Juha Tarkka
Bank of Finland Research Department
23.8.1989 26/89

COMPETITIVE DEPOSIT RATES AND BANK SERVICE CHARGES*

* Paper to be presented at the 4th congress of the European Economic Association in Augsburg September 2 - 4, 1989

Suomen Pankin monistuskeskus
Helsinki 1989
ISBN 951-686-215-2
ISSN 0785-3572

ABSTRACT

This paper presents a partial equilibrium model of the determination of deposit rates of interest and bank service charges in a competitive banking industry. It is shown that uncertainty regarding the future use of transactions services can cause a positive interest rate margin on deposits, and below-cost pricing of transactions services. This contrasts with existing literature which has explained the existence of "implicit interest" as a consequence of interest rate ceilings or non-neutral taxation.

TIIVISTELMÄ

Tarkastellaan talletuskorkojen ja pankkipalvelumaksujen määräytymistä vapaan kilpailun vallitessa. Osoitetaan, että pankkipalvelujen tulevaa käyttöä koskeva epävarmuus voi aiheuttaa positiivisen talletuskorkomarginaalin syntymisen markkinoiden tasapainossa. Vastaavasti pankkipalvelut tulisivat alihinnoitelluksi. Tulokset eroavat aiemmista tutkimuksista, joissa korkomarginaalin olemassaolo ja pankkipalvelujen alihinnoittelu on selitetty korkosäännöstelyn tai epäsymmetrisen verotuksen avulla.

CONTENTS

1 INTRODUCTION

Recently, the question has been posed as to why banks continue to pay "implicit interest" on transactions deposits even when this is no longer made necessary by interest rate ceilings set by monetary authorities (e.g. Mitchell (1988)). "Implicit interest" is, of course, the practice of offering transactions services to depositors either free of charge or at below-cost prices.

The standard conjecture in the older literature seems, indeed, to be that unrestricted competition among banks would eliminate implicit interest, since it is an inefficient way of rewarding depositors. Among many others, Fischer (1983) and Startz (1983) have predicted that, under perfect competition and with no distorting taxes, the explicit interest on deposits would equal the marginal (opportunity) cost of funds to the bank. Likewise, transactions services provided by banks would be priced according to their marginal factor cost.

Orgler and Taggart (1983) and Walsh (1985) have, however, pointed out that, if explicit interest is taxable, it may be optimal for banks to substitute implicit for explicit interest even in a competitive environment without deposit rate ceilings. In their models, the marginal tax rate of interest income is balanced with the marginal efficiency loss of rewarding depositors in kind (with free, non-marketable services). In his Comment, Mitchell recognizes this tax-based explanation for the existence of the implicit interest phenomenon, but wonders whether "other factors are involved" as well.

In this paper I show that an alternative, or perhaps complementary, explanation to the one based on asymmetrical taxation may indeed be found. Put briefly, implicit interest may be viewed as a device which reduces the exposure of depositors to the uncertainty regarding their transaction needs. If banks are risk-neutral, or at

least able to pool the transactions uncertainty faced by individual depositors, it may well be the viable policy in a competitive market to set the prices of transactions services below their actual cost, and to substitute the revenue foregone by lowering the interest paid on deposits.

The model is related to some previous contributions in which banks constitute a risk-sharing arrangement for depositors, notably Diamond and Dybvig (1983) and Smith (1984).

2 THE BANKS

The following demonstration of the viability of "implicit interest" in a competitive market for deposits relies on a kind of arbitrage argument. Therefore, a partial model is employed with few restrictions on the wider context in which the banks and their customers operate.

The banks supply two distinct products to the market: deposits and transactions services. By "deposits" I mean bank accounts with a cheque, giro, or electronic transfer facility so that the account may be used as a store for transactions balances. Transactions services are acts of servicing the depositor's account such as cheque clearings or payment transfers. Deposits, as a stock, are measured in money terms, and payment services by their number within a unit period of time.

Competition among banks in the market for deposits and payment services is assumed to be perfect, except for the technical constraint that the transactions services must be purchased from the same bank where the deposits are held. As emphasized by Hodgman (1961), this constraint forces the banks to compete for customers instead of competing separately in the deposit and service markets. Hodgman used the term "deposit relationship" for the bundle of deposit and service business tied to a customer's decision to bank with a particular bank.

It must be emphasized that the deposit relationship constraint does not imply that transactions services and deposits can be treated as a composite good in the analysis of banking, as is sometimes done in the "implicit interest" literature (see, e.g. the discussion and references in Startz (1979)). This would be warranted only in the very special case in which transactions services and deposits are be demanded in fixed proportions, independent of the user cost of deposits or the price of transaction services.

