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## DOES DISTANCE MATTER IN DEPOSIT SUPPLY? A BANK-LEVEL STUDY***

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**ABSTRACT:** We study empirically the determinants of deposit supply using bank level data from local Finnish cooperative banks. Of special interest is the effect of bank branch density on deposit supply. Our main finding is that holding other things constant, the denser the branch network, the lower the deposit rate. We also find that the effect of the branch network decreases over time. Our evidence thus suggests that quite like in the US small business lending (Petersen and Rajan 2001), distance matters in deposit supply, but less than before.

**KEYWORDS:** banking, deposit supply, branch network

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**TIIVISTELMÄ:** Työpaperissa analysoidaan empiirisesti talletusten tarjontaa määrääviä tekijöitä käyttämällä pankkitason aineistoa. Tarkastelemme erityisesti sitä, kuinka konttoriverkoston tiheys vaikuttaa talletusten tarjontaan. Keskeinen tulos on, että kun monien muiden tekijöiden vaikutusta kontrolloidaan, tiheä konttoriverkosto näyttää johtavan alhaisempaan talletuksille maksettavaan korkoon. Konttoriverkoston vaikutus on kuitenkin heikentymässä. Tuloksemme ovat yhdenmukaisia Petersenin ja Rajanin (2001) yhdysvaltalaisella luottoaineistolla saamien tulosten kanssa: (fyysisellä) etäisyydellä on merkitystä edelleen, mutta sen merkitys on vähenemässä.

# 1 INTRODUCTION

It is widely believed that recent technological advance and particularly improvements in information and communications technology have had profound consequences for banking. Empirical evidence on the consequences is however scant. A notable exception is Petersen and Rajan (2001) who, using US loan markets data, show that improvements in banking productivity and technology have reduced the importance of physical distance in small business lending. On the deposit market, there is to the best of our knowledge no corresponding empirical evidence. Anecdotal accounts and practitioners suggest, however, that the increasing use of automatic teller machines (ATMs) since the 1980s and more recently telebanking and the Internet have potentially had an even more profound consequence by rendering the branch networks of banks near to obsolete.[1] The simultaneous substitution of noncash payments for cash transactions and particularly the spread of debit and credit card payments (see Snellman, Vesala and Humphrey, 2001) may also have decreased the importance of bank branches in the provision of bank deposits services. In this paper, we study the extent to which the role of bank branches has changed in the deposit market.

Though no evidence exists on the changing role of bank branches, there are several studies examining the competitive effects and strategic use of branches on deposit markets.[2] In his study of the determinants of banking service accessibility in the US, Evanoff (1988) shows that accessibility, measured by the number of banking branches per square mile, is improved when interstate branching is allowed for. He also finds that the US banks may have used branches for market preemptive behaviour. Nakamura and Parigi (1992) document that most likely because of improved service availability, deposit interest rates are inversely related to the number of branch increases. Finally, Calem and Nakamura (1998) find in their recent study that bank branching tends to increase competition for deposits at peripheral locations by broadening the geographic scope of interbank competition. Their study nevertheless supports the traditional notion that the market for (consumer) deposits is local.

In this paper, we augment the earlier literature by focusing on the potential *changes* in the role of bank branches. The theory put forward, and tested, is very simple. Standard models of product differentiation (see, for a textbook presentation, Tirole, 1988, and Freixas and Rochet, 1997) suggest that firms are able to charge higher markups, the better the match between the attributes of their product, and the demands of the customers.[3] In the deposit market, the theory suggests that holding other things constant, the denser the branch network, the lower the deposit rates. We hypothesize that the relationship between the deposit interest rates and branch network may have become

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1 On its www-page, the Finnish Bankers' Association for example concludes that "Along with the growth of computerised data access and the ever-wider use of bank cards, the role of branch offices in providing banking services has diminished."

2 The relationship between concentration and the pricing of deposits is a somewhat more intensively researched area. The consensus emerging from these studies is that holding other things constant, banks in concentrated markets pay less to their depositors than banks in less concentrated markets (see, e.g., Berger and Hannan, 1989, Hannan, 1991).

3 Or as some bank managers put it to us: (Finnish cooperative) banks operate large branch networks to attract cheap deposits.

weaker and even disappeared during the 1990s. In particular, if the technological advance has decreased the importance of physical distance in the informationally sensitive and therefore local small business lending (as Petersen and Rajan find), then distance is likely to matter less in the provision of deposit services, too. If distance matters less, the effective size of the deposit markets faced by depositors may be expanding. An important implication of the expansion is that the value for depositors of having a bank with *local presence* (in the form of a branch) in the neighborhood is likely to have decreased.

To test whether the branch network reduces the deposit-market mark-ups less than before, we adopt an approach close to that of hedonic price models. That is, we treat deposits as products that heterogeneous depositors offer banks. Depending on the characteristics of the depositors, their marginal cost of offering one more unit of deposits may vary. For example, families who own their own homes may be forced to save money for loan repayments, thereby lowering their production cost. In similar vein we think that, besides the deposit interest rate, the branch network and, more generally, the service level of a bank are complementary ways of paying for the product. Thus the (full) price of the product that the bank "demands", i.e., a given amount of deposits, has other dimensions in addition to the interest rate.

