by the banks as an essentially riskless way of increasing volume of business

[4] See eg. Pettersson (1993).

and thereby lowering unit costs and increasing capital through retained earnings.[5] Finding that especially the weakly capitalized and high cost banks expanded lending strongly could be interpreted as indicating that these banks used the newly liberalized markets to adjust their unit costs and capital towards the industry average. Thus no moral hazard needs to be involved.

Although the plausibility of the "lower unit costs through growth" or "riskless expansion" story is doubtful given the traditional view of the banking community about the riskiness of rapid expansion, the story cannot not rejected a priori. Fortunately there may be a way of distinguishing between the two explanations. If the riskless expansion story holds, all banks should start to delecerate lending growth when the expectations change and the banks that have in the process assumed more risks than others should do so more clearly. In practice, many things suggest that the Spring of 1989 was such a period of revision of expectations. A tightening of monetary policy led to higher interest rates, and in particular the imposition of a special cash reserve requirement penalized lending growth. Stock and real estate prices peaked, and lending growth started to decelerate rapidly on the aggregate level.

3 A preliminary look at the data

3.1 The sample

The data set consists of 333 cooperative banks and 150 savings banks. Thus almost all the banks that existed at the end of 1990 are included.[6] The sample is balanced by aggregating the observations of the banks that merged during the sample period.

The bank data contains annual balance sheet and income statement information for the years 1985 through 1990 augmented with information about regulatory capital adequacy. A description of the bank data and their sources are provided in Appendix 1.

For each bank, a geographical area of operation is defined as the municipalities in which the bank had the head office or a branch at the end of 1990. Data on demographic and economic conditions available on municipal level are aggregated over the operation area to construct variables that reflect the market conditions in every bank's local market. A list of the collected data is in Appendix 2.

The period of the analysis is 1986 through 1990. The choice of this particular period for analysis is based on the observation that it covers the whole period of "credit boom" from the start of accelerating lending growth in the aftermath of financial liberailization (see Vihriälä 1996a). By the end of 1990 bank lending stagnated and in 1991 credit stocks already fell.

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[5] This explanation emerges very clearly from a recent savings bank history (Kuusterä 1995). It assumes that there was excess capacity in the banking system. Expanding the volume of business would not increase essentially total costs so that unit costs would go down. Given the observed cuts in the use of resources by the banks in the 1990s this assumption of excess capacity seems as such well-founded.

[6] The data set contains all savings banks. 5 cooperative banks are excluded because of data problems. The included banks account for 99.3 per cent of the balance sheet total of the cooperative bank group at the end of 1990.

The banking institutions examined are limited to the savings banks and cooperative banks, because these banks form a relatively homogenous group in terms of banking activities (almost no foreign banking business, very little activity in the capital market etc.) while still comprising banks with highly varied levels of capitalization, costs, and growth of lending in the period of interest. Furthermore, the most severely hit banks during the subsequent crisis period - the savings banks which in 1992 formed the Savings Bank of Finland - are all included in the sample.

3.2 Salient features of the cooperative banks and savings banks

Group structure and decision making

The cooperative banks and the savings banks form, respectively, two banking groups in the sense that several activities are coordinated within the respective groups, see Vihriälä (1996a).

This group structure has potentially important implications for the analysis of the behaviour of individual banks. First, it raises the question whether the decisions taken by an individual cooperative bank and savings bank can be considered independent, ie. whether the sample indeed contains a large number of independent observations. Although this is in the end an empirical question, there are reason to presume a considerable degree of independence in the decision making. First, legally an individual bank and its management bear full responsibility for the commitments taken. Second, many accounts by insiders in the respective banking groups suggest that a well-run member bank cannot be forced to take decisions againts the will of the management.[7] Nevertheless, the central organizations very likely have been in the position to influence decisions of the member banks, and the policies in this regard may have been different across the two groups.

A more precise implication is that the non-deposit funding ("money market debt" in the theoretical model) of an individual cooperative or savings bank can principle in take the form of either direct funding from the money market or borrowing from the group's central bank. To the extent the member banks have not had a direct access to the money market (more likely for the smaller banks than the larger ones), the pricing of non-deposit funding may have differed across the two banking groups depending on the policies followed by the the two central banks.[8]

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[7] For example, mergers among the member banks have taken place far more slowly than recommended by the central organizations on grounds of operational efficiency, see eg. Kuusterä (1995).

[8] In addition, the fact non-deposit funding can have taken these two forms makes it very difficult to determine the amount of money market funding, as the "claims of other banks" in the available statictics contain many types of instruments. Thus examining the determination of the amount of money market debt is not in practice possible with the data available.

Lending and its funding

Lending to the public financed by deposits by the public is the main business of both the cooperative banks and savings banks. In 1990 loans accounted for some 70 per cent of these banks' total assets, while the deposit shares were 64 and 56, respectively (Table 2).

Lending grew much faster in the savings bank group than in cooperative bank group in the second half of the 1980s, while the opposite is true for deposit growth. To facilitate the strong growth of lending, the savings banks increased substantially their debts to other banks (chiefly their central bank Skopbank) and to the money market. Also the cooperative banks increased borrowing from other banks (again chiefly from their central bank Okobank) and the money market, but the contributions of these sources were clearly smaller.

The period of rapid growth of lending began in both banking groups in the Spring of 1987, and growth peaked at the end of 1988, when many transactions on enterprise ownership, induced by a tax reform, boosted both lending and deposit stocks considerably. In the Spring of 1989 lending growth started to decelerate rapidly in response to policy changes and presumably changed expectations, as noted above. In this period of deceleration, the savings banks expanded lending much faster than the cooperative banks. As there was no similar difference in the respective growth rates of deposits, the loan deposit ratio steadily increased in the savings bank group through the whole period while it stabilized in the cooperative bank group already in 1989 (Figure 1).

Approximating the rate of growth of lending $\Delta L/L$ by the differential $\Delta(L/D)(D/L) + \Delta D/D$ one can decompose the change in lending between the contribution of change in the loan deposit ratio and the contribution of deposit growth. On the basis on the figures in Table 2, such a decomposition indicates that for the cooperative banks the contribution of the change in the loan deposit ratio was some 11 per cent. However, for the savings banks the contribution of the change in the loan deposit ratio was .35 per cent. Thus while other financing than deposits was just a marginal source of funding to the cooperative banks, over one third of the growth of lending of the savings banks was financed from these non-deposit sources.

A considerable part of the rapid growth of lending in the savings bank group originated in a relatively small number of large banks. Nevertheless, also the average savings bank expanded credit much faster than the average cooperative bank, increasing the loan-deposit ratio significantly, while this ratio of the average cooperative bank remained essentially unchanged between 1986 and 1990 (Table 3).

The data exhibit a great deal of bankwise variation in the rate of growth of lending, much more so than in the rate of deposit growth. And the variability is much stronger among the savings banks than among the cooperative banks. Thus the savings banks not only expanded strongly lending financed from other banks and the money market but many of them did so to an extreme extent.

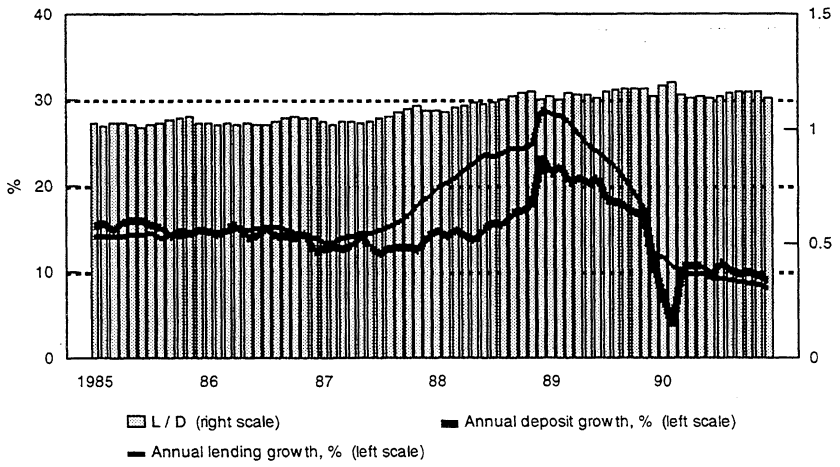
Table 2. **Bank balance sheet structure**

	Cooperative banks*				Savings banks*			
	Share in total assets, %		Rate of growth 1986-1990, %	Contribution to balance sheet growth 1986-1990 Percentage points	Share in total assets, %		Rate of growth 1986-1990, %	Contribution to balance sheet growth 1986-1990 Percentage point
	End-1990	End-1986			End-1990	End-1986		
Loans	72.7	74.4	85.4	63.5	70.2	72.1	122.5	88.3
Bonds	3.8	3.1	132.8	4.2	2.0	2.9	56.3	1.6
Receivables from Banks	12.3	13.2	77.4	10.2	11.4	13.1	99.1	13.0
Other receivables	11.1	9.3	126.3	11.7	16.4	11.9	214.6	25.5
Balance Sheet Total	100.0	100.0	89.6	89.6	100.0	100.0	128.5	128.5
Deposits	64.1	71.4	70.3	50.2	55.9	77.2	65.3	50.4
Claims by Banks	15.3	10.0	189.4	19.0	21.0	10.6	354.4	37.5
Other Debts	14.5	13.2	107.7	14.3	16.6	7.3	420.7	30.7
Capital & reserves	6.0	5.3	115.0	6.1	6.5	4.9	202.1	9.9
Loan-deposit ratio	1.13	1.04			1.26	0.93		

* The sector as a whole

Figure 1. **Bank loans (L) and deposits (D)**

(a) Cooperative banks



(b) Savings banks

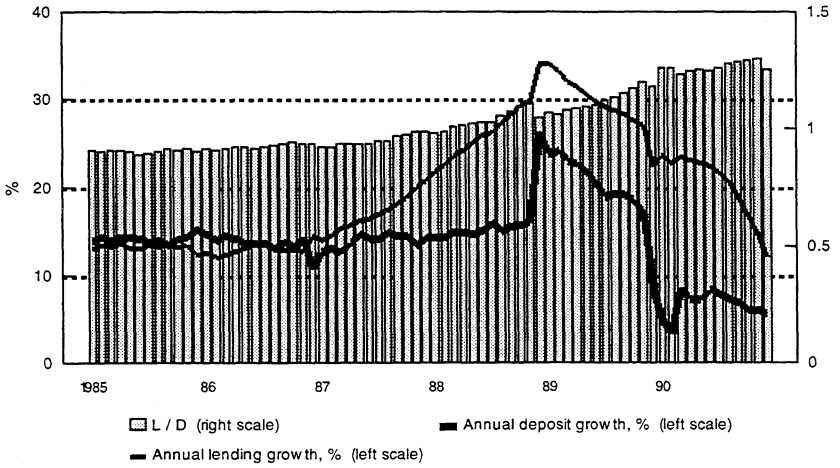


Table 3. **Lending and its funding of the individual local banks**

		Cooperative banks				Savings banks			
		Average	Standard deviation	Min.	Max.	Average	Standard deviation	Min.	Max.
Growth of lending 1986-1990, %		69.9	29.8	-44.4	224.7	91.5	65.4	27.1	577.4
Growth of deposits 1986-1990, %		68.7	17.2	-51.8	163.3	67.9	22.3	30.3	206.2
Loan-deposit ratio	End-1986	1.03	0.16	0.56	1.76	0.96	0.15	0.50	1.56
	End-1990	1.03	0.20	0.48	2.27	1.08	0.29	0.46	1.93
	Change 1986-1990	0.00	0.15	-0.61	0.89	0.13	0.25	-0.21	1.00
Share in total assets:									
Debts to other banks	End-1986	0.09	0.06	0.00	0.47	0.12	0.07	0.02	0.38
	End-1990	0.13	0.10	0.00	0.58	0.19	0.15	0.00	0.75
Net claims on other banks	End-1986	0.10	0.11	-0.37	0.83	0.06	0.13	-0.23	0.71
	End-1990	0.07	0.16	-0.48	0.93	0.00	0.21	-0.63	1.11
Other debts	End-1986	0.05	0.05	0.01	0.66	0.04	0.03	0.01	0.14
	End-1990	0.06	0.07	0.01	0.60	0.11	0.10	0.01	0.44
Capital and reserves	End-1986	0.053	0.012	0.025	0.101	0.052	0.015	0.022	0.094
	End-1990	0.061	0.015	0.016	0.108	0.066	0.017	0.020	0.132

