IMPLICIT INTEREST ON DEMAND DEPOSITS

by

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Abstract

Traditionally, monetary theory assumes money bears zero interest More recently, it has been recognized that banks implicitly pay interest through providing free services. In this paper the implicit interest rate is estimated from two different sources Implicit interest appears to be about one-half of what a competitive rate would be in the absence of the prohibition against explicit interest.

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1. Introduction

In most macroeconomic work, "money" is assumed to bear a zero nominal yield. Monetary policy operates through levering interest rates around this fixed fulcrum. More recently, it has been suggested that "implicit interest" is paid on demand deposits through the provision of free services. It has been suggested that "total ineffectiveness" of the formal prohibition is more nearly correct than is the contrary position. In this paper I offer several empirical measures of implicit interest which substantially refute both extreme positions.

Practically all empirical work on money demand and practically all analysis of monetary policy has rested on the untested assumption that the return to money is fixed and usually that it is zero. (See the literature referenced below for some of the most notable exceptions.) Beyond the continued interest in this question for macroeconomic analysis, it takes on a special current importance, as the nation moves towards one form or another of legalization of explicit interest on demand deposits. If, after all, the pro forma prohibition is currently being fully, effortlessly, and efficiently evaded, it is hard to see where legalization could have a major substantive effect.

The empirical evidence used in this paper supports an intermediate position. The rate of implicit interest appears to be well below the competitive rate on deposits. It is also well above zero and is responsive to changes in market interest rates. I estimate that the implicit deposit rate has been historically approximately one-third to one-half of the competitive rate.

Imagine a world in which banks act purely as intermediaries. There is one alternative asset which yields r_A. Banks pay r_d on deposits. They are able to loan out a fraction (1 - c) of deposits as loans (where c is reserves plus float). If consumers use drafts on intermediary liabilities as a means of payment, they pay explicitly the costs of providing such services. (At least theoretically, there is no reason why customers might not contract for check clearing services from a different organization than the intermediary which issues the liability.) Perfect competition (with constant returns to scale and constant factor prices) requires that banks pay $r_d = (1 - c)r_A$.

There are three plausible, simple, hypotheses about the relation of r_d to r_A. The competitive hypothesis is $r_d = (1-c)r_A$. The "traditional" hypothesis is $r_d = 0$. What might be labelled the "modified traditional" hypothesis is that banks pay some positive levle of interest on deposits, $\bar{r}_d$, but that this level does not vary with r_A, at least so long as $(1-c)r_A$ does not fall below $\bar{r}_d$. The three hypotheses are all stated jointly in (1).

$$r_d = d_0 + d(1-c)r_A \tag{1}$$

$d_0 = 0$	$d = 1$	competitive hypothesis
$d_0 = 0$	$d = 0$	traditional hypothesis
$d_0 > 0$	$d = 0$	modified traditional hypothesis

The three hypotheses imply not only the value of the coefficients in (1), but also that this is the correct functional form. If these hypotheses fail, then there is no necessary reason for the relation to be exactly linear.

The substantial bulk of this paper involves the construction of estimates of r_d. Since in the real world there is no single r_A, I make comparisons to several different asset returns. The conclusions are not notably sensitive to which return is used.

Banks are forbidden to explicitly pay interest on checking accounts. It has been suggested that banks evade the restriction by providing free services. This constitutes "implicit interest" on deposits. (However, it is generally true that free services which cost a bank one dollar to provide are less valuable to a consumer than paying the dollar explicitly.) Let D stand for demand deposits, X for gross expenses attributable to servicing demand deposits, SC for explicit payments by consumers for the services, and let NX be net expenses. We can measure the implicit rate of interest as in (2).

$$r_d = \frac{NX}{D} = \frac{(X - SC)}{D} \quad (2)$$

Throughout this paper I will measure the value of bank services as the cost to banks of providing these services. Since the distortional effect of the explicit interest prohibition is to limit consumer choice, it follows from elementary price theory that a dollar spent by banks and paid in the form of implicit interest is worth less (no more) than a dollar explicitly paid to the consumer. I compare the constructed series on implicit interest to the competitive rate. It should be remembered that this may over-estimate the implicit interest rate as seen from the consumers' viewpoint.