In this paper, we use data on the Finnish banking industry over the 1992-1995 period. The data set is unique in two ways. First, it covers the four-year period at the beginning of the 1990s when the more impersonal ways of providing transaction and saving services (requiring, as we argue, less local presence) took off in the Finnish banking sector. Prior to these years, the use of ATMs had increased while during the sample period, telebanking and Internet-based banking services became significantly more widespread, if not exploded.[4] The substitution of non-cash payments, such as debit and credit cards, for cash transactions continued simultaneously in Finland and elsewhere in Europe (Snellman, Vesala and Humphrey, 2001). Thus, in addition to the general question of what role the (within period, at least) essentially fixed branch investments play on the deposit side we can explore the short, but unique time period to see if the role of branches (distance) has changed over time.

Second, the data is unique in the sense that the banks in the data do not compete against each other. This feature allows us to use a rich set of market specific characteristics as explanatory variables. Simultaneously, we can measure the average competitiveness of deposit markets by estimating the elasticity of deposit supply. All markets in our data are very concentrated, usually being duopolies or, in some cases, triopolies. This suggests that these banks may have monopsony power in the deposit market. The implication of monopsony power would be that the elasticity of deposit supply should be above unity.

Our main finding is that holding other things constant, the denser the branch network, the lower the deposit rate. We also find that the effect of the branch network de-

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4 Unlike in Finland, the European banks' branch networks still have a quite important role for example in transferring of payments. In Europe, a significant proportion of payments is still processed in paper form in branches. In Finland, EFTPOS terminals as well as telebanking services have since the late 1980s reduced payment processing in branches. Simultaneously, the number of bank branches has reduced dramatically. According to the Finnish Bankers' Association, currently some 88% of the Finnish payment transactions are electronic (www.pankkiyhdistys.fi). See also Andersen, Hyytinen and Snellman (2000) who provide an overview of the recent developments in the Finnish banking sector.

creases over time. Our evidence thus suggests that quite like in the US small business lending market (Petersen and Rajan 2001), the distance matters in deposit supply, but less than before. Finally, the results of this paper suggest that the co-operative banks on which we focus have monopsony power in the deposit market.

This paper is organized as follows: In the next section we discuss our data and the Finnish deposit markets. In Section 3 we introduce our econometric model, and present and interpret our results. Section 4 offers short concluding comments.

# 2 THE DATA

For the purposes of this study, we use data from Finnish local cooperative banks. There are 250 cooperative banks in our data, over 1992-1995. These are truly local banks in that they operate only in their local market, and there are essentially no overlaps between them. In other words, they do not compete against each other (neither on the deposit, nor on the credit side of the market). This feature greatly facilitates our analysis, as it is relatively straightforward to match market characteristics to banks. We do not, however (in contrast to Petersen and Rajan, 2001, for example), have customer-level data. Instead, we have a wealth of information as to the aggregate characteristics of the customer population that each of the banks faces.

## 2.1 Market Environment

The sample period includes a severe recession, and years of high growth. Several studies (e.g. Nyberg and Vihriälä, 1993, Koskenkylä and Vesala, 1994) describe the events before and during the recession and the banking crisis, so we will offer only a synopsis here. The volume of lending grew very rapidly (at times by over 30% p.a.) in the late 1980s, partly due to financial market liberalization that took place in the mid-1980s, partly due to an economic boom and lax monetary policy. The boom ended in an economic crisis and in a collapse of asset values including real estate (a prime source of collateral). As a result, the Finnish banking sector suffered, since 1990, from rapidly increasing loan losses and falling earnings.

Because of the evolving problems of the banking sector, and speculations about its collapse, the Finnish Government intervened heavily. As documented in Nyberg (1992) and Nyberg and Vihriälä (1993), the first measure taken by the authorities was the takeover (by the Bank of Finland) of Skopbank in September 1991. In March 1992, further measures were taken when the Government provided the Finnish banks with a capital injection, totalling to FIM 8 billion (1 FIM ≅ 1/6 EUR). At the same time, it decided to establish a Government Guarantee Fund to support the banks. The Fund's main objective was to ensure the stability of the banking system by securing the claims of domestic and foreign depositors. The Fund was formally established on 30 April 1992 by Act of the Finnish Parliament when it was authorised to use up to FIM 20 billion in bank support. The support activities were based on the principle that the Finnish Government will under all circumstances secure the stability of the Finnish banking system. The principle was made explicit in the Government declaration of 6 August 1992.

From the point of view of the present study, the most important implication of the government intervention is that the Finnish Government explicitly safeguarded bank deposits. The main principle was that a bank's deposits were safeguarded even in the case that the bank was unable to meet its obligations towards the depositors on its own or with the help of the deposit insurance fund to which it belongs (see for example Nyberg 1992, and Nyberg and Vihriälä 1993). The depositors apparently appreciated the Government's promise, as we are aware of no signs of bank runs or erosion of deposit stocks in the problem banks during the banking crisis. Because of the Government's universal and unlimited deposit protection, we can to a large extent abstract from studying the effects of bank default risk on the deposit pricing.