Capital and capital adequacy

Bank capital[9] and reserves (provisions) on the balance sheet increased in the period of interest not only in absolute terms but also relative to the balance sheet total. The savings banks increased capital more, and had on average somewhat better equity capital - asset ratios in 1990 (Table 4).

Also the average capital ratios calculated for regulatory purposes increased in both bank groups in the second half of the 1980s. The regulatory capital concept used until the beginning of 1991 included apart from the aforementioned capital items on the balance sheet half of the provisions for bad loan losses and subordinated debt up to a maximum.[10] In contrast, the regulatory capital ratio calculated according to the new risk-based rules were on average somewhat better for the cooperative banks than for the savings banks at the end of 1990.

Table 4. **Bank capital ratios, end of year**

		1986			1990		
		average	min	max	average	min	max
Regulatory capital ratio according to the pre-1991 rules, per cent	coops	4.75	2.39	14.7	5.88[1]	1.66[1]	13.7[1]
	savings	4.51	2.34	9.46	6.11[1]	2.00[1]	15.7[1]
Regulatory capital ratio according to the 1991 rules, per cent	coops				13.2	2.38	35.7
	savings				11.7	3.71	23.6
Equity capital and provisions per cent of total assets	coops	5.32	2.56	10.1	6.17	1.63	10.9
	savings	5.22	2.23	9.4	6.62	2.06	13.3
Subordinated debt per cent of tier-I capital	coops				18.5	0	384.3
	savings				1.8	0	32.2

(1) end of 1989

One obvious reason for the increase in the capital asset ratios in the late 1980s was the anticipated tightening of capital regulations. After being discussed among the authorities and the banking community over several years, the main lines of the reform became clear in 1988. Thus at least from that year onwards the banks were aware that a tightening would take place in the early 1990s.[11]

The structure of capital differs somewhat between the two banking groups. The

[9] Equity capital in a broad sense consists of the balance sheet items share capital (commercial banks), primary capital (savings banks), cooperative capital (cooperative banks) plus reserve fund, equalization fund, and "distributable" equity.

[10] The data in Table 4 reports the regulatory ratio only for 1986 and 1989, as data do not exists for the end of 1990.

[11] Capital regulations and their changes are described in more detail in Appendix 3.

"primary capital" that corresponds to share capital of joint stock companies is minuscule in the savings banks, reflecting the legal nature of the savings banks. Also the corresponding "cooperative capital" of the cooperative banks is a small but nevertheless much bigger fraction of the total capital of the cooperative banks. Thus both banks have added to their capital mainly from retained earnings.

What may be of some importance is that the savings bank group boosted its capital between 1986 and 1989 very significantly through value adjustments of particularly fixed property. FIM 1.7 billion or almost half of the increase in bank capital from FIM 1.5 billion to FIM 5.0 billion is accounted for by a change in the "equalization fund". The cooperative banks that have traditionally owned less fixed property did not and actually could not augment their capital significantly in this way; for them the increase in the equalization fund amounted to mere FIM 200 million in the same period. Given the highly inflated property prices in 1989, the additional capital based on the value adjustments soon turned out to be illusory.

Subordinated debt has been of substantial importance for the cooperative banks in meeting the regulatory capital requirement even though most of the cooperative banks failed to utilize it up to the regulatory maximum. In contrast, subordinated debt remained relatively insignificant in the savings bank sector throughout the 1980s.

Costs

In the beginning of the boom period operating costs ie. other costs than interest expenses were higher (relative to the average total assets) in the savings bank group than in the cooperative banks. The savings banks also had marginally higher average deposit rates than the cooperative banks. However, by the end of the period the situation had changed. The savings banks had managed to reduce the ratio of operating costs to average total assets substantially, while the ratio had remained largely unchanged for the cooperative banks. In contrast the difference in the average deposit rates had marginally increased (Table 5).

Table 5. **Costs of individual local banks**

		1986			1990		
		average	min	max	average	min	max
Average deposit rate, per cent	coops	4.60	3.86	6.71	6.27	5.02	9.17
	savings	4.71	3.68	5.51	6.49	3.74	7.65
"Other costs", per cent of average total assets	coops	3.60	1.99	7.81	3.64	1.60	11.0
	savings	3.95	2.56	5.46	3.38	1.88	6.84

4 Specification of the equations to be estimated

The theoretical model implies in the first place the signs of the hypothesized relationships between lending on the one hand and capital, costs, demand variables and regulatory policy parameters on the other hand. What exact variables and functional forms one should use is left to a large extent open.

The principal empirical experiments consist of estimating regression equations for bank lending. The dependent variable in the regressions is the total lending to "the public" ie. enterprises and households. In a preliminary analysis it will be used in the rate of growth form (eg. GL9086 will denote the per cent growth of lending between the end of 1986 and the end of 1990). But, in most equations the dependent variable will be the change in the ratio of loans to the core deposits over the period of interest, as will become clear shortly (eg. ΔL/D9086 denotes the change in the ratio of loans to deposits between the end of 1986 and the end of 1990). The deposit variable comprises all demand and time deposits issued by the bank (the growth is denoted by GD9086 etc.).

In section 2 it was noted that deposits and deposit rates could in principle be endogenous. Some simple experiments reported in Appendix 4 suggest that in fact neither the growth of deposit in 1986 through 1990 nor the average deposit rate seems to depend significantly on bank characteristics, in clear contrast to the rate of growth of bank lending. The endogeneity problems does not appear serious.

Whatever the determinants of the loan stock are, it is unlikely that the observed stocks at any given time were the preferred ones in the presence of shocks and given the usual adjustment costs. All versions of the equation contain therefore the beginning-of-the-period loan deposit ratio, L/D. If there is a common optimal long run L/D ratio for the banking industry, one would observe a negative relationship between the level of the loan deposit ratio in the beginning of the period and the subsequent change in the ratio.

Bank capital K should contain all the items that constitute the residual claim on bank assets. It will be operationalized as the sum of the book value of equity capital on the balance sheet and total reserves (general provisions for bad loan losses etc.). In the analysis the ratio of capital and provisions over the balance sheet total, denoted by K/A, is used.

As far as the providers of money market funding are concerned the relevant capital measure might also contain subordinated debt. In addition, the supervisory authority may be most interested in the bank's capacity to meet the statutory capital requirement, according to which subordinated debt is included in the definition of capital. Therefore also the regulatory capital ratio, $(K/A)^{REG}$ is experimented with.

In the theory the exogenous cost element is the deposit rate, but as discussed earlier, also other exogenous costs should have an analogous effect. In the empirical analysis these two cost elements are analyzed separately, as their effect may differ depending among other things on the time frame within which these costs are likely to change. The deposit costs are proxied by the average deposit rate obtained by diving the interest expenses on deposits in a given year by the average deposit stock approximated by the average of the end-of-year deposit stocks; the variable name is

RD. The other costs than interest costs, "operating cost", are measured by the ratio of the income statement item "other expenses" over the average balance total, C/A.[12]

According to the theory, the potential moral hazard is strongest when both capital is low and costs are high. In addition, the if a bank has that much capital that it can meet its commitments under all possible (perceived) realizations of the loan returns, no moral hazard exists irrespective of costs and the principle of pricing of purchased funds. A way to incorporate these two effects is to replace RD and C/A by cross-terms $RD*((K/A)^{safe} - K/A)$ and $(C/A)*((K/A)^{safe} - K/A)$, where $(K/A)^{safe}$ is a capital ratio assumed to be high enough to make bank debt safe. The moral hazard hypothesis predicts that these variables have a positive impact on lending.[13]

To alleviate the potential problems of simultaneity, all of the preceding variables are defined for the beginning of the period. Thus, when the dependent variable is the change in the loan deposit ratio between the end of 1986 and the end of 1990, the capital ratios refer to the end-of-1986 ratio and the costs to the year 1986 costs.

Demand for loans is assumed to be related positively to the rate of growth of per capital income (ΔINC) and negatively to the change in the rate of unemployment (ΔUNR) over the period of interest. The banks that operated in the areas where the structure of the economy was tilted towards the most expansionary activities of the late 1980s - construction and services - probably faced higher demand for loans than the banks in the average areas. The share of construction and service employment CONSER is used to depict this influence. Similarily, given the relative increase of economic activity in the urban areas over a longer period of time, the share of urban population, URPOP, is included as a variable supposed to have a positive effect on the demand for loans.

The aforementioned variables fall out rather directly from the theoretical model. As the model abstracts away from many aspects which may have been important for the observed patterns of lending growth, some variables are added to control for such potential effects. They are as follows.

The access to borrowed funds is likely to be better for large banks than small ones, as the bigger banks are better known and, at least in the upper tail of the size distribution, may benefit from an implicit "too-big-to-fail" guarantee. Also management behaviour may have differed between large and small banks. Thus controlling for the size of the banking institution seems appropriate. As the size variable is used the log of the number of employees, denoted SIZE.[14]

A bank's lending behaviour is likely to be affected by the local competitive conditions. The theory assumes that every bank faces a downward sloping demand curve for credit. Its position and slope may be dependent on the presence of competing banks in the local market. To incorporate these influences a dummy, CP0,

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[12] The results would not change qualitatively if the two cost variables were incorporated in an aggregated form, but the fit would be somewhat worse.

[13] Defining an appropriate "safe" capital asset ratio is naturally somewhat arbitrary. In the light of the losses made by the savings bank sector as a whole in the recent crisis three times the actual capital might have been sufficient. Although also other values for $(K/A)^{safe}$ are experimented with, the value 15 per cent will be used in the analysis. It is about three times the average capital asset ratio and about 1.5 times the maximum observed value in the sample.