The profit earned by a representative bank from a representative deposit relationship may be written as follows:

$$P = (r - i)\tilde{M} + (p - k)\tilde{N} \qquad (1)$$

where r is the opportunity cost of funds to the bank, i is the deposit rate, $\tilde{M}$ is the stock of deposits on the account, p is the price charged for a single payment transaction, k is the unit cost of carrying out a transaction, and $\tilde{N}$ is the number of transactions purchased by the deposit holder. $\tilde{N}$ and $\tilde{M}$ are stochastic variables, with expected values N and M, respectively.

We assume that perfect competition forces the expected profit from any deposit relationship to be zero. This may result from risk neutrality of banks. Another possible justification might be the independence or negative correlation of variations in $\tilde{N}$ and $\tilde{M}$ across customers. In that case, uncertainty regarding profits from individual deposit relationships would vanish in aggregation and large banks would be immune to it.

Zero expected profits imply that the interest rate margin of the bank may be expressed as follows:

$$(r - i) = (k - p)(N/M) \qquad (2)$$

Expression (2) is actually a constraint on the deposit terms (i,p) which the depositor may get from a competitive banking industry. Subject to this constraint, the banks are willing to supply deposits

and transactions services at any combinaton of i and p desired by the depositor.

3 THE DEPOSITORS

The depositors are assumed to be rational, risk-averse agents who prefer, ceteris paribus, lower costs to higher costs. No assumption on the degree of risk aversion is necessary for the argument in this paper.

The deposit holdings and transactions services demanded by the representative depositor are assumed to result from some cash management problem which the depositors solve period by period. Some form of uncertainty is assumed to be present in the depositors' decision-making situation, causing imperfect control of the amount of transactions and actual transactions balances. Regardless of the details of the cash management problem, the solution to it is assumed to be of the form[1]

$$\tilde{M} = M + e, \quad E(e) = 0, \quad E(e^2) = var(e) \tag{3}$$

$$\tilde{N} = N + v, \quad E(v) = 0, \quad E(v^2) = var(v)$$

$$E(ev) = cov(e,v)$$

Note that the M and N may be, and generally are, functions of prices such as r, i and p. Closer specification of the determinants of M and N is not necessary for the purposes of this paper.

For simplicity, it is assumed that the opportunity cost of funds to the depositors is the same as that to the banks. The total expected cost of a deposit relationship is given by

---

[1]Actually, the assumption of the existence of means and finite variances of the stochastic components in M and N imposes some, albeit weak, constraints on the nature of the cash management problem faced by the depositors.

$$E(C) = (r - i)M + pN \tag{4}$$

Observing the zero-profit constraint (2), this may be written as:

$$E(C) = (r - i)M + pN = (k - p)N + pN = kN \tag{5}$$

Thus, the expected total cost of transacting and holding money is, in this taxless framework, quite independent of the terms of the deposit relationship (i, p) as long as the expected profit to the bank from the relationship is zero. This implies that in a competitive market the depositors are free to select such terms (i*, p*) which minimize the uncertainty in their total cost.

Uncertainty is analyzed here in terms of variance. The variance of the total cost of a representative deposit relationship is

$$var(C) = (r - i)^2 var(e) + p^2 var(v) + 2(r - i)p\ cov(e,v) \tag{6}$$

which, again observing the zero expected profit constraint (2), reduces to

$$var(C) = ((k-p)(N/M))^2 var(e) + p^2 var(v) + 2(k-p)p(N/M)cov(e,v) \tag{7}$$

The variance is now given as a function of only one price, i.e. p. Since the constraint of zero expected profits is already taken into account in p, the depositor is free to select such p that var(C) is minimized.

The first-order condition for a minimum variance is

$$p^* = \frac{var(e)/M^2 - cov(e,v)/(NM)}{var(e)/M^2 + var(v)/N^2 - 2cov(e,v)/(NM)}\, k \tag{8}$$

The second-order condition for a minimum is that the denominator is positive. It is straightforward to see that this is true in all but one extreme case. The exception occurs when $\tilde{M}$ and $\tilde{N}$ have the same coefficient of variation and are perfectly correlated. In that

extreme case both the denominator and the numerator are zero and the variance minimization problem does not have a unique interior solution.