The finding that implicit interest is paid at less than a competitive rate may be attributed to either of two causes. The first is that the legal prohibition against interest can only be partially evaded. The second is that banks are able to hold down the implicit rate through some inherent monopoly power. I believe that the former is by far the preferred explanation, but I make no attempt to resolve this issue.

The issue of implicit interest payments is controversial because it is so important. For this reason I have constructed estimates of the implicit interest rate from two separate sources. The first source is the Functional Cost Analysis program of the Federal Reserve system. This data is generated by a direct survey of costs measured by bankers. The second source is the reports of income and condition for all insured commercial banks. I use a time series/ cross section approach to statistically allocate expenses to different bank functions. I use the results to project back and create an implicit interest rate series for the last two decades. These quite different sources produce quite similar results.

The issues in this paper are the subject of much current policy debate. Therefore, a special caveat is in order. The data in this paper comes from aggregating over all classes of depositors. There is some strong reason to believe that implicit payments vary by account size. The mix of accounts has a major impact on bank profits and may also be of interest for public policy analysis in terms of the distributional effects of legal interest payments. For the macroeconomic questions with which the paper is concerned, little injustice is done by aggregation.

The plan of the remainder of the paper is as follows. Some of the most relevant literature is reviewed briefly in the next section. The third section uses the Functional Cost Analysis data to construct a measure of implicit interest which is then compared to a competitive interest rate. In section 4 I use a time series/cross section analysis to allocate expenses to different bank functions. The results of this are used in the fifth section to construct an implicit interest series for aggregate data. This new series is then compared to the competitive rate, producing findings which confirm the FCA results. In section 6, I discuss some of the implications of the findings for monetary policy. A concluding section and Appendix follow.

2. Relevant Literature

The question of implicit interest payments to demand deposits has received extensive consideration in the literature. Four distinct approaches have emerged.

Benjamin Klein, in "Competitive Interest Payments on Bank Deposits," assumed that the implicit payments were at the fully competitive level and entered this rate in a money demand equation. In most of the reported formulations the variable is significant and tends to be of nearly equal magnitude (and of opposite sign) from the rate on alternative assets. Klein does not attempt to measure the actual level of implicit payments and therefore can only make indirect tests of the importance of implicit interest.

A large literature has followed the pioneering work of Feige, The Demand for Liquid Assets... . Feige's basic idea is to take actual service charges by banks and consider these as negative interest. He gets very good (significant and believable) results. This is not surprising as he quite carefully uses a time series/cross section analysis, states by years. Feige makes the assumption implicitly that services rendered are unrelated to service charges.

Though this work is of some use in estimating the own price elasticity of money demand, it does not precisely bear on the question of implicit interest. Feige has moved the established position from a zero nominal interest rate to a negative nominal interest rate.

Barro and Santomero, in "Household Money Holdings and the Deposit Rate," examine service charge remissions as a measure of implicit interest. This is a particularly valuable approach, as it measures the marginal return to another dollar of deposits, where other works (including this paper) examine the average return. The results suffer from two problems. First, they implicitly assume that services provided have been constant, which appears to be untrue. Second, the data behind the estimates is somewhat scanty.

Barro and Santomero surveyed very large commercial banks and received descriptions of service charge schedules from which they constructed a series of marginal remissions from 1950 to 1968 (annually). Twenty-three banks provided data which typically showed three or four instances of changes in the schedule. The constructed series has eleven values over the nineteen-year period.

The authors also insert their constructed series in a money demand function. The effect of implicit interest on money demand of implicit payments is estimated to be 82 per cent as large as the effect of explicit interest. However, the 95 per cent confidence interval is .42 to 1.19.