[14] Having some other obvious size variable such as the amount of loans or total assets or the number of branch offices would not change the results as all of these are highly correlated.

is defined. CP0 obtains the value 1 if neither of the two largest commercial banks - KOP and SYP - has a branch in the operation area of the cooperative or savings bank analyzed and is 0 otherwise.

As discussed above, the behaviour of the cooperative banks and the savings banks may have differed. It is therefore reasonable to allow the parameters to differ across the two banking groups. In a preliminary analysis such a difference is allowed for all parameters except the coefficients of the demand variables. The potential difference is incorporated by including savings bank dummies ($SBDUMMY_j$) for the intercept and the respective slope coefficients.

Finally, there is the possibility that bank behaviour has been affected by factors not linked in any way to the maximization of bank value. Criminal behaviour on the part of the management is a possibility. To control for such an effect we include a dummy variable obtaining value 1 for the banks which have been subject to criminal proceedings and 0 otherwise (CRIMPRO). Of course criminal behaviour may also be an extreme way of maximizing bank value, but even in that case it is probably useful to separate such effects from more purely economic factors.

The functional form of the estimated relationship is assumed to be linear in parameters.

The basic equation to be estimated is thus of the following type. As noted RD and C/A may, however, be replaced by the somewhat more complicated terms incorporating the cross-effect of capital and costs.

$$\begin{aligned} gL = {} & a_0 + a_1\frac{L}{D} + a_2\frac{K}{A} + a_3 RD + a_4\frac{C}{A} + a_5 gD + a_6 CP\emptyset + a_7 SIZE + a_8 \Delta INC \\ & + a_9 \Delta UNR + a_{10} CONSER + a_{11} URPOP + a_{12} CRIMPRO \\ & + \Sigma a_j SBDUMMY_j + u \end{aligned} \tag{1}$$

where the a's and b's are the constants to be estimated and u and v are error terms.

5 The estimation results

This section reports the empirical results. First, the fully linear version of eq. (1) is estimated for the cross-section covering the years 1986 through 1990. Here different estimating techniques are used and behaviour of most variables is allowed to differ between the two banking groups. These preliminary experiments result in a condensed equation, where the dependent variable is the change in the loan deposit ratio $\Delta(L/D)$, and where only a few parameters are allowed to differ between the two banking groups. The results for the whole period are reported in section 5.2. Section 5.3 provides some checks of robustness. In section 5.4 the observation period is split into two subperiods, ie. the equation is estimated separately for the cross-sections covering the first two years 1986-1988 and the last two years 1988-1990. This is followed by an analysis of the behaviour of subordinated debt in section 5.5. Finally, section 5.6 reports some counterfactual calculations to assess the quantitative significance of the observed moral hazard incentives.

5.1 Preliminary experiments

Table 6 reports the estimation results for the specification (1) using first ordinary least squares (column (a)). The OLS results show that a large fraction of the cross-sectional variation in loan growth can be explained by the included variables; R^2 is over 70 per cent. Second, many bank characteristics and demand variables appear to exert significant influence on lending growth, including several savings bank dummies. However, the error term shows serious heteroscedasticity and non-normality calling into question the validity of inference on the basis of the OLS results.

The observed irregularity of the error term may in principle be due to a small number of highly extreme observations. One way of handling the problems would be exclude such observations from the sample, re-estimate the model with the truncated sample and examine the outliers separately. As discussed in section 2, the banks facing very weak demand for loans relative to the core deposits might behave rather differently from the banks using non-deposit funding. Experiments with excluding small numbers of low L/D observations do not, however, change the results essentially. The remaining sample is still plagued with the same problems of the error term. Similarily, one might simply exclude the most extreme observation on the basis of the estimated residuals. But some attempts to that effect do not yield normal errors for the remaining sample either.

An alternative is to leave the sample untouched and use estimation techniques which take into account the nature of the observed error term. Unfortunately, there is no obvious way of handling the two problems of heteroscedasticity and non-normality simultaneously. We therefore estimate the equation on the one hand using least squares with the heteroscedasticity correction suggested by White (1980; LS/HEC) and on the other hand using the least absolute deviations (LAD), which has been shown to perform well in relation to least squares with many types of non-normal disturbances, see eg. Harvey (1981). The former of these alternartive estimation techniques affects only the standard errors while in the LAD estimation both the point estimates and the standard errors in general deviate from those obtained by OLS.

The results of these alternative estimations are reported in columns (b) and (c) in Table 6. As can be seen, the heteroscedasticity correction changes the standard errors and thus the t-values significantly. In particular, the significance of the savings bank dummies diminishes. Similarily, the point estimates in the LAD estimation differ substantially from the least squares estimates as do the t-values, although qualitatively the results are in many respects similar. A particularly interesting observation is that while the coefficient of deposit growth GD9086 remains in all versions insignificantly different from unity, the positive savings bank slope dummy for that variable in the OLS estimation loses substantially in significance with the heteroscedasticity correction and turns insignificant in the LAD estimation. One may thus argue that if not too much weight is given to some exceptional observations, lending has responded with unitary elasticity to deposits.

The unitary elasticity is in conflict with a literary interpretation of the underlying theoretical model. The model namely implies an elasticity less than unity, and in some specifications zero or even negative. A large positive response would furthermore be likely under the circumstances when also capital has a positive effect

on lending. Yet, in the estimated equations the capital variable obtains a negative coefficient. Two explanations are readily available. First, the deposit variable used in the empirical analysis contains - in addition to true core deposits - funding that is in effect equivalent to money market debt. However, given the regulatory environment of the 1980s this does not appear plausible. And, as noted, the results on a deposit equation in Appendix 4 speak against this explanation. Another and more plausible explanations is that deposit growth proxies for growth of the local banking market not fully captured by the demand-for-loans variables used.

The unitary elasticity of lending with respect to deposits suggests that imposing this constraint would not distort conclusions. In the sequel, we therefore replace the growth of lending as the dependent variable by the change in the loan deposit ratio over the period of interest dropping deposit growth from the explanatory variables. This formulation highlights the role non-deposit funding as a determinant of lending growth. We also drop all the savings bank dummies which remain insignificant at the 10 per cent level in LAD regressions. Actually the same dummies get excluded, whether one uses the purely linear specification or the specitication with the cross-terms of eq. (1). We thus end up with the following functional specifications:

$$\begin{aligned}\Delta\frac{L}{D} = {} & a_0 + a_1\frac{L}{D} + a_2\frac{K}{A} + a_3 RD + a_4\frac{C}{A} + a_5 CP\emptyset + a_6 SIZE + a_7 \Delta INC \\ & + a_8 \Delta UNR + a_9 CONSER + a_{10} URPOP + a_{11} CRIMPRO \\ & + a_{12} SBINTDUM + a_{13} SBCOSTDUM + a_{14} SBSIZEDUM + u\end{aligned} \tag{2}$$

$$\begin{aligned}\Delta\frac{L}{D} = {} & b_0 + b_1\frac{L}{D} + b_2\frac{K}{A} + b_3 RD*\left(\frac{K^{safe}}{A} - \frac{K}{A}\right) + b_4\frac{C}{A}*\left(\frac{K^{safe}}{A} - \frac{K}{A}\right) + b_5 CP\emptyset \\ & + b_6 SIZE + b_7 dINC + b_8 dUNR + b_9 CONSER + b_{10} URPOP \\ & + a_{11} CRIMPRO + b_{12} SBINTDUM + a_{13} SBCOSTDUM \\ & + a_{14} SBSIZEDUM + v\end{aligned} \tag{3}$$

where the dependent variable is multiplied by 100 to scale the coefficients larger, SBINTDUM is the savings bank intercept dummy, SBCOSTDUM is the savings bank slope dummy for the cost term and SBSIZEDUM is the savings bank dummy for the size variable.

Given that heteroscedasticity and non-normality of the error term cannot be handled simultaneously one either has to examine the estimates based on least squares with heteroscedasticity correction and the LAD estimates throughout the analysis or choose between the two. For simplicity we choose to use the more standard least squares with the heteroscedasticity correction. However, some calculations based on the equation estimated with least squares will be cross-checked by making the same computations based on corresponding LAD estimates.

Table 6. **Results for the basic specification**

	(a)		(b)		(c)	
Dependent variable	GL9086		GL9086		GL9086	
Estimation method	OLS		LS/HEC		LAD	
Explanatory variables	coefficient	t-value	coefficient	t-value	coefficient	t-value
Constant	-76.6	-2.42***	-76.6	-1.87*	-25.3	-0.98
L/D	-19.5	-1.98**	-19.5	-1.82*	-27.9	-4.04***
Cap	-2.03	-1.77*	-2.03	-1.85*	-1.67	-2.12**
RD	10.7	2.46***	10.7	2.03**	5.30	1.72*
Cost	2.30	0.84	2.30	.59	-1.08	-0.74
Size	4.06	2.13**	4.06	2.33**	4.31	2.92***
CP0	6.32	1.90*	6.32	2.28**	4.35	1.90*
Δinc	0.2	1.73*	0.20	1.59	0.23	2.90***
Δunr	-0.22	-0.31	-0.22	-0.31	0.32	0.64
Conser	12.5	1.13	12.5	0.97	4.13	0.64
Urpop	37.8	4.54***	37.8	4.01***	40.1	7.77***
Crimpro	75.5	9.02***	75.5	3.77***	55.7	9.94***
GD9086	1.04	12.2***	1.04	9.60***	0.95	17.0***
D:Constant	-60.2	-1.05	-60.2	-0.76	-77.7	-1.70*
D:L/D	-7.40	-0.42	-7.40	-0.29	18.7	1.71*
D:Cap	-1.85	-1.04	-1.85	-0.87	-0.75	-0.63
D:RD	-8.57	-0.99	-8.57	-0.75	-1.28	-0.21
D:Cost	13.5	2.62***	13.5	2.03**	10.3	3.85***
D:Size	6.56	2.18**	6.56	1.85*	8.49	3.57***
D:CP0	6.50	1.05	6.50	0.95	9.06	2.14**
D:GD9086	0.73	5.86***	0.73	1.77*	0.05	0.63
Number of observations	.483		.483		.483	
ADJ. R^2	.71		.71		.67	
White	282.6***					
JB	388.2***					

White: the White test statistic for homoscedasticity
JB: the Jarque-Bera test statistic for normality
*, **, ***: the test statistic significant at the 10 %, 5 % or 1 % level, respectively
The t-values are corrected for heteroscedasticity (White, 1980), except in the LAD estimation.

5.2 The basic Δ(L/D) equations for the whole period

The least squares parameter estimates and the t-ratios incorporating the heteroscedasticity correction for the specifications (2) and (3) are reported in columns (d) and (e) of Table 7. When the parameters are allowed to differ between the two banking groups, the table reports the coefficient estimates for both types of banks in the same way ie. the savings bank estimate incorporates the dummy effect. For the non-linear version the table contains also the derivatives of the dependent variable with respect to the capital and cost variables. Finally, the table reports the χ^2 tests for the joint significance of the capital and cost variables on the one hand and the four demand variables on the other hand.