Generally, it is the existence of transactions uncertainty in the sense of a positive variance of v that is necessary for the model to explain the "implicit interest" phenomenon. For if var(v) were zero, cov(e,v) = 0 would also be implied and thus $p^* = k$. For implicit interest to be positive, $p^* < k$, the covarianve between e and v must not, however, be too large:

$$p^* < k \text{ only if } M/N > \text{cov}(e,v)/\text{var}(e) \tag{9}$$

Note that the quotient on the right hand side of the condition is the regression coefficient b in the regression equation $\tilde{N} = c + b\tilde{M} + w$, and that the condition actually states that the intercept c in that equation must be positive. It must be strongly emphasized that this regression should not be interpreted as such in a time series context, for the "means" N and M are not assumed to stay constant in time.

Inserting the above-derived equilibrium value for p (expression 8) in the zero expected profit constraint (2), the equilibrium interest rate margin of deposits is obtained:

$$(r - i^*) = \frac{\text{var}(v)/(NM)}{\text{var}(e)/M^2 + \text{var}(v)/N^2 - 2\,\text{cov}(e,v)/(NM)}\,k \tag{10}$$

The interest rate margin is positive whenever N, M, and var(v) are positive and e and v are not perfectly correlated. Furthermore, it is patent that it is the uncertainty in the number of transactions (var(v)) that really causes the deviation from the marginal cost pricing rule i = r. In the extreme case of certainty with respect to deposit balances, var(e) = 0, the interest rate margin reduces to

$$(r - i^*) = (N/M)k \tag{11}$$

In that case the optimal service charge would be zero.

4 DISCUSSION

In the above analysis I have demonstrated that the equilibrium conditions for a competitive market for bank deposits are generally incompatible with the marginal cost prices i = r and p = c. The reason for this is that banks and depositors have a different attitude towards the uncertainty present in transaction costs. Banks might even be viewed as instruments for pooling the uncertainty regarding future transaction needs. Risk neutral banks are willing to trade lower service charges for a higher interest rate margin on a zero expected profit basis; the customers, however, value lower lower transaction costs for more than just their expected cost effect. They want to avoid the risk caused by the uncertain number of future transactions and are able to do this if transaction charges are lowered.

A necessary condition for the ability of banks and customers to use cross-subsidization between deposits and transactions is of course the "deposit relationship" constraint à la Hodgman. Without it, competition would operate separately in the two markets and neither uncertainty nor taxation could cause cross-subsidization between them.

The deposit relationship constraint is in any case much less restrictive than the assumption of strict proportionality of $\tilde{M}$ and $\tilde{N}$ which lies behind much of the "implicit interest" literature. The present framework yields meaningful results precisely in the cases in which there is independent variation in $\tilde{M}$ and $\tilde{N}$. Indeed, the case in which the use of services is linearly dependent of the stock of deposits is shown above to be a limiting case in which no well-defined equilibrium terms (p*, i*) could be derived.

LITERATURE CITED

DIAMOND, D.W. and P.H. DYBVIG (1983) Bank Runs, Deposit Insurance, and Liquidity. Journal of Political Economy 91, 401 - 419.

FISCHER, Stanley (1983) A Framework for Monetary and Banking Analysis. Economic Journal 93 (Conference Papers Supplement 1983), 1 - 16.

HODGMAN, Donald (1961) The Deposit Relationship and Commercial Bank Investment Behavior. Review of Economics and Statistics 28 (August 1961), 257 - 268.

MITCHELL, Douglas (1988) Explicit Interest and Demand Deposit Service Charges. Journal of Money, Credit, and Banking 20 (May 1988), 270 - 274.

ORGLER, Yair and Robert TAGGART (1983) Implications of Corporate Capital Structure Theory for Banking Institutions. Journal of Money, Credit, and Banking 15 (May 1983), 212 - 221.

SMITH, Bruce (1984) Private Information, Deposit Interest Rates, and the 'Stability' of the Banking System. Journal of Monetary Economics 14, 293 - 317.

STARTZ, Richard (1979) Implicit Interest on Demand Deposits. Journal of Monetary Economics 5 (October 1979), 515 - 534.

STARTZ, Richard (1983) Competition and Interest Rate Ceilings in Commercial Banking. Quarterly Journal of Economics' 98 (May 1983), 255 - 265.

WALSH, Carl (1983) Taxation of Interest Income, Deregulation and the Banking Industry. Journal of Finance 28 (December 1983) 1529 - 1542.