Barro and Santomero never actually test whether their measure of implicit interest is close to a competitive rate. Since all the data is provided in the paper, it is possible to make a rough test of the proposition. The numbers themselves are interesting. They rise monotonically from 1.43 per cent in 1950 to 2.42 per cent in 1968. Regressing this on the alternative interest rate the authors use, the rate on savings and loan shares, I found the following results:

$$r_d = \underset{(14.5)}{40.2} + \underset{(.040)}{.365} r_s \qquad \text{(in basis points)}$$

Regarding the regression as a convenient way to summarize the Barro-Santomero data rather than as performing an explicit statistical test, their data after all is not adjusted by the fraction (1-c), it is clear that implicit interest does move with market interest rates but that it is by no means fully competitive.

The final approach, and the one out of which the empirical work in this paper grows, is a short section by Poole in "Whither Money Demand." Poole points out that if the interest prohibition is entirely effective, then bank profits ought to rise and fall with the market interest rate. He takes 1964 as a base year. He then takes the increase in the treasury bill rate and multiplies it times demand deposits. To this he adds time deposits times the increase in the treasury bill rate minus the time deposit rate. This total, which includes a rough correction for reserves, is the assumed increase in bank earnings. This is compared with the actual increase in bank earnings (net). Poole finds "... bank earnings have been somewhat below what would have been expected if the prohibition of interest on demand deposits and the ceiling on time deposits were fully effective. Yet the difference (between predicted and actual) ... is not so large as to suggest that implicit interest is paid to a significant extent in the short run."

3. Functional Cost Analysis Data

The Functional Cost Analysis (FCA) program of the Federal Reserve Banks gathers information on bank expenses and income. This data is intended as a management tool for banks. For our purposes it is quite useful because it provides direct observations on the costs of servicing demand deposits.

The voluntarily participating banks use uniform accounting standards to supply the direct costs of servicing demand deposits. "Indirect expenses" are then allocated by the FCA program in accordance with "experience factors." Since this is intended as a management tool and since participation is purely voluntary, banks have a strong incentive to supply accurate information. The data is intended to allow a banker to compare his bank to other banks with similar activities and is also intended to allow a bank which continues participation to make year to year comparisons of its own costs. Comparisons over a long period are somewhat less accurate for two reasons. First, the program has been continually refined, so that newer data may be more accurate but may not be quite comparable. Second, the set of banks which choose to participate changes from year to year. Though the data was not intended for the current purpose, it has the very appealing property that cost allocations are done directly by each bank.

The data was made available by the Federal Reserve Bank of Boston (which is obviously not responsible for the way I interpret it). The data can be broken into three periods. From 1959 through 1965 I have data from New England banks with less than 50 million dollars in deposits. The data from 1966 to 1976 is national and comes from banks of diverse size. The last major revision of the program occurred in 1971, so that data from that point on are particularly uniform.

In Table 1 I present two series for each variable. The first is the New England banks through 1965 and national banks of less than 50 million in deposits, thereafter. The second series begins in 1966 and is a weighted average (see Appendix) of all participating banks.

FCA coverage, at least in recent years, is quite substantial. Participating banks in 1976 held 38.5 billion in demand deposits, or about 15 per cent of total member bank deposits.

The processing expenses data is included as a minimum cost which would not be effected by disagreement about FCA cost allocation methods. This evidence alone clearly rejects the most extreme version of traditional theory. Annual processing expenses net of service charges rose from 0.41 per cent of demand deposits in 1960 to 1.73 per cent in 1976.

Comparison of implicit interest to the adjusted portfolio yield can be seen most easily in the graph of Figure 1. The hypothesis of a full competitive pass through would require the relation to fall along the 45 degree line. The traditional hypothesis would have the data lie along the horizontal axis and the modified traditional hypothesis would require a horizontal line. Examination of the graph easily rejects all three of these hypotheses. The implicit interest rate has been consistently in the area of one-half the competitive rate. The line drawn through the data is the ordinary least squares regression line.