Besides the banking crisis, changes in the taxation of deposits may have changed the functioning of the deposit markets. During our observation period, indeed until 2001, Finland had a dual system of deposit interest rates.[5] Interest rates on transaction accounts and certain types of fixed-term deposit accounts were tax-free, but subject to an interest rate ceiling. For instance, at the beginning of 1992, maximum interest rate for transaction accounts was the Bank of Finland's base rate less 4 percentage points, while for 24-month fixed-term deposit accounts it was the base rate less one percentage point (as carefully documented in Rantama and Solttila, 1994). Interest rates on the other types of ("market-rate") investment accounts were during our sample period taxable. They were in particular subject to a withholding tax, which had been introduced at the beginning of 1991.

The entry into force of the withholding tax increased competition for deposits and changed the allocation of deposits between different types of accounts (Rantama and Solttila 1994). The structure of the deposit stock stabilized however rapidly, and by the end of 1991 around 30 percent of households' deposits was on the taxable accounts, with the rest in tax-exempt accounts. At the beginning of 1992, the withholding tax was 15 percent, but it increased to 20% in January 1993, and to 25% in January 1994.

In the early 1990s, the pricing of (the use of) deposit accounts was characterised by rather sophisticated schedules of charges applicable to transaction accounts (Tarkka 1996). The Finnish banks applied the "user pays" principle and charged different prices for different types of transactions. Tarkka (1996) also reports that preference has often been given to self-service and automated activities and that since 1992, banks have offered service packages. The service packages allow - for a flat monthly fee - the customers to make their normal transfers, such as paying of bills, free of activity-specific charges. Besides the taxation, the complex deposit pricing and service charges may reflect the imperfectness of competition on the deposit market, a feature that we verify empirically in this paper to apply to co-operative banks.

## 2.2 Bank Characteristics

Table 1 presents some bank level descriptive statistics, averaged over the sample period (year-wise descriptive statistics are presented in Appendix 1).[6] Although all of the banks

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5 Until the early 1990s, tax-exempt deposits formed the core of the Finnish banks' deposit taking. The taxable deposits became a relevant alternative no earlier than in 1989 when capital income deduction was increased; see for further details Rantama and Solttila (1994), on which our discussion largely builds.

6 See also Hyytinen and Toivanen (2000) for a more detailed description of the data.

belong to the same banking group and are small in international comparison, substantial differences exist in several dimensions: the smallest bank's deposits (*DEP*) amount to just over FIM 11 Million whereas the largest ones amount to over 4220 Million, with the mean at 284 Million. On average the banks seem to have slightly more deposits than loans (mean 257 Million), meaning that they are likely to be net lenders in the inter-bank market. The table also reveals that there is less variation in *DEP* than in loans.

Table 1

Bank Level Descriptive Statistics

| Variable definition | Mean | S.d. |
|---|---|---|
| *DEP* = The amount of deposits in year t | 284.759 | 470.767 |
| *LOAN* = The amount of credit market loans in year t | 257.451 | 473.358 |
| $R_D$ = Deposit interest rate in year t, calculated as interest rate expenses/ amount of deposits | 0.044 | 0.018 |
| $R_L$ = Loan interest rate in year t, calculated as interest rate income/amount of outstanding loans | 0.098 | 0.015 |
| $R_{DM}$ = Interbank market borrowing interest rate in year t, calculated as interest rate expenses/amount of interbank market deposits | 0.067 | 0.020 |
| $R_{LM}$ = Interbank market lending interest rate in year t, calculated as interest rate income/amount of outstanding interbank market loans | 0.060 | 0.021 |
| *BRANCH* = The number of branches of the bank in year t | 3.615 | 5.445 |
| *BRA* = The number of branches at the beginning of year t divided by the size (in square kilometers) of the market area | 0.008 | 0.017 |
| *PERS* = The amount of personnel expenses in year t, divided by the number of branches at the beginning of year t | 5.620 | 9.777 |