The first observation is that the two specifications tell an essentially similar story about the determinants of the loan deposit ratio and thus bank lending. There is no difference in fit, and comparable parameters are of the same order of magnitude.

Second, both demand factors as a group and most bank characteristics are highly significant. Thus excluding either would be misleading. Furthermore, all of the demand variables obtain coefficients with the expected signs. Both the change in income and the share of urban population have significant positive effects on the loan deposit ratio.

Third, the message about the effect of capital and costs is striking: both specifications suggest that capital exerts a negative impact on the change in the loan deposit ratio while both the deposit rate and the ratio of other costs over total assets exert positive effects. In the linear specification all the relevant parameters are significant at the 1 per cent level with the exception the "other cost" variable for the cooperative banks. In the non-linear specification, even that term turns marginally significant. To the extent the effects are allowed to differ between the two banking groups, they are significantly stronger for the savings banks. Thus the findings are consistent with the moral hazard hypothesis for both types of banks but much more strongly so for the savings banks than for the cooperative banks.

Fourth, bank size has a clear positive effect on the change in the loan deposit ratio. This suggests that particularly large banks benefited from the new opportunities of financing lending with non-deposit funding in the second half of the 1980s. Interestingly, the size effect is significantly larger among the savings banks than the cooperative banks.

Fifth, absence of commercial bank competition in the local market seems to increase loan growth of the local bank. In the context of the simple background model, this may be simply due to the fact that the dummy proxies for geographical variation in loan demand not captured by the demand variables. But it is also consistent with some recent ideas about the effect of bank competition on lending when product markets are imperfectly competitive, see Koskela and Stenbacka (1995).

Sixth, the banks whose managements are suspected for criminal activity by the authorities clearly increased the loan deposit ratio faster than other banks.

Finally, the results give some support for convergence towards a common industry-wide loan deposit ratio, as the coefficient of the beginning-of-the-period loan deposit ratio is negative.

Table 7. **The constrained linear and non-linear specifications**

		(d)		(e)	
Dependent variable		ΔL/D9086		ΔL/D9086	
Explanatory variable		coefficient	t-value	coefficient	t-value
Constant,	CB's	-49.9	-3.11***	-82.1	-3.47***
	SB's	-80.7	-4.73***	-105.4	-4.40***
L/D		-11.1	-1.90*	-9.7	-1.69*
Cap:		-1.42	-2.92***	3.71	2.45**
RD		-6.68	2.98***		
RD*(15-Cap)				0.71	2.82***
Cost	CB's	1.89	1.15		
	SB's	8.42	3.58**		
Cost*(15-Cap)	CB's			0.28	1.70*
	SB's			0.73	3.36***
Size	CB's	2.80	2.92***	2.48	2.64***
	SB's	5.53	4.26***	5.51	4.19***
CP0		4.57	2.92***	4.45	2.83***
Δinc		0.18	2.48**	0.19	2.62***
Δunr		-0.25	-0.63	-0.22	-0.58
Conser		8.31	1.35	8.36	1.33
Urpop		19.6	3.90***	19.8	3.95***
Crimpro		44.4	7.00***	44.5	6.79***

Derivatives w.r.t.	Coops	Savings
Cap	-0.56	-2.50
RD	6.87	6.93
Cost	2.72	7.10
Number of observations	483	483
ADJ. R^2	.51	.51

Tests of joint significance (significance levels)

	Coops	Savings	Coops	Savings
Cap & RD & Cost	.0002	.0000	.0214	.0000
Demand	.0000		.0000	

*, **, ***: the test statistic significant at the 10 %, 5 % or 1 % level, respectively
The t-values are corrected for heteroscedasticity (White, 1980)

5.3 Some checks of specification and robustness

Every model specification and every choice of sample is just one among many a priori reasonable alternatives. It is therefore useful to check how the results would change if some important choices had been made differently.

One question is the choice of the capital variable. The used ratio of equity capital and reserves (provisions) to total assets seems natural from the point of view of the theoretical model. But as discussed above, the regulatory capital ratio may also be relevant. The K/A variable in the linear version (4) in Table 7 is therefore replaced with the appropriate regulatory capital ratio $(K/A)^{REG}$ which includes subordinated debt but excludes some provisions and uses a slightly different scaling factor. The estimation results of an equation modified in this way are reported in column (f) in Table 8. It turns out that the regulatory capital ratio does not have any association what so ever with the dependent variable while the estimated effects of the cost variables remain essentially unchanged. The relevant capital concept thus seems to be the original variable most closely resembling the equity capital concept of the theoretical model.

Also two other issues pertaining capital may be important. As noted above and discussed more thoroughly in Appendix 3, capital regulation changed as of the beginning of 1991. That this type of change would very likely take place, was probably understood in the banking community at least since 1988. The change implied a tightening of the requirement in general and in particular for those banks which had more than the average share of loans to the public in their assets. The latter effect can be tested with our cross-section data, as one can compute an estimate for the change in the regulatory capital ratio due to the regulatory change for every bank. Such a variable, denoted ΔREG, should according to the theoretical model have a negative effect on lending.[15]

Secondly, as discussed above many savings banks added substantially to their equity capital through value adjustments mainly related to fixed property. One may suspect that these banks were behaving differently from those who did not seek to expand their capital base in this, ex post highly illusory, way. To check for this possibility one specification of the equation is augmented with the variable VAD/K which measures the share of cumulative net value adjustments ("equalization fund") in total equity capital plus reserves at the time when the cumulative value adjustments peaked (1989).

Column (g) in Table 8 reports the results when the two additional variables are included; due to missing data the sample is somewhat smaller than in the earlier regressions. The results give some support to the conjecture that the change in the capital regulation that took place in 1991 indeed constrained bank lending already in the late 1980s. Furthermore, allowing for this effect in no way alters the earlier results supporting the moral hazard hypothesis.

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[15] The variable ΔREG is computed by subtracting from the end-of-1990 regulatory capital ratio calculated according to the old rules a corresponding estimated ratio according to the new rules. As data on the old ratio for the end of 1990, $(K/A)^{REG}(90)$, were not available, the ratio was estimated by $(K/A)^{REG}(89)*(K/A)(90)/(K/A)(89)$, where K/A(90) is the ratio of equity capital and reserves over total asset used elsewhere in the analysis. Due to missing data, ΔREG cannot not be calculated for 23 banks of the original sample.

Table 8. **Some alternative specifications**

		(f)	(g)	(h)	(i)
Dependent variable		ΔL/D9086	ΔL/D9086	High L/D90 ΔL/D9086	Low L/D90 ΔL/D9086
Explanatory variable		coefficient (t-value)	coefficient (t-value)	coefficient (t-value)	coefficient (t-value)
Constant,	CB's	-72.1***	-62.1***	-80.4**	23.3
		(-4.19)	(-2.90)	(-2.53)	(1.04)
	SB's	-101.9***	-87.6***	-99.8***	25.7
		(-5.59)	(-3.96)	(-3.09)	(1.13)
L/D		9.28	-12.9**	-21.6***	-51.8***
		(-1.58)	(-2.26)	(-2.72)	(-6.65)
Cap:		0.14	3.14**	4.59**	0.17
		(-.34)	(2.35)	(2.30)	(0.13)
RD		8.28***			
		(3.47)			
RD*(15-Cap)			0.60***	0.93***	0.12
			(2.67)	(2.96)	(0.61)
Cost	CB's	2.72			
		(1.69)			
	SB's	8.26***			
		(3.36)			
Cost*(15-Cap)	CB's		0.22	0.21	0.15
			(1.37)	(0.96)	(0.86)
	SB's		0.71***	0.66**	0.08
			(3.28)	(2.52)	(0.45)
Size	CB's	2.49***	2.48***	0.99	2.64***
		(2.64)	(2.59)	(0.81)	(2.83)
	SB's	6.14***	5.30***	3.49**	2.79*
		(4.40)	(4.12)	(2.33)	(1.76)
CP0		4.79***	3.11**	4.47**	-0.13
		(3.07)	(2.06)	(2.49)	(-0.09)
Δinc		0.15**	0.14**	0.26***	0.04
		(2.30)	(2.02)	(3.09)	(1.01)
Δunr		-0.32	-0.26	-0.17	-0.61
		(-0.81)	(-0.70)	(-0.42)	(-1.15)
Conser		9.07	9.42	7.74	5.97
		(1.43)	(1.48)	(1.37)	(-0.87)
Urpop		18.4***	15.7***	24.9***	2.84
		(3.59)	(3.04)	(4.24)	(-0.67)

	(f)	(g)	(h)	(i)
Dependent variable	ΔL/D9086	ΔL/D9086	High L/D90 ΔL/D9086	Low L/D90 ΔL/D9086
Explanatory variable	coefficient (t-value)	coefficient (t-value)	coefficient (t-value)	coefficient (t-value)
Crimpro	42.9***	45.9***	41.3***	..
	(6.64)	(6.45)	(6.40)	..
ΔReg		-0.53*		
		(-1.85)		
Vad/K		0.05		
		(0.68)		
Derivatives w.r.t.	Coops Savings	Coops Savings	Coops Savings	Coops Savings
Cap		-0.41	-0.45	-0.91
		-2.51	-2.41	-0.72
RD		5.84	9.03	1.14
		5.90	9.12	1.15
Cost		2.09	2.03	1.48
		6.95	6.47	0.85
Number of observations	483	460	362	121
ADJ. R^2	.50	.53	.57	.38

Tests of joint significance (significance levels)

	Coops Savings	Coops Savings	Coops Savings	Coops Savings
Cap & RD & Cost	.0035	.040	.029	.30
	.0002	.0002	.0004	.33
Demand	.0000	0.0001	.0000	.54

*, **, ***: the test statistic significant at the 10 %, 5 % or 1 % level, respectively
The t-values are corrected for heteroscedasticity (White, 1980)

In principle this finding that the tightening of capital regulation (increase in k in the theoretical model) can even be used to discriminate between the two sources of moral hazard: underpricing of non-deposit funding and anticipation of perverse bank support policies (rewarding capital insufficiency, $c < 0$). The negative effect is namely consistent with the underpring hypothesis but inconsistent with the hypothesis that bankers expected that capital insufficiency would be rewarded. Nevertheless, given that the exact significance level of the ΔREG coefficient is as high as .064, strong conclusions are not warranted.

In contrast, the degree to which the banks used value adjustments as a way to boost capital did not matter for growth of lending (column (g) in Table 8).

The theory suggests that the relationship between bank lending and various exogenous factors is more predictable for the banks which fund themselves in the money market than for the highly liquid banks, whose essential decision problem is to allocate an exogenous amount of capital and deposits between risky lending and bonds. Unfortunately, there is no way of classifying the banks with any degree of certainty into the two categories on the basis of available data. One can nevertheless, compare how well the specified model fits for those banks which had low L/D ratios with how well the model fits for the supposedly more standard banks that used significant amount of non-deposit funding. Columns (h) and (i) in Table 8 report estimates for two subsamples constructed on the basis of the 1990 L/D ratio. The results in column (h) are obtained by using only the observations, for which the 1990 L/D ratio was within the three top quarters (75 per cent from the top), and the results in column (i) relate to the banks with the lowest quarter of the L/D ratios.