BANK OF FINLAND DISCUSSION PAPERS

ISSN 0785-3572

1/89 PAULA LÄHDEMÄKI Economic indicators of the U.S.S.R. analysed on the basis of the National Accounts. 1989. 57 p. In Finnish. (ISBN 951-686-182-2)

2/89 MATTI VIRÉN A note on interest rate policy during the great depression. 1989. 20 p. (ISBN 951-686-183-0)

3/89 ERKKI KOSKELA - MATTI VIRÉN International differences in saving rates and the life cycle hypothesis: a comment. 1989. 20 p. (ISBN 951-686-184-9)

4/89 SAMPO ALHONSUO The efficiency of financing and banking in Finland. 1989. 81 p. In Finnish. (ISBN 951-686-185-7)

5/89 AMY SKOLNIK The U.S. - Canada free trade agreement: a model for Finland? 1989. 26 p. (ISBN 951-686-186-5)

6/89 JUHA TARKKA - ALPO WILLMAN - CHRIS-MARIE RASI Labour supply, wages and prices in the BOF4 quarterly model of the Finnish economy. 1989. 50 p. (ISBN 951-686-187-3)

7/89 JARMO KONTULAINEN Determination of exchange rates in a general equilibrium model. 1989. 80 p. In Finnish. (ISBN 951-686-188-1)

8/89 ESKO SYDÄNMÄKI New protectionism. 1989. 41 s. In Finnish. (ISBN 951-686-189-X)

9/89 JUHA TARKKA - ALPO WILLMAN - HANNA-LEENA MÄNNISTÖ Consumption and investment in the BOF4 quarterly model of the Finnish economy. 1989. 59 p. (ISBN 951-686-190-3)

10/89 SAMPO ALHONSUO - KJELL PETER SÖDERLUND - JUHA TARKKA Return on bonds in Finland in 1948 - 1986. 1989. 34 p. In Finnish. (ISBN 951-686-193-8)

11/89 PENTTI PIKKARAINEN - MATTI VIRÉN Granger causality between money, output, prices and interest rates: some cross-country evidence from the period 1875 - 1984. 1989. 19 p. (ISBN 951-686-195-4)

12/89 HELVI KINNUNEN Estimation of preliminary current account figures by means of short-term forecasting methods. 1989. 20 p. In Finnish. (ISBN 951-686-196-2)

13/89 PERTTI HAAPARANTA - JARMO KONTULAINEN Real exchange rate as an unobservable variable. 1989. 17 p. (ISBN 951-686-197-0)

14/89 MATTI VIRÉN Saving, investment and the current account: a review of recent evidence. 1989. 17 p. (ISBN 951-686-198-9)

15/89 HARRI LAHDENPERÄ The effect of information on the functioning of financial markets and on the efficiency of central bank policy - a survey of the literature. 1989. 55 p. In Finnish. (ISBN 951-686-199-7)

16/89 PAAVO PEISA Aggregate versus industry-specific sources of economic growth and business cycle fluctuations. 1989. 35 p. (ISBN 951-686-202-0)

17/89 TIMO TYRVÄINEN Unions, wages and employment in Finland. 1989. 56 p. (ISBN 951-686-203-9)

18/89 ANTTI ILMANEN Use of duration analysis in the estimation and management of interest rate risk of bonds. 1989. 116 p. In Finnish. (ISBN 951-686-204-7)

19/89 MATTI VIRÉN How does domestic and foreign money growth affect the U.S. economy? 1989. 24 p. (ISBN 951-686-205-5)

20/89 MATTI VIRÉN The long-run relationship between interest rates and inflation: some cross-country evidence. 1989. 24 p. (ISBN 951-686-207-1)

21/89 ERKKI KOSKELA - MATTI VIRÉN Taxes, credit market 'imperfections' and inter-country differences in the household saving ratio. 1989. 38 p. (ISBN 951-686-208-X)

22/89 TIMO TYRVÄINEN Why break down centralized wage bargaining? 1989. 24 p. (ISBN 951-686-209-8)

23/89 ARI LAHTI - MATTI VIRÉN The Finnish rational expectations QMED model: estimation, dynamic properties and policy results. 1989. 34 p. (ISBN 951-686-210-1)

24/89 TAPIO PEURA - UWE KOLLSTER The development of external balances in the Nordic countries. 1989. 37 p. (ISBN 951-686-213-6)

25/89 PERTTI HAAPARANTA - JOUKO VILMUNEN The demand for consumer durables in Finland. 1989. 17 p. In Finnish. (ISBN 951-686-214-4)

26/89 JUHA TARKKA Competitive deposit rates and bank service charges. 1989. 14 p. (ISBN 951-686-215-2)