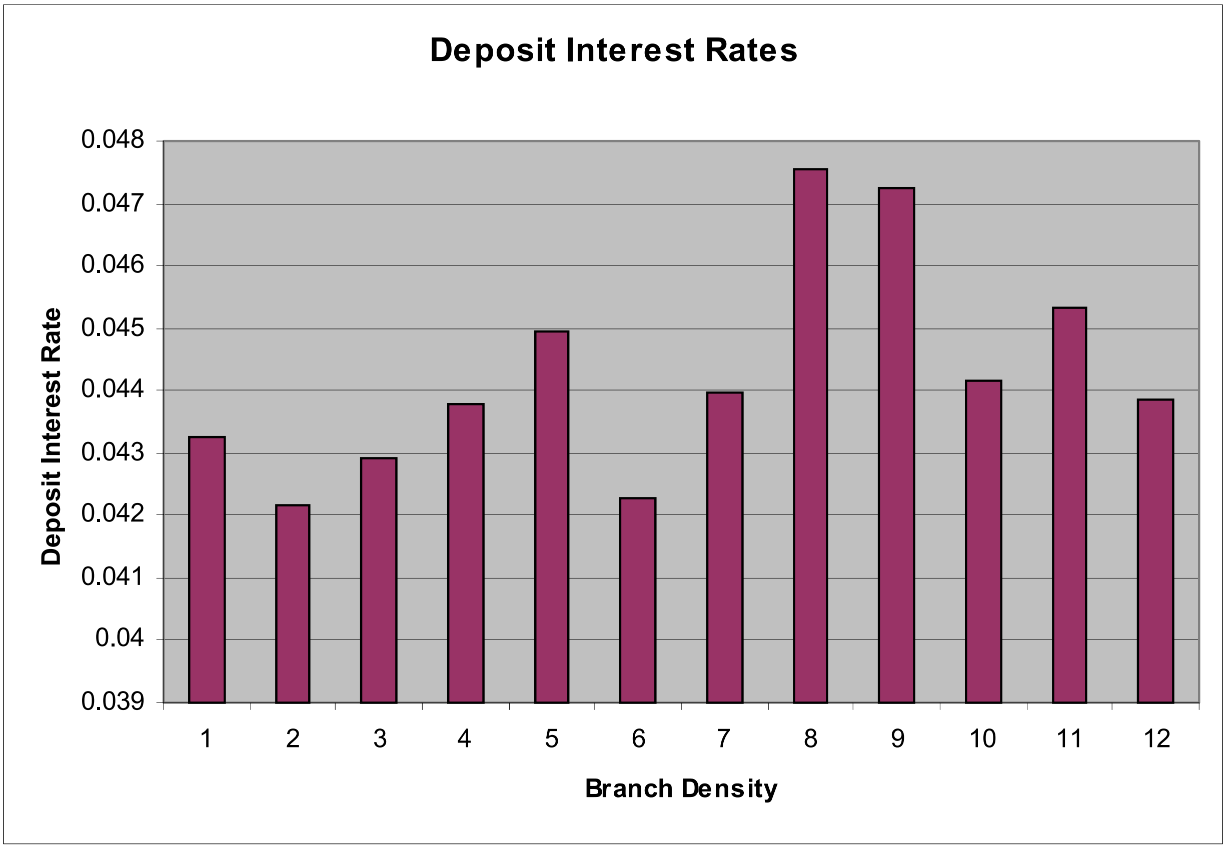
Notes: The data is provided by the Central Bank of Finnish Cooperative Banks. All data are bank level and there are 250 banks in the data. The sample period is 1992-1995.

We have calculated four interest rates; two are "costs" (the interest rates the banks pay for their deposits ($R_D$) and for their interbank borrowing), and two are "revenues" (the interest rates the banks earn on their loans and on their interbank lending and other interest bearing securities). Of the four interest rates, $R_D$ is the key endogenous variable of this study (together with *DEP*, of course). We report the other interest rates to illustrate the nature of the data. It is clear from Table 1 that $R_D$ is lower than the interest paid for interbank borrowing, although there is bank-level variation. The same applies for loans granted to customers, as the banks receive a higher interest rate for them than for their interbank lending. The margin between the interest rates on loans and deposits is on average around 5%.

The key (exogenous) variable of this study is the density of banks' branch network. We call this variable *BRA* and define it as the ratio of the number of a bank's branches to the size of the bank's geographical area in square kilometres. *BRA* is also Evanoff's (1988) preferred indicator of banking service accessibility. In his study of the determinants of banking service quality, he specifically argues that service accessibility and customer convenience are mainly a function of the time, distance and cost required to obtain banking services. As direct measures of these are not available, a measure of average distance travelled might well serve as a proxy. Time spent and cost incurred should correlate positively with distance. Then, assuming that numbers of banks' branches and customers are approximately uniformly distributed, the average distance travelled would correlate negatively with the number of branches per unit of area (which is the definition of *BRA*).[7] As Table 1 shows, *BRA* has a mean of 0.008 in our sample, while the mean number of branches is 3.6. We have also found that the variation in *BRA* is cross-sectional rather than intertemporal.[8]

In Figure 1 we display the distribution of $R_D$ over *BRA*. For presentational purposes we have pooled all the observations (over banks and over years) and divided them into 12 categories. This allows us to present the distribution using a single histogram. As is evident from the figure, no clear pattern can be seen in the relationship between branch density and deposit interest rates. Whether a relationship exists once the other determinants of $R_D$ are controlled for can be examined by running multivariate regressions.

FIGURE 1




Before running the multivariate regressions, we present as a final look at the data descriptive statistics of selected market characteristics in Table 2. These show among other things that the markets are fairly small on average: population (*POP*) mean is about 18 000 while the average number of farms (*FARM*) is 484. The average rate of unemployment (*UE*) is as high as 20%. Though not explicitly shown in the table, it is

7 If branches or customers are not evenly distributed *BRA* is a weaker measure of service accessibility. We have two responses to this. First, we can to some extent control for spatially concentrated population by our control variables. Second, if *BRA* is not a proper measure of service accessibility, it should not gain statistical significance in estimations.

8 As the Tables presented in Appendix 1 show, there is significant variation in *BRA* across banks. The minimum is $1.22*10^{-5}$ and the maximum 0.154. The same applies to the number of branches; it varies between 1 and 46.

also evident that substantial heterogeneity exists. Unemployment, for example, varies between less than 4% and over 35%.