The results differ quite a bit. As predicted by the theory, the equation fits much better for the high L/D banks than for the low L/D banks in terms of both R^2 and number of significant coefficients. In particular the effects of capital and costs are insignificant for the low L/D banks, while for the high L/D banks the results are very close to those obtained for the whole sample. Qualitatively the capital and cost effects are the same in both subsamples. Therefore and as there is no obvious cut-off point, no attempt is made to eliminate from the sample any given number banks with small L/D ratios.

5.4 Stability over time

The examined period of credit expansion is relatively long spanning the years 1987 through 1990. This as such raises the question whether bank behaviour remained essentially the same over the period. Furthermore, as hinted in section 2, examining the potential changes in bank behaviour around the early 1989 may tell something about the reasons for why high cost banks expanded lending more than others.

Table 9 reports estimation results for the non-linear specification (4) for the periods 86-88 and 88-90. For the former period, column (j), the model is fully analoguous with the whole period version of the earlier tables. Thus the exogenous variables are dated either at the beginning of the period or, as in the case of income growth and change in the unemployment rate, over the period of interest. For the latter period two different versions are reported. The first one, column (k) is again fully analoguous with the whole period model; the exogenous variables are dated at the end of 1988 or over the period end of 1988 through end of 1990. In the second

version, column (l), the end-of-1988 exogenous variables are replaced by the corresponding end-of-1986 variables.

Several interesting differences exist between the subsample results. First, the fit is much worse for the first subperiod than the second. Particularly the demand factors appear to influence credit growth very little in the first period while they are very important in the latter period.

Second, for all subsample regressions the fit is worse than the for the period as a whole. This suggests that the banks' horizon for lending decisions is relatively long. At least during the growth period banks seem to have abided largely by the same strategy for the whole period. A practical implication is that the data set cannot usefully be analyzed year by year even though such an analysis would add the number of observations and would at least in principle allow modelling also time-dependent effects such as that of the general level of interest rates. In other words, the phenomenon under examination is of such duration that doing full-fledged panel analysis with, say, annual observations would be futile: splitting the period of observation generates random variation in the dependent variable rather than informative observations.

Third, comparing the first period results with analogous second period results, column (k) suggests of a remarkable change in the capital and cost effects: the moral hazard incentives seem to vanish, no significant effects can anymore be detected. Taking this at the face value, one might conclude that the observed positive relationship between costs and lending and the observed negative relationship between capital and lending for the period as a whole and for the first subperiod would not represent deliberate risk taking. Rather it would appear to be motivated by an attempt to reduce unit costs and increase capital through growth in an environment where risks of rapid growth were not at all understood by the bankers or their lenders. According to this story, behaviour changed radically when the macroeconomic prospects turned for worse in the early 1989 and bankers as well as perhaps their lenders became aware of potential credit risks. Thus the popular explanation the banks' credit growth that was called in section 2 the "lower unit costs through growth" or "riskeless expansion" story rather than moral hazard would be the explanation for the observed bank-wise variation in lending growth. However, a closer look suggests that quite the opposite is plausible in the light of the data of this analysis.

Table 9. **Estimates for the sub-periods**

		(j)		(k)		(l)	
Dependent variable		ΔL/D8886		EXOG.: 1988 ΔL/D9088		EXOG.: 1986 ΔL/D9088	
Explanatory variable		coefficient	t-value	coefficient	t-value	coefficient	t-value
Constant,	CB's	-28.5	-1.67*	-16.8	-0.91	-53.9	-3.76***
	SB's	-33.7	-1.94*	-35.4	-2.05**	-72.5	-4.98***
L/D		-1.53	-0.43	-12.3	-3.47***	-8.66	-2.24**
CAP:		1.36	1.23	-0.26	-0.23	2.56	2.91***
RD*(15-Cap)		0.29	1.81*	0.19	0.96	0.45	2.60***
Cost*(15-Cap)	CB's	0.08	0.69	-0.15	-1.21	0.20	1.87*
	SB's	0.30	1.99**	0.08	0.55	0.45	2.78***
Size	CB's	2.29	3.30***	1.14	1.65	0.15	0.19
	SB's	1.09	1.27	5.80	5.22***	4.35	4.04***
CP0		1.31	1.36	4.07	3.20***	3.25	2.49**
Δinc		-0.01	-0.18	0.17	2.00**	0.17	1.87*
Δunr		-0.22	-0.54	-0.02	-0.07	0.04	0.11
Conser		-0.26	-0.08	12.5	1.87*	11.9	1.81*
Urpop		7.89	2.32**	16.7	4.18***	12.7	3.35***
Crimpro		9.94	2.14**	36.2	5.06***	35.0	5.10***

Derivatives w.r.t.	Coops	Savings	Coops	Savings	Coops	Savings
Cap	-0.29	-1.20	-0.67	-1.57	-0.24	-1.34
RD	2.87	2.89	1.83	1.78	4.39	4.44
Cost	0.78	2.89	-1.45	0.77	1.94	4.36
Number of observations	483		483		483	
ADJ. R^2	.17		.46		.47	

Tests of joint significance (significance levels)

	Coops	Savings	Coops	Savings	Coops	Savings
Cap & RD & Cost	0.221	0.010	.195	.045	.014	.0005
Demand	.174		.0000		.0002	

*, **, ***: the test statistic significant at the 10 %, 5 % or 1 % level, respectively
The t-values are corrected for heteroscedasticity (White, 1980)

Bank lending is business where revenues are earned up-front. Various fees and charges turn in at the beginning of the loan contract. In addition, hardly any customer fails to pay interest on newly taken debt. Debt service problems emerge typically towards the end of the contract period.[16] This is likely to be particularly characteristic for the so-called "bullet" loans, ie. loans where the full principal is paid back at the maturity. These loans became very popular in the late 1980s, particularly among the savings banks. Thus the banks which in 1987 and 1988 had rapidly expanded their lending not only managed to reduce their unit costs but also posted high profits and thereby added to their capital base. Therefore, if the banks which had adopted a growth strategy in the early phase of the credit boom period continued the same strategy in the latter period, there might not be any relationship between the 1988 capital and cost and the subsequent lending growth. This is what one observes in column (k).

But, if this conjecture of unchanged lending strategies holds, and it is supported by the earlier observation that the fit is better for the period as a whole than the subperiods, one should find the same significant capital and cost effects in the second version (col. l) of the latter period as for the first subperiod. In the version (l) the capital and costs variables are namely dated at 1986, prior to the improvement caused by the early credit growth. And this is exactly what one finds in column (l). In fact, the perverse cost effects seem to be even stronger for this period than for the first period. Noteworthy is that these stronger effects obtain, even if also some other interesting variables obtain much larger coefficients in col. (l) than in col. (j). Thus the coefficient of the criminal process dummy more than triples, even though it was significant to begin with. Similarily, the size effect quadradouples for the savings banks between the two periods.

The evidence lends thus support to the conclusion that the low capital, high cost banks which chose a strategy of rapid growth in the aftermath of financial liberalization, continued if not sharpened this lending policy when the macroeconomic prospects turned for worse in 1989. Rapid growth was pursued especially by large savings banks and banks in which signs of criminal behaviour were later detected. This pattern fits very well with the moral hazard explanation. In contrast, it is difficult to reconcile with the idea that the banks expanded lending in 1987 through 1990 because they did not understand risks, as in this case one would have expected the banks to change their behaviour radically in a conservative direction once the external conditions changed for worse.

5.5 The behaviour of subordinated debt[17]

Moral hazard may, according to the underlying theoretical model, result either from undepricing of bank liabilities or perverse enforcement of capital regulation. As noted in section 2, banks' choice of the amount of subordinated debt can be informative

[16] Default premia in the interest rate further increase the up-front nature of the earnings on risky bank lending.

[17] The date on subordinated debt is based on the files of Statistics Finland. The aggregate so obtained for the cooperative bank group does not precisely correspond to what the group reports. There is, however, no practical way to identify the source of the discrepancy.

about the nature of liability pricing or capital regulation. More specifically, if pricing is fair and the bank is penalized with a positive penalty for capital insufficiency, the banks which use money market debt also issue the maximum allowed amount of subordinated debt. In the case of zero penalty no specific amount of subordinated debt is implied, and in the case of negative penalties the optimal subordinated debt volume is zero. Also the underpricing of senior liabilities may results in zero optimal subordinated debt irrespective of the sign of the penalty parameter.

It was already noted above that the cooperative banks typically used relatively much subordinated debt in the late 1980s while most savings banks had no such debt at all. This broad observation is consistent with the results of the loan equation regressions: the potential problem of moral hazard was more serious among the savings banks than among the coopertative banks.

But to really be able to draw the conclusion that the patterns of subordinated debt are in line with the results of the loan equation one needs to check that the issuance of subordinated debt by individual banks conforms with what the theory predicts. There are two important predictions in this regard. First, that the banks that issue the maximum amounts of subordinated debt indeed are banks that use non-trivial amounts of non-deposit funding (have high L/D's). Second, that the banks which issue most subordinated debt are also weakly capitalized, as the function of subordinated debt is to alleviate the problem of insufficient relulatory capital.

In Figure 2, I have plotted the ratio of subordinated debt over tier-I capital (SUBSHA; per cent) against the L/D ratio and the total regulatory capital ratio (CAPRAT) at the end of 1990. The maximum amount of subordinated debt which is counted as regulatory capital is 50 per cent of tier-I capital.