Table 2

Descriptive Statistics of Market Level Data

| Variable definition | Mean | S.d.. |
|---|---|---|
| UN = Unemployment rate | 0.202 | 0.047 |
| FARM = Number of farms | 484.445 | 516.401 |
| OWN = Proportion of population owning the house they live in | 0.298 | 0.025 |
| INCAP = Taxable income per capita | 0.818 | 0.038 |
| INC3 = Proportion of population in the highest income group | 0.072 | 0.028 |
| MOBIL = Proportion of employed population inhabiting the market area but working outside the area | 0.155 | 0.087 |
| POP = Total population (in thousands) | 18.197 | 36.575 |

Notes: The data is provided by Statistics Finland. The sample period is 1992-1995. The financial data is in FIM millions.

# 3 EMPIRICAL MODEL, AND RESULTS

In this section, we first present our empirical model. Thereafter the results of the empirical analysis are presented and discussed.

## 3.1 Empirical Model

We estimate a hedonic type model where the bank-level deposit interest rate, $R_D$, is a function of three sets of variables: 1) customer characteristics; 2) deposit supply (which, of course, equals demand in equilibrium); and 3) branch density. We formalize the relationships in an inverse *supply* function as follows:

$$R_{D,i,t} = \alpha_i + \lambda_t + \delta DEP_{i,t} + \phi BRA_{i,t} + X_{i,t}'\beta + \varepsilon_{i,t} \quad (1)$$

where $DEP_{i,t}$ = the amount deposit demanded by bank $i$ at time $t$, $BRA_{i,t}$ is the branch density, $X_{i,t}$ are market characteristics, i.e., characteristics of the average customer of bank $i$, $\alpha_i$ is the bank specific constant, $\lambda_t$ is the yearly time dummy, and $\varepsilon_{i,t}$ captures the effects of market and bank specific unobservables on deposit interest rates. The key parameters of interest are $\delta$ and $\phi$, while $\beta$ is the vector of parameters for the market characteristics.

Although the branch density is endogenous in the long term, we think it as unlikely that banks would make within-year adjustments to the density after observing period-specific shocks. We therefore treat the variable as predetermined in our estimations. Unlike branch density, $DEP_{i,t}$ is likely to be correlated with $\varepsilon_{i,t}$, as is usual in any supply or demand function estimation. We therefore instrument it. As an instrument we use the amount of inter-bank deposits of bank $i$ as well as the deposit interest rate that the bank earns on its interbank deposits. We have only weak theoretical motivation to rely on these instruments. However, we carefully test for the validity of the instruments by i) running the first stage regression; and ii) by calculating a Hausman test. The former test validates the maintained assumption that our instrument correlates with the endogenous explanatory variable; the second ascertains that the instrument should not have been included into the second stage specification.

We estimate the equation as a least squares dummy variable model, but allowing for the endogeneity of $DEP_{i,t}$; that is, we use Within 2SLS.[9] In the estimations we have 250 yearly bank/market observations, i.e. a total of 1000 observations.

## 3.2 Results

Table 3 contains our basic results. Before going to the actual results, we note that our instruments pass the tests for instrument validity. Specifically, we can always validate at 1% significance level the maintained assumption that our instruments correlate with the endogenous explanatory variable(s). That is, the instruments are jointly very significant in the first stage regressions in all the specifications we consider. As the over-identification tests reported in the last row of Table 3 show, the instruments should neither have been included into the second stage specification. We have also estimated the same regressions using the standard Within-estimator, and found that the bias in the deposit coefficient is sometimes substantial.[10]

The explanatory variables used in Table 3 are the branch density, the amount of deposits and a vector of bank/market characteristics (all in natural logs). One of the most important bank characteristics in the regressions is the ratio of personnel costs of a bank to the number of the bank's branches (*PERS*). The variable measures the average size of branches and is thus a proxy for the service level in branches, i.e., for "branch level human capital".[11] In the first specification (column (1)) of Table 3 we only include *BRA*, *PERS* and *DEP* as regressors. Specification 2 (column (2)) repeats the regression based on specification 1, but allows for a time trend in *DEP* and *BRA* so as to explore whether any significant changes occurred in the elasticity of deposit supply and the role of branches over the sample period. As we argued earlier, the ongoing transformation in banking suggests that such changes could have taken place even within the relatively short sample period of ours. We also allow for a time trend in *PERS* to control for the changing effects, if any, of branch size. The three additional trend variables are denoted *BRAT*, and *DEPT*, *PERST*. In the third specification (column (3)), a vector of market characteristics is added to specification 2. The vector includes unemployment (*UE*), number of farms (*FARM*), proportion of population living in own homes (as opposed to rental; *OWN*), taxable income per capita (*INCAP*), the proportion of population in the highest income group (*INC3*), the proportion of population working outside the area (*MOBIL*), and total population (*POP*). Unemployed most likely face a higher demand

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9 Pirotte (1999) has recently shown that estimating a static relation when the true model is a dynamic one, the Within estimator is associated with the short-run effects (of the exogenous variables).

10 These results are available from the authors on request.

11 The mean of *PERS* is 5.6 Million (see Table 1).

for liquid assets than the average population, thereby making them more likely to deposit money. Cooperative banks, of which our sample consists of, have traditionally served rural areas and the agricultural sector. The number of farms controls for variation in the deposit interest rates due to this. Per capita income is a control for the budget constraint the customers of a bank on average face. In addition, we control for cross-sectional differences in income distribution by including the shares of population in the highest third of income groups. Finally, *MOBIL* controls for the mobility of the depositors while *POP* should eliminate the effects, if any, of market size on deposit pricing. At the same time, it controls together with *FARM* for the concentration of population, as in the rural areas the concentration is lower than the urban areas. The fourth and final specification (column (4)) includes the squared values of all bank and market characteristics, an interaction term for *BRA* and *PERS* as well as the squared time trend of *BRA*.[12]

The results reveal that as expected, the point estimate of (the inverse of) the elasticity of the deposit supply is positive and statistically significant (at better than the 10% level) in all regressions. Its coefficient exhibits no time trend, suggesting that the interest rate elasticity of the deposit supply has remained relatively stable over the sample period. The interest rate elasticity of deposit supply depends on the specification and varies between 5.7 and 10.5. The point estimates are high and (a lot) larger than one. The economic significance of this is that a monopsony bank would price at the elastic part of demand function, i.e., the coefficient of deposits should be larger than unity. The estimated model is therefore consistent with the hypothesis that co-operative banks are monopsonies on the deposit market.

The key result of Table 3 is that the branch density, or the inverse of geographical distance, decreases the deposit interest rates. Specifically, the coefficient of *BRA* is in each specification negative and statistically significant at better than the 10% level. This is what the standard models of product differentiation suggest; holding other things constant, the denser the branch network, the lower the deposit rates. The elasticity of deposit interest rates to branch density varies between -0.11 and -0.08, depending on the specification used. The coefficient of *BRA* also exhibits a positive trend, and the trend is statistically significant at the 1% level. Specification 4 suggests that the trend may be stronger for banks with denser branch networks. The column also shows that allowing for non-linearities in the market characteristics does not change our key result: The customers of co-operative banks care about the geographical distance, but less than before.

As to control variables, the coefficient of *PERS* is negative, as expected if it indeed proxies the service level in branches. The variable however loses its statistical significance once the (other) control variables are included. *UE* obtains a negative and significant coefficient in specification 3 but not in 4. The negative coefficient in the two specifications is however consistent with the view that holding other things equal, the unemployed are more prone to save and hold deposits as a buffer stock for liquidity shocks than the employed. *INC3* and its squared value, *INC32*, obtain a negative and

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[12] Squared *BRA* cannot be included in the regression without inflating the standard error of the linear *BRA* term. The reason is that the two are highly correlated (the coefficient of correlation is –0.98.) Were the squared *BRA* included, both it and the linear *BRA* would be very imprecisely measured. However, the linear *BRA* would still obtain a negative coefficient, while *BRAT* and its squared value would be positive and statistically significant.

Table 3

Deposit Supply Function Estimations

| Variable | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| *UE* | - | - | -.050*** | -.082 |
| | | | (.018) | (.059) |
| *FARM* | - | - | .006 | -.043 |
| | | | (.019) | (.034) |
| *OWN* | - | - | .039 | 1.557 |
| | | | (.135) | (1.132) |
| *INCAP* | - | - | .079 | .108 |
| | | | (.083) | (.094) |
| *INC3* | - | - | -.042* | -.242*** |
| | | | (.022) | (.092) |
| *MOBIL* | - | - | .003 | .061 |
| | | | (.012) | (.047) |
| *POP* | - | - | .143 | .426 |
| | | | (.201) | (1.168) |
| *UE2* | - | - | - | -.005 |
| | | | | (.015) |
| *FARM2* | - | - | - | .005 |
| | | | | (.003) |
| *OWN2* | - | - | - | .589 |
| | | | | (.461) |
| *INCAP2* | - | - | - | .273 |
| | | | | (.442) |
| *INC32* | - | - | - | -.034** |
| | | | | (.015) |
| *MOBIL2* | - | - | - | .013 |
| | | | | (.011) |
| *POP2* | - | - | - | -.018 |
| | | | | (.066) |
| *BRA* | -.109*** | -.090** | -.078* | -.080* |
| | (.042) | (.045) | (.046) | (.042) |
| *BRAT* | - | .003*** | .004*** | .012*** |
| | | (.001) | (.001) | (.003) |
| *BRAT2* | - | - | - | .0001*** |
| | | | | (.00005) |
| *PERS* | -.112*** | -.079* | -.068 | -.049 |
| | (.043) | (.046) | (.048) | (.053) |
| *PERS2* | - | - | - | .002 |
| | | | | (.004) |
| *PERST* | - | -.001 | .0001 | -.00001 |
| | | (.009) | (.002) | (.001) |
| *PERST2* | | - | - | .0002* |
| | | | | (.0001) |
| *BRA*PERS* | - | - | - | .002 |
| | | | | (.005) |
| *DEP* | .175*** | .122** | .103* | .095* |
| | (.053) | (.058) | (.061) | (.057) |
| *DEPT* | - | .001 | .00001 | - |
| | | (.002) | (.002) | |
| rss | 1.001 | .975 | .955 | .916 |
| Hausman (4 d.f.) | 6.860 | 5.403 | 4.677 | 5.520 |