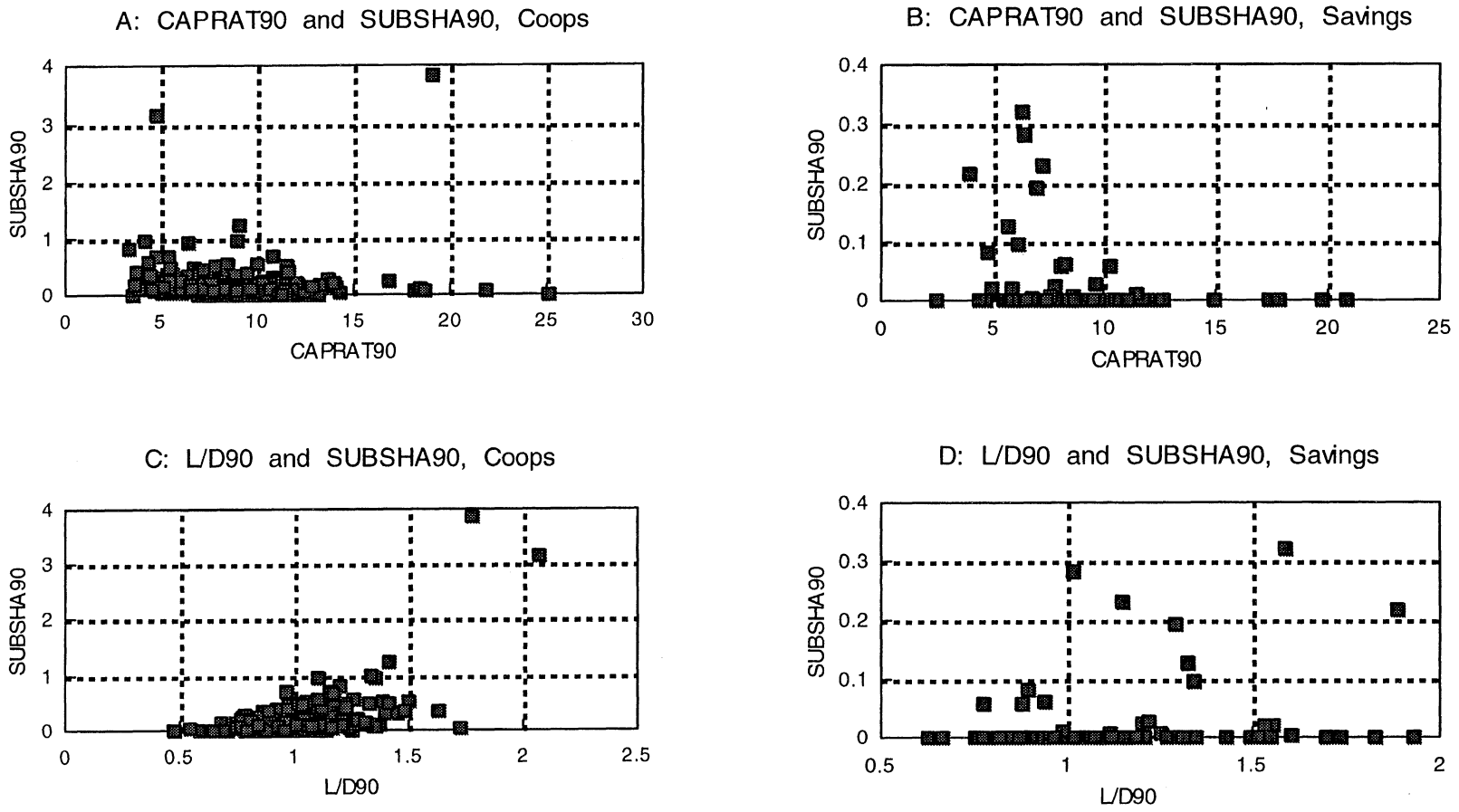
As can be seen no savings bank utilized in full the possibility to augment regulatory capital with subordinated debt. In contrast, several cooperative banks had subordinated debt outstanding well in excess of the regulatory maximum and quite many more were close to the maximum. Yet, even most cooperative banks were below the maximum, suggesting that also within this group many banks perceived the problems of capital inadequacy relatively small or the senior money market funding was attractively priced relative to subordinated debt.

Importantly, there is a clear positive relationship between SUBSHA and L/D, as required by the theory. This is particularly so for the cooperative banks but it may exist also among the savings banks.

Plotting SUBSHA againts the regulatory capital concept CORRAT also displays rather systematic behaviour.[18] The banks that issue significant amounts of subordinated debt are at the low end of the regulatory capital ratio. This is again clearly in line with the theoretical model, according to which the value of subordinated debt for the bank pertains to capital adequacy.

[18] Essentially the same type of scatters would emerge if the plots were against tier-I capital ratio or K/A. The banks that utilized most subordinated debt thus did not manage to improve their regulatory capital ratios so as to make them rank very differently in an ordering of regulatory capital ratios. Ie. subordinated debt worked to alleviate insufficiency of regulatory capital, not to eliminate it.

Figure 2. **Share of sub-ordinated debt in core capital against Caprat and L/D**



Importantly, the negative relationship between capital adequacy and issuance of subordinated debt also suggests that the issuance activity is governed by the supply side: Issuance by some banks is small because these banks prefer small amounts of such debt, not because buyers of subordinated debt had charged high lemons premia and at the extreme rationed such risky lending to the banks. If the latter factor had been dominant, one would expect to see the better capitalized banks having issued in relative terms more than the weakly capitalized banks. Also the observation that some cooperative banks issued subordinated debt several times over the regulatory maximum suggests that pricing or availability of subordinated debt was no problem.

To ensure that the two partial relationships, which individually conform with the underlying theory, obtain also simultaneously, a Tobit model for the end-of-1990 SUBSHA was estimated. The explanatory variables are constant, L/D, K/A and bank size. Bank size is included to account for possible differences in the access to the market of subordinated debt by banks of different size; small banks presumably have higher unit costs of transaction and are likely to face higher lemons premia if such premia exist. The L/D ratio in the analysis is adjusted by deducting the amount of subordinated debt from the loan stock to make the ratio reflect more precisely the extent to which lending was financed with senior non-deposit funding. The results are reported in Table 10.

Table 10. **Tobit models for SUBSHA90**

A. The Cooperative Banks			B. The savings Banks		
Number of observations 332[1], of which 324 have positive values for SUBSHA90			Number of observations 128[1], of which 27 have positive values for SUBSHA90		
Explanatory variables	Coefficient	t-value	Explanatory variables	Coefficient	t-value
Constant	-10.4	-0.81	Constant	-7.29	-0.46
L/D[2]	37.7	4.16***	L/D[2]	-6.34	-0.68
K/A	-4.19	-3.72***	K/A	-3.55	-2.40**
Size	5.62	3.15***	Size	6.32	3.30***
Log of likelyhood function = -1555.6			Log of likelyhood function = -139.6		

(1) Data on some variables missing.
(2) In the calculation of the ratio, the amount of subordinated debt is subtracted from L.

The results confirm the bivariate negative relationship between bank capitalization and issuance of subordinated debt: weakly capitalized banks use more subordinated debt than others. It is important that the negative relationship obtains even after controlling for bank size, which as expected, exerts a positive impact on issuance of subordinated debt. However, the positive relationship between the issuance of subordinated debt and the L/D ratio is significant only for the cooperative banks.

In sum, the local banks' issuance of subordinated debt has behaved broadly as predicted by the underlying theory. Its behaviour is furthermore consistent with the

results obtained with the loan regressions. Although banks used subordinated debt to improve their regulatory capital ratios in the late 1980s, only a small fraction of them did so to the extent allowed by regulations. That they did not do so seems furthermore depend on their own choice rather than possible lemons premia or rationing in the market for subordinated debt.

As in the loan regressions, there is an important difference in the behaviour of subordinated debt between the cooperative banks and the savings banks. The moral hazard incentives, which are suggested for both types of banks, seem to have been much stronger among the savings banks than the cooperative banks.

5.6 The quantitative significance of moral hazard

Even though the results suggest that moral hazard has affected banks' credit supply in the boom period, the test results do not yet quantify its importance in a concrete manner. One way of doing this is to make counterfactual calculations about what the expansion of credit had been according to the model in the cooperative bank and savings bank sectors, had bank capital been sufficient to eliminate most if not all moral hazard.

The calculations utilize a decomposition of lending growth into the changes of the individual banks' loan deposit ratios and deposit growth:

$$\frac{\Delta L}{L} = \sum_{i=1}^{N} \frac{\Delta L_i}{L} \approx \sum_{i=1}^{N} \left(\Delta \left(\frac{L_i}{D_i} \right) \cdot \frac{D_i}{L} + \frac{L_i}{L} \cdot \frac{\Delta D_i}{D_i} \right) \tag{4}$$

where $\Delta(L_i/D_i)$ is the change in the loan deposit ratio for bank i predicted by the model, D_i/L and L_i/L are ratios of bank i deposits and loans over the aggregate loans, respectively, and $\Delta D_i/D_i$ is the rate of deposit growth in bank i. The decomposition thus weighs together the predictions for individual banks to arrive at an aggregate growth of credit prediction. In doing so it allows a big bank to affect the sectoral outcome according to its actual size, not just with the weight of an observation in the total samples of 333 or 150 banks.

The hypothetical prediction of credit growth in the absence of moral hazard is computed by setting the capital asset ratio K/A at the beginning of the period at 15 per cent for all banks in the nonlinear specification of the capital and cost effects. This implies that the cross terms vanish from the equation. As roughly tripling the average capital asset ratio is a rather demanding requirement, also the counterfactual prediction with the capital asset ratio at 10 per cent (about the maximum observed ratio in the sample) is computed. The calculations are done for three specifications: The first one is the specification (e) of Table 7, where the parameters are estimated with least squares and some important parameters are allowed to differ between the two banking groups. The second one is the same structure, but the estimation method is LAD. The third version is based on least squares estimation of a specification where the behaviour is imposed to be the same across the two banking groups, ie. the savings bank dummies of the earlier versions are eliminated.

The results are reported in Table 11. The first line provides an overall benchmark by showing what the growth rates were for the two banking groups

separately and combined when using the decomposition (4) with the true Δ(L/D) values. For every estimated specification, the first line reports what the predicted sectoral growth rates is using the true capital ratios K/A. Comparing these to the overall benchmark constitutes a sector level indicator of the goodness of fit. Comparing the counterfactual computations with the prediction with the true K/L ratios in turn provide measures of the quantitative importance of moral hazard.

The first observation is that the version allowing behaviour to differ between the two banking groups and using least squares as the estimation method produces almost precisely the same rates of growth as the decomposition with the true L/D ratios. In contrast, the prediction based on the LAD estimates underestimates growth in both sectors. Similarily, imposing the same behaviour on all banks leads to an overestimation of the cooperative banks' rate of growth and an underestimation of the savings banks' rate of growth. These observations suggest that the most reliable inference can be made on the basis of the first version ie. the specification (e) of Table 7.

The counterfactual calculation suggest that the estimated moral hazard effect is quantitatively very important. Had the capital ratios been at the assumed safe level of 15 per cent for all banks, the rate of growth of lending by the two banking groups combined had been 16–21 percentage points ie. over one fifth less than it in fact was.

Even more striking are the results for the two banking groups separately. According to the version with the best overall fit, the absence of moral hazard had reduced the savings bank growth rate by almost a third from 98 per cent to 68 percent during the four year period considered. Also lending by the cooperative banks had been less without moral hazard incentives, but the difference is much less, only less than a thenth of the actual growth rate. If the capital ratios for all banks had been at the maximum observed, 10 per cent, the reduction in moral hazard incentives had been less but still 15 percentage points for the savings banks.

Finally, the difference between the two banking groups stems mainly from different behaviour, although to some extent also the capital positions and cost positions of the savings banks were less favourable than those of the cooperative banks at the outset of the boom period.