Notes: The dependent variable is the deposit interest rate, $R_D$. The reported numbers are coefficient and (standard error). ***, **, * indicate statistical significance at 1, 5, and 10% levels. All estimations are Within 2SLS and include a full set of time dummies. Rss = residual sum of squares of the 2nd stage regression. Hausman = an over-identification test. The test statistic has a $\chi^2$-distribution (with 4 d.f.). The 5% critical value is 9.49.

significant coefficient, a finding that is in accordance with the view that its is easier to attract deposits the more high-income households there are in a bank's market area. The remaining control variables never obtain significant coefficients.

Besides the regressions shown in Table 3 we have run a series of robustness tests. We have for example experimented with various combinations of the interacted trend variables, but our key result remains unchanged. We have also included further market controls, such as the number of households, and the proportion of population with secondary and tertiary education. These further controls have no effect on our results.

# 4 CONCLUSIONS

The objective of this study was to uncover whether the role of bank branch networks (and thus distance) has changed in the provision of bank deposit services. Standard IO theory suggests that the closer to customers the bank, and the better the service that it offers, the lower the deposit interest rate that it has to pay. This is the traditional role of bank branches.

We utilise a unique bank level data set from Finland. A key feature of this data set is that the banks do not compete against each other; each of them operates in a non-overlapping geographical market. We estimate hedonic deposit supply functions, controlling for the characteristics of the markets our banks operate in.

Our main finding is that the coefficient of the branch network density is negative and statistically significant. The finding implies that increasing the branch density allows a bank to obtain the same level of deposits at a lower interest rate. This is what the standard IO models of product differentiation suggest; holding other things constant, the denser the branch network, the lower the deposit rates. Customers thus care about the geographical distance. We find however that the coefficient of the branch network becomes smaller in absolute value over time, as indicated by its statistically significant time trend. The finding suggests that a fundamental change of in the role of bank branches may be taking place. We conclude that quite like in the US small business lending (Petersen and Rajan 2001), the distance matters in deposit supply, but less than before.

# References


Andersen, Atso, Ari Hyytinen and Jussi Snellman, 2000, Recent Developments in the Finnish Banking Sector, Bank of Finland Discussion Papers, 15/200.

Berger, Allen N., David B. Humphrey, and Lawrence B. Pulley, 1996, Do consumers pay for one-stop banking? Evidence from an alternative revenue function, *Journal of Banking and Finance*, Vol. 20, pp. 1601-1621.

Berger, Allen N., and Timothy H. Hannan, 1989, The price-concentration relationship in banking, *Review of Economics and Statistics*, Vol. 71, pp. 291-299.

Calem, Paul S., and Leonard I. Nakamura, 1998, Branch banking and the geography of bank pricing, *Review of Economics and Statistics*, Vol. 81, pp. 600-610.

Evanoff, Douglas D., 1988, Branch banking and service accessibility, *Journal of Money, Credit and Banking*, Vol. 20, pp. 191-202.

Hannan, Timothy H., 1991, Bank commercial loan markets and the role of market structure: Evidence from surveys of commercial lending, *Journal of Banking and Finance*, Vol. 15, pp. 133-149.

Hyytinen, Ari and Otto Toivanen, 2000, Monitoring and market power in loan markets, Bank of Finland Discussion Papers, 9/2000.

Koskenkylä, Heikki and Jukka Vesala, 1994, Finnish deposit banks 1980-1993: Years of rapid growth and banking crisis, Bank of Finland Discussion Papers 16/94.

Nakamura, Leonard I., and Bruno M. Pagani, 1992, Bank branching, Federal Reserve Bank of Philadelphia Working Paper, No. 91-18.

Nyberg, Peter, 1992, The government guarantee fund and bank support, *Bank of Finland Bulletin*, Vol. 66, No. 11 (November 1992).

Nyberg, Peter and Vesa Vihriälä, 1993, Finnish banking problems: Handling and prospects, *Bank of Finland Bulletin*, Vol. 67, No. 4 (April 1993).

Petersen, Mitchell A., and Raghuram G. Rajan, 2001, Does distance still matter? The information revolution in small business lending, forthcoming in *Journal of Finance*.

Pirotte, Alain, 1999, Convergence of the static estimation toward the long run effects of dynamic panel data models, *Economics Letters*, Vol. 63, pp. 151-158.

Snellman Jussi S., Jukka M. Vesala and David B. Humphrey, 2001, Substitution of noncash payment instruments for cash in Europe, *Journal of Financial Services Research*, Vol. 19, No. 2/3, pp. 131-145.

Rantama, Jaana and Heikki Solttila, 1994, Bank deposits and their taxation, *Bank of Finland Bulletin*, Vol. 68, No. 4 (April 1994).

Freixas, Xavier and Jean-Charles Rochet, 1997, *Microeconomics of Banking*. Cambridge: The MIT Press.

Tarkka, Juha, 1996, Issues in the pricing of transaction deposit accounts, *Bank of Finland Bulletin*, Vol. 70, No. 1 (January 1996).