Table 11. **Predictions for the aggregate growth of credit in 1986–1990, per cent**

	The cooperative banks	The savings banks	The cooperative banks and savings banks together
The total differential with the true $\Delta\frac{L}{D}$ values	79	99	89
Prediction on the basis of specification (e) in Table (7)			
with the actual K/A ratios	79	98	88
with K/A = 15%	73	68	70
with K/A = 10%	76	83	79
Prediction on the basis of LAD-estimates of the same model			
with the actual K/A ratios	77	95	86
with K/A = 15%	68	72	70
with K/A = 10%	73	84	78
Prediction of the basis of an equation imposing the same behaviour on the two banking groups			
with the actual K/A ratios	82	93	88
with K/A = 15%	67	72	69
with K/A = 10%	83	74	78

6 Discussion

The estimation results on credit extension by the cooperative and savings banks support the hypothesis that low capital and high costs induced banks to expand lending in the boom years. The effect is particularly strong in the case of the savings banks. In the formal model that underlies the empirical analysis, the finding is consistent with moral hazard on the part of bank equity holders. The observed behaviour of banks' issuance of subordinated debt is broadly consistent with these conclusions.

The part of credit growth in 1986 through 1990 that, according to the estimated models, can be associated with moral hazard is also quantitatively very large. Counterfactual calculations suggest that almost a third of the lending growth of the savings banks as a group was due to moral hazard. For the cooperative banks the role of moral hazard seems quantitatively much smaller. In fact, in the absence of moral hazard, the lending by the savings banks had grown less than that of the cooperative banks. As there is a close association between lending growth and the magnitude of problem assets (Solttila and Vihriälä 1994), eliminating moral hazard from the savings bank behaviour would probably have changed the magnitude and nature of the Finnish banking crisis fundamentally.[19]

The results suggest that banks did not on average change radically their lending strategies during the boom period; in fact the overall change can be better accounted for than changes over shorter subperiods. To the extext there was change over time, the results suggest that the prime impulses from weak capital and high costs to expansion of credit took place in the early part of the boom period, immediately after the main deregulatory measures in the financial markets. Furthermore, behaviour between the cooperative banks and the savings banks was more uniform in this period than later. On the other hand, demand impulses seemed to be largely absent early on.

In the second half of the boom period (1989 and 1990), when restrictive monetary and regulatory policies had been introduced, the banks that had adopted an expansionary strategy in the early stage in response to weak capital and high costs, continued to expand lending rapidly. Relative to other banks their expansion in fact accelerated. In particular large savings banks continued rapid expansion of credit in this stage. So did the banks, in the running of which criminal activity was later suspected. Given the substantial upfront earnings associated with rapid growth, the profitability and capital asset ratios of these expansionary banks had improved markedly by the end of 1988. Therefore, for a while these banks did not look particularly weak in terms of profitability or capital.

The observation that particularly those banks that had adopted the policy of rapid expansion in the beginning of the boom period continued to expand (in relative terms) also in 1989 and 1990 is consistent with the idea that risk taking was to a large extent deliberate rather than based solely on overoptimistic expectations. So is the finding about the role of criminal activity. Thus moral hazard rather than misunderstanding of credit risks or bad luck is suggested. This conclusion is also

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[19] In fact the effect of eliminating the "excessive" lending growth by the savings banks may be stronger than just limiting the later losses of the savings banks. The aggressive behaviour of the savings banks in the loan market probably induced also other banks to expand in a direct response to losses of market shares and also through the impact on asset values.

supported by some internal documents of the two banking groups. In the Spring of 1989 a circular sent from Skopbank to savings bank managers encouraged the banks to not to slow down credit growth in response to the special cash reserve requirement imposed by the Bank of Finland, but to use the opportunity to increase market shares (Kuusterä 1995). In contrast, a similar type of circular sent from Okobank to cooperative banks already in late 1988 suggested that the cooperative banks should slow down credit growth and tighten credit criteria.

The findings of this paper about moral hazard as a cause of rapid growth of bank lending are consistent with the results by Keeley (1990) and others who have found evidence of moral hazard.[20]

However, our results differ in an important respect from most of the analyses finding support for moral hazard.The fundamental reason for moral hazard in these studies is underpriced deposit insurance.[21] This is not the case in this analysis. The theoretical model underlying the empirical analysis points to two reasons for moral hazard: underpricing of non-deposit funding and perverse enforcement of capital regulations or perhaps more appropriately bank support policies which reward risk taking.

There is some evidence suggesting that the proximate cause of moral hazard is underpricing of non-deposit funding rather than an anticipation that a failure to meet the capital adequacy regulations would be rewarded by bank support with leanient terms. Namely, the introduction of tighter capital regulations in 1991 seems to have discouraged growth of lending. Such an impact is consistent with the underpricing of non-deposit funding but in conflict with the rewarding of capital insufficiency. Given the relatively weak statistical significance of the parameter in question, this evidence is not very conclusive as such. Nevertheless, against anticipated lenient bank support policies speaks also the fact that there was no experience of any such policy actions - proper or improper - after the second world war prior to the crisis of the 1990s.

Why then had non-deposit funding been underpriced, and in particular so for the savings banks? In principle two types of explanations exist. First, the lenders to the banks did not understand the risks involved, either because the shocks which made bank portfolios to a large extent non-performing were wholy unpredictable or because the lenders simply were myopic. The shocks experienced by the Finnish economy very likely were to some extent unpredictable, and one cannot discount fully myopia

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[20] Keeley examined 150 largest American bank holding companies in the period of 1970 through 1986. He found evidence that low underlying profitability or rather a low charter value of a bank as measured by the ratio of the market value to the book value of bank assets had a positive impact on risk taking by the banks. Risk taking was measured by the ratio of the market value of equity to the market value of assets and by the CD rates. Wheelock (1992) analyzed 257 Kansas banks of the 1920s. He found that the banks whose deposits were insured chose riskier portolios and failed with a higher probability than the uninsured banks. Park (1992) examined data on basically all the FDIC insured banks for the years 1984 through 1988. He found negative bivariate relationships between lending growth and other measures of risk taking on the one hand and capital asset ratios and earnings on assets on the other hand.

[21] Keeley's results do not necessarily require underpriced deposit insurance, but could equally well be due to implicit creditor protection, "too big to fail" policies. No distinction is made in his analysis between insured and uninsured institutions, as is done by Wheelock. However, Keeley himself interprets the results to reflect the particular problem of deposit insurance.

either.[22] However, it is very likely that a second factor ie. anticipation of creditor protection policies by the authorities played a role as well. For this speaks the same fact which was used to argue that risk taking by the expansionary banks was deliberate: No change in the behaviour was observed even though the external conditions turned for worse in 1989. Second, the holders of non-deposit liabities are typically banks and other professional investors, who should know as much as there is to be known about bank risks. Third, particularly in the banking community there is a kind of folk theorem saying that rapid expansion is risky. Finally, the events during the banking crisis of course proved all potential expectations about public creditor protection policies correct: no creditor was allowed to incur losses.

However, given the differences in behaviour between the savings bank group and the cooperative bank group it is useful to take a look at the types of non-deposit funding used by the individual savings and cooperative banks. As discussed in section 3, the local banks had in principle two ways of finding non-deposit funding: directly from the market for example by issuing large denomination CD's or indirectly via their respective "central banks", Okobank for the cooperative banks and Skopbank for the savings banks. Tables 2 and 3 reveal that relative to the total assets, the savings banks increased strongly borrowing from both sources in the boom period while the cooperative banks increased only borrowing from other banks (chiefly their central bank) and even that much less than the savings banks. On the assumption used in the underlying model that the banks indeed maximized the value of equity, these patterns suggest that pricing or availability of funding was different between the two banking groups for both sources of refinancing.

It seems in fact possible that the two central banks had different policies in the pricing of these funds. Although no numerical evidence is available, it has been often argued that Okobank charged a clear margin on the short-term financing of the cooperative banks on top of the CD rates. Although these rates may not have contained an explicit risk premium, funding of this type was subject to quantitative constraints even in the late 1980s, potentially resulting in steeply rising marginal cost schedules for individual cooperative banks, at least after some level of indebtedness.[23] In contrast, according to Kuusterä (1995), Skopbank provided the individual savings banks money market funding in unlimited amounts effectively at the going CD rates. Thus while the individual cooperative banks faced a relatively steeply rising marginal cost schedule of their "central bank" financing, the savings banks may have been able to increase lending at an essentially constant posted marginal cost. A potential for moral hazard type of behaviour for individual savings banks seems to exist.

But if indeed Okobank followed a stricter policy with regard to financing the cooperative banks than Skopbank in financing the savings banks, why didn't cooperative banks substitute direct borrowing from the money market for borrowing from Okobank? One likely explanation is the very small average size of the cooperative banks; at the end of 1990 the average total assets of the cooperative banks were 310 millions while those of the savings banks were FIM 812 millions. Small banks have higher unit transaction costs and may be charged higher lemons

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[22] For example Guttentag and Herring (1984) point out that "disaster myopia" may strongly limit economic agents' capacity to take precautions againts catastrofic low frequency events.

[23] The head of the finance department of Okobank, Mr. Jaakko Eloranta, confirmed this conjecture in a telephone interview in June 1995.

premia than larger banks. But small bank size may not be the whole truth. In the regression analyses reported in this paper bank size is accounted for - and has a positive impact on lending, as expected - but the behaviour still differs significantly between the two banking groups.

To fully account for these differences, one may need to resort to explanations that are outside the basic theoretical framework of this paper. More specifically, it may be that in some sense the legal structure and business traditions put less constraints on the savings bank managers who potentially seeked to exploit underpriced funding than on similar cooperative bank managers.[24]

Whatever are the reasons for differences between the savings bank group and the cooperative banks group and the differences between large and small banks, the question remains, how could Skopbank and some large savings banks and cooperative banks finance themselves in the money market without sufficient risk premium (or rationing)? We are thus back in the question about the role of implicit creditor protection policies. As long as one is unwilling to accept the idea that investors in these banks' uninsured liabilities did not understand the risks involved, one is forced to conclude that the investors must have anticipated that their claims on the banks would be protected by the authorities.

Probably in most countries the banks which have a pivotal role in the payments system and wholesale market are among the banks which can be perceived "too big to fail". In the Finnish system of the late 1980s such core banks presumably comprised, from the point of view of investors, at least the 5 "helibor" banks, including Skopbank and Okobank. The helibor banks were the banks, whose CD's were used to calculate the indicative money market rates, the helibors.

Bank CD's were in the late 1980s in fact the main money market instrument. Given the low public sector indebtedness, there were not sufficient amounts of either short-term or long-term government paper in circulation for them to become the benchmark instruments in the money market. Instead bank CD's took this role. The predominant position of bank CD's was strengthened by the fact that they became the instrument of the market operations of the central bank, when such operations started in the early 1987. This role of the CD's very likely contributed to a uniform pricing of these instruments in the market, as the central bank treated all helibor banks' CD's in the same way and actually priced them at par with its own CD's when conducting market operations. As particularly Skopbank used CD funding very aggressively in the boom period, pressures emerged in the market place in some instances to discount these papers relative to other CD's. However, price discrimination remained small, 20 basis points at the maximum, and was not applied by all major market

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[24] There are in fact arguments that explain "excessive" risk taking by management interests. Particularly the line of argument put forward by Gorton and Rosen (1992) may have some relevance in explaining why large savings banks were inclined to expand lending in the adverse conditions of 1989 and 1990. Their basic argument is that (low ability) managers that hold such a stake in a bank that their control by other shareholders is largely ineffective but whose ownership is not big enough to align their interests with those of the equity holders in general, are likely to take risky action under adverse economic conditions. Even though there are no true owners in the savings banks, excessive risk taking by the management may be constrained by other constituencies more effectively in small banks than in large banks. The representatives of depositors who according to savings bank legislation have the supreme powers may have a stronger influence in small banks. Similarly, the regulators may have greater prestige among the small banks. On the other hand, a full alignment of management and owner interests is unlikely in the savings banks of any size, as the managers cannot sell their "stake" in the bank as shareholder in a joint stock company can.

players. Not only the central bank continued to price Skopbank CD's at par with its own CD's but such uniform pricing was used also by some competing helibor banks.