Tirole, Jean, 1988, *The Theory of Industrial Organization*. Cambridge: The MIT Press.

Table A.1

Yearly Descriptive Statistics of Bank Variables

| year | Mean | Med. | S.d. | Min. | Max. |
|---|---|---|---|---|---|
| | | | *DEP* | | |
| 1992 | 241.5775 | 123.641 | 384.2059 | 11.0846 | 2969.309 |
| 1993 | 258.4518 | 131.3481 | 416.6836 | 12.6948 | 3244.395 |
| 1994 | 314.6419 | 159.4877 | 524.9837 | 13.6927 | 4194.973 |
| 1995 | 324.3661 | 162.7845 | 535.9779 | 13.8813 | 4226.674 |
| | | | *LOAN* | | |
| year | Mean | Med. | S.d. | Min. | Max. |
| 1992 | 242.4031 | 108.1146 | 439.4923 | 6.3583 | 3296.819 |
| 1993 | 247.7302 | 111.2777 | 451.8151 | 7.0851 | 3358.258 |
| 1994 | 275.5024 | 122.9388 | 515.3931 | 7.8430 | 3875.546 |
| 1995 | 264.1695 | 119.7953 | 485.1355 | 7.7068 | 3734.778 |
| | | | $R_D$ | | |
| year | Mean | Med. | S.d. | Min. | Max. |
| 1992 | 0.070867 | 0.0707 | 0.004618 | 0.0565 | 0.0831 |
| 1993 | 0.047007 | 0.0463 | 0.004034 | 0.0365 | 0.0611 |
| 1994 | 0.028483 | 0.0284 | 0.002412 | 0.0225 | 0.0364 |
| 1995 | 0.027876 | 0.0277 | 0.002588 | 0.0210 | 0.0377 |
| | | | $R_L$ | | |
| year | Mean | Med. | S.d. | Min. | Max. |
| 1992 | 0.1203 | 0.1207 | 0.005476 | 0.1011 | 0.1344 |
| 1993 | 0.0996 | 0.1004 | 0.007272 | 0.0558 | 0.1164 |
| 1994 | 0.0853 | 0.0852 | 0.004791 | 0.0708 | 0.1059 |
| 1995 | 0.0874 | 0.0873 | 0.004120 | 0.0742 | 0.1005 |
| | | | $R_{DM}$ | | |
| year | Mean | Med. | S.d. | Min. | Max. |
| 1992 | 0.0603 | 0.0567 | 0.0216 | 0.0091 | 0.1194 |
| 1993 | 0.0603 | 0.0577 | 0.0218 | 0.0045 | 0.1229 |
| 1994 | 0.0602 | 0.0565 | 0.0195 | 0.0177 | 0.1240 |
| 1995 | 0.0600 | 0.0560 | 0.0206 | 0.0136 | 0.1161 |
| | | | $R_{LM}$ | | |
| year | Mean | Med. | S.d. | Min. | Max. |
| 1992 | 0.0818 | 0.0789 | 0.025919 | 0.0297 | 0.1333 |
| 1993 | 0.0716 | 0.0721 | 0.018423 | 0.0254 | 0.1163 |
| 1994 | 0.0581 | 0.0580 | 0.011537 | 0.0294 | 0.0912 |
| 1995 | 0.0573 | 0.0571 | 0.011230 | 0.0319 | 0.0970 |

Table A.1 (continued)

| | | | | | |
|---|---|---|---|---|---|
| | | | *BRANCH* | | |
| year | Mean | Med. | S.d. | Min. | Max. |
| 1992 | 3.636 | 2 | 5.1147 | 1 | 38 |
| 1993 | 3.388 | 2 | 5.0972 | 1 | 37 |
| 1994 | 4.064 | 2 | 6.2892 | 1 | 46 |
| 1995 | 3.372 | 2 | 5.1921 | 1 | 37 |
| 1996 | 2.9 | 2 | 3.9375 | 1 | 33 |
| | | | *BRA* | | |
| year | Mean | Med. | S.d. | Min. | Max. |
| 1992 | 0.0082 | 0.0038 | 0.0155 | 1.22E-05 | 0.1148 |
| 1993 | 0.0077 | 0.0034 | 0.0156 | 1.22E-05 | 0.1148 |
| 1994 | 0.0094 | 0.0039 | 0.0191 | 1.22E-05 | 0.1543 |
| 1995 | 0.0078 | 0.0033 | 0.0156 | 1.22E-05 | 0.1108 |
| | | | *PERS* | | |
| year | Mean | Med. | S.d. | Min. | Max. |
| 1992 | 2.9745 | 1.1732 | 5.3055 | 0.0309 | 45.578 |
| 1993 | 2.9476 | 1.2909 | 4.9627 | 0.0301 | 36.5921 |
| 1994 | 3.2946 | 1.2699 | 6.4811 | 0.0189 | 46.0681 |
| 1995 | 3.5208 | 1.3505 | 7.0704 | 0.0406 | 61.01389 |

Notes: Numbers reported are mean, median, standard deviation, minimum and maximum value. All figures in are in nominal FIM

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