But quantitatively even more important than markka CD's was the funding Skopbank and some larger savings banks obtained from foreign banks and other foreign investors; at the end of 1990 Skopbank group alone had outstanding CD liabilities of the order of FIM 13 billion (when peaking somewhat earlier about FIM 20 billion), while the debts owed to foreign banks were FIM 29 billion and bond liabilities (excluding subordinated debt) FIM 15 billion. That also this funding, often times much longer in maturity than the CD funding in the markka market, was forthcoming at acceptable terms suggests that the crucial issue was a general trust that Finnish banks' debts would be very low risk rather than the role of bank CD's as a monetary policy instrument.

Finally, there is the question why the central organizations of the two respective local banking groups behaved differently. In a sense this is an issue of economic history rather than economics. But disaster myopia may have played a role here too. Okobank experienced severe solvency problems in the early 1970s, as did later a relatively large cooperative bank, Iisalmen Osuuspankki. These experiences may have figured in the minds of the cooperative bank and Okobank managers in the late 1980s, while similar acute crises had not been faced in the savings bank group.

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Appendix 1

The bank data

The bank data are based on the income statement and balance sheet information published by the Statistics Finland for individual cooperative and savings banks (denoted by p in the list below). These public data are augmented with confidential information provided by the Statistics Finland on written authorizations by the banks concerned (denoted by c in the list). In addition, Financial Supervision has provided confidential data on capital adequacy (denoted by c).

The basic data contains the following variables:

Income statement 1985-1990

1. Interest earnings on credits granted to the public (p)
2. Other interest earnings (p)
3. Interest expenses on deposits by the public (p)
4. Other interest expenses (p)
5. Interest margin (p)
6. Other earnings (p)
7. Salaries and wages (p)
8. Other expenses (incl. credit losses since 1987) (p)
   Credit losses (c)
9. Operating margin (p)
10. Depreciation (incl. credit losses 1986)(p)
11. Business profit/loss (p)
12. Increase/decrease in reserves (p)
13. Direct taxes (p)
14. Net earnings/loss for the accounting year (p)

Balance sheet 1985-1990

1. Cash (p)
2. Receivables from banks (p)
3. Overdrafts (p)
4. Bills os exchange (p)
5. Loans to the public (p)
6. Loans granted from state funds (p)
7. Adjustment items (p)
8. Bonds and debentures (p)
9. Shares and partnerships (p)
10. Machinery and equipment (p)
11. Other assets (p)
12. Equalization items (p)
13. Deposits by the public (excl. demand deposits) (p)
14. Demand deposits (p)

15. Claims of other banks (p)
16. Other liabilities (p)
    Subordinated debt (since 1987) (c)
    Other debt securities (since 1987) (c)
    Debentures (1985, 1986) (c)
17. Adjustment items (p)
18. Reserves (p)
    Reserves for bad debt losses (c)
19. Cooperative capital / primary capital (p)
20. Reserve fund and other funds (p)
    Reserve fund (c)
    Equalization fund (c)
21. Undistributed profit from previous years (p)
22. Net loss from previous years (p)
23. Net earning for the accounting year (p)
24. Net loss for the accounting year (p)

Other data from Statistics Finland 1985-1990

1. Number of advances (p)
2. Number of deposit accounts (p)
3. Number of bills of exchange (p)
4. Number of employees (p)
5. Number of branch offices (incl. the head office) (p)

The data from Financial Supervision (c)

1. Regulatory capital according to the Commercial Bank Act, Cooperative Bank Act and Savings Bank Act 1980-1989
2. Capital ratio according to the aforementioned acts 1980-1989
3. Capital according to the Deposit bank act 31/12/90
    Tier I
    Tier II
    Total
4. Assets and off-balance sheet commitments by risk category 31/12/90
    100 per cent category
    50 per cent category
    20 per cent category
    0 per cent category

Appendix 2

The data on local market conditions

The construction of the variables that are assumed to proxy local market conditions is dictated by the availability of data on municipal level. The main source is the municipal data base of Statistics Finland (Kunta-avain). In addition, employment data have been obtained from the Ministry of Labour, and data on market shares from a Bank of Finland survey of the banks service network. The basic data consist of the following variables:

(A) Statistics Finland:

1. population annually
2. urban population (taajamaväestö) in 1990
3. working age (15-65) population in 1990
4. population by occupation in 1990
   - agriculture
   - manufacturing
   - construction
   - other
5. taxable income in municipal taxation annually

(B) Ministry of Finance

6. register-based unemployment rate, annual average

(C) Bank of Finland

7. Loans extended by the branches of the major 5 banks in 1991

To obtain observations that correspond to the operation area of a given bank, the basic data are added over the municipalities in which the bank has branches. In the case of the unemployment data, working age population is used as a weighting variable. Only population, taxable income and the unemployment rate variables are truly annual. The population structure variables are assumed to have been essentially constant over the period of interest.

Appendix 3

Capital regulation in the 1980s and the early 1990s

The capital regulations in force throughout the 1980s and until the end of 1990 required the cooperative banks and the savings banks to hold a minimum of 2 per cent of capital in relation to bank liabilities. The required ratio for the commercial banks which had a somewhat wider scope of authorized banking activities was 4 per cent.

Towards capital were counted equity capital (commercial banks), cooperative capital (cooperative banks), primary capital (savings banks, reserve fund, equalization fund and other funds. The regulatory capital concept could also include half of the reserves for bad debt losses (up to 0.5 per cent of total liabilities), and subordinated debt (up to 50 per cent of the capital proper).

The denominator in the regulatory capital ratio consisted of all liabilities on the balance sheet less subordinated debt and the equivalent of cash, reveivables from the state, municipalities, church, Bank of Finland and other banks. Also the receivables guaranteed by the state, municipalities, church and certain bonds could be deducted. The savings banks and the cooperative banks could furthermore deduct up to 50 per cent of the loans that were guaranteed by a publically supervised insurance company. On the other hand half of the off-balance sheet commitments were included in the bank liability concept.

The details of the regulations were set by instructions of the Banking Supervision. Thus, for example, the value adjustments of fixed property that could be used to add to the equalization fund were regulated by the Banking Supervision.

In 1990 the banks were allowed to transfer 90 per cent of the reserves for bad loan losses to the reserve fund. This implied an increase in the regulatory capital as only half of the reserves could be counted towards capital.

As of the beginning of 1991 a new Deposit Bank Act entered in force setting on all types of deposit banks a uniform requirement of 8 per cent of regulatory capital in relation to the risk-weighted assets and off-balance sheet commitments. The regulations followed relatively closely the BIS recommendations of the time. A notable exception was that the assets of the savings banks and cooperative banks that were insured in a supervised insurance company continued to have a preferred treatment: they were included in the 50 per cent risk category instead of the normal 100 per cent. The regulatory reform implied tighter capital regulation for basically all banks, although the difference was not as much as the pure percentages would suggest. The main lines of the prospective reform became known in the banking community at the latest in mid-1988.

At the beginning of 1994 the Deposit Bank Act was replaced by the Credit Institution Act, which fully harmonized the Finnish capital regulations with the EC banking directives thus for example abolishing the favourable treatment of the insured assets.

Appendix 4

The exogeneity of deposits and deposit rates

The exogeneity of deposit rates and deposit volumes are examined by regressing the deposit rate RD, the growth of deposits between 1986 and 1990 $\Delta D/D$ on the same explanatory variables as in the basic model for the loan deposit ratio (with the exception of RD, of course). For comparison, a similar equation is estimated also for the rate of growth of lending ($\Delta L/L$) between 1986 and 1990.

The dependent deposit rate refers to the year 1988 in the reported equations. However, the results would not change qualitatively if any other year or the average over the whole period were used. The bank dependent variables are dated alternatively at 1986 or 1988. The deposit growth rate is over the boom period as a whole. Again the results would not change qualitatively if shorter periods were used.

None of the deposit rate or the deposit growth equations obtains a noteworthy R^2. The explanatory variables - whether the characteristics of the banks or demand variables - are simply unable to account for the variation in the dependent variables. There is a clear difference in this regard vis-à-vis the equation for lending growth.

In the rate equation the "other cost" variable obtains a significant negative coefficient. It is clearly inconsistent with the idea that costly banks would try to attract deposits with high deposit rates. If anything, it suggests that some costs have been incurred to be able to attract deposits with low rates of interest.

The deposit growth equation perform marginally better indicating some dependence of income growth and the share of urban population Given these influences, also the size of the bank and whether the bank is a savings bank seems to be associated with deposit growth. As a whole the deposit equation does not suggest that treating deposits exogenous would be a bad approximation.

Finally, the coefficients of the demand variables in the two growth rate equations suggest that lending growth is more elastic with respect to demand shift variables than deposit growth.

Table A4.1 **Equations for deposit rate and deposit growth, N = 483**

	Dependent variable							
	(1) RD		(2) RD		(3) ΔD/D		(4) ΔL/L	
period	88		88		86-90		86-90	
Explanatory variables								
CONSTANT	.068	(5.5)***	.062	(8.47)***	0.61	(5.4)***	-.19	(-.88)
K/A^{86}	-.025	(-1.17)			-.68	(-1.04)	-3.42	(-3.18)**
K/A^{88}			.027	(.60)				
C/A^{86}	-.207	(-2.96)***			-2.34	(-.68)	4.19	(.81)
C/A^{88}			-.18	(-2.22)**				
$SIZE^{86}$	.00054	(1.65)*			-.024	(-1.96)*	.06	(2.42)*
$SIZE^{88}$			.00033	(1.18)				
CPØ	-.0045	(-1.02)	-.0047	(-1.07)	-.006	(-.33)	.085	(2.46)**
dINC	.012	(1.33)	.010	(1.14)	.0081	(1.98)**	.032	(2.95)***
dUNR	.002	(.20)	.005	(.38)	.073	(.16)	-.40	(-.46)
CONSER	-.0088	(-1.40)	-.0089	(-1.44)	.043	(.71)	.22	(1.28)
URPOP	-.009	(-.78)	-.010	(-.80)	.16	(2.24)**	.41	(3.45)***
D:CONST	.006	(1.60)	.005	(1.55)	.052	(2.42)**	.10	(2.47)**
χ^2(K/A, C/A)	.025		.025		.037		.00002	
$\bar{R}^2$	.006		.005		.06		.31	

***, ** and * denote significance at the 1, 5 and 10 per cent level respectively. (a) the significance level.

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