The results are confirmed by formal statistical testing. Regression results are presented in Table 2. The principal tests of interest are on the value of the slope coefficient, labelled "d" in the introduction. The OLS regressions reject both d = 0 and d = 1 with confidence intervals between 4.7 and 22 standard errors wide. However, the low Durbin-Watson statistics mean that the standard errors are not reliable. The regressions which correct for first order serial correlation reject both the competitive and traditional hypothesis. The apparent large intercept and low slope is actually just an artifact of having the serial correlation coefficient "pick-up" the fit in a relation which is not exactly linear. To show that this in fact explains the corrected regressions and that the modified traditional hypothesis should also be decisively rejected, I eliminated the three highest data points (which are those <u>least</u> favorable to the modified traditional hypothesis) and re-ran the corrected regressions. These last results in Table 2 reject d = 0 at nine standard errors.

year	portfolio income		processing expense		service charges		implicit interest		time deposit expenses		number of banks	
1959	2.63	-	1.09	-	0.68	-	1.38	-	0.61	-	83	-
1960	2.93	-	1.25	-	0.79	-	1.45	-	0.59	-	82	-
1961	3.07	-	1.38	-	0.79	-	1.48	-	0.56	-	81	-
1962	3.21	-	1.44	-	0.78	-	1.52	-	0.57	-	91	-
1963	3.27	-	1.72	-	0.87	-	1.51	-	0.60	-	92	-
1964	3.38	-	1.94	-	0.91	-	1.60	-	0.60	-	95	-
1965	3.45	-	1.87	-	0.92	-	1.61	-	0.61	-	94	-
1966	3.92	3.72	1.66	1.39	0.76	0.59	1.55	1.39	0.45	0.42	774	1022
1967	4.07	3.88	1.76	1.52	0.79	0.61	1.66	1.52	0.45	0.42	769	1035
1968	4.44	4.28	1.82	1.62	0.78	0.66	1.82	1.66	0.44	0.43	695	980
1969	4.87	4.71	1.92	1.78	0.81	0.63	1.86	1.91	0.51	0.50	603	881
1970	5.17	5.00	2.00	1.82	0.80	0.63	1.99	1.95	0.55	0.58	665	951
1971	4.93	4.52	2.04	1.60	0.81	0.62	2.01	1.86	0.54	0.53	684	984
1972	5.01	4.47	2.01	1.63	0.78	0.62	2.02	1.91	0.53	0.52	590	945
1973	5.40	5.04	2.03	1.71	0.76	0.59	2.09	2.10	0.58	0.52	557	942
1974	5.91	5.74	2.30	1.97	0.82	0.63	2.38	2.33	0.63	0.57	525	905
1975	5.94	5.32	2.47	2.09	0.83	0.62	2.63	2.51	0.62	0.59	473	862
1976	6.03	5.38	2.60	2.26	0.87	0.65	2.77	2.70	0.63	0.60	443	869

Table 1

Functional Cost Analysis Data

Notes:

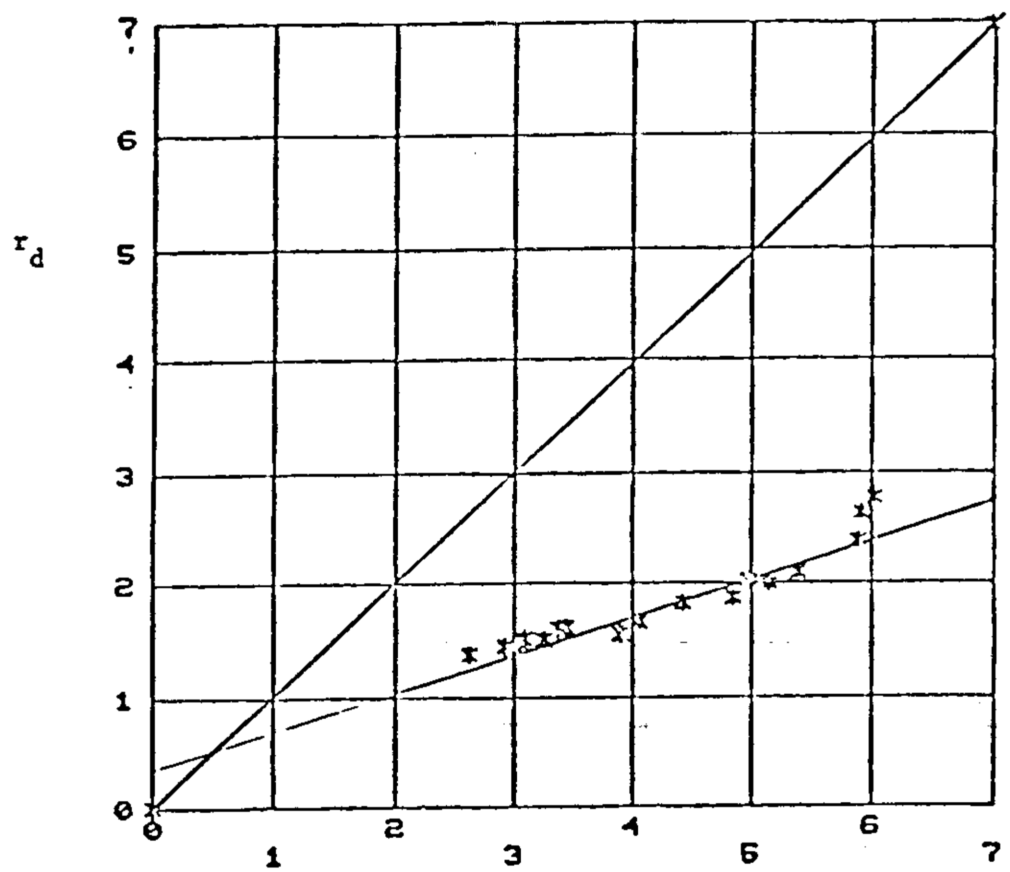
All columns (except "number of banks") are reported as the flow of income (or expense) per dollar of asset in annual percentage points. Thus, the first entry under "implicit interest" states that net annual expenses on demand deposits were \$1.38 per \$100.00 of deposits.

Portfolio income is the net rate of return to the total bank portfolio, adjusted downward to reflect the portion of demand deposits not available for loan or investment.

Processing expense is costs directly attributable to demand deposit handling, but does not include overhead, F.D.I.C., etc.

Figure 1

1959-1976 Implicit Interest -- FCA



adjusted portfolio yield

Table 2

Regressions of r_d on $(1 - c)r_A$

dependent variable	constant	adjusted net yield	ser	nobs	D.W.	R^2
		ordinary least squares				
small banks	0.377 (0.135)	0.342 (0.030)	0.14	18	0.52	.88
all banks	-0.78 (0.42)	0.583 (0.088)	0.18	11	1.13	.83
		corrected for serial correlation			rho	
small banks	2.54 (1.40)	0.158 (0.125)	0.10	17	0.97	.95
all banks	2.87 (0.69)	0.152 (0.074)	0.08	10	0.94	.95
		corrected for serial correlation (3 highest points omitted)				
small banks	0.695 (0.098)	0.253 (0.023)	0.06	14	0.25	.95
all banks	0.981 (0.159)	0.254 (0.026)	0.02	7	0.85	.99

Source: Table 1

While this analysis firmly rejects all three hypotheses in favor of an intermediate position, this conclusion is only as strong as the data behind it. The sections which follow re-examine the questions using totally separate data. One particular criticism of the Functional Cost Analysis data should be considered here. In recent years bank branches have proliferated. An advocate of the competitive hypothesis might well argue that all the increased occupancy cost should in an economic sense be attributed to demand deposits; and that banks using simple accounting rules or FCA procedures which use "experience factors" under-allocate this expense, biasing downward the implicit interest estimates. While this is undoubtedly true to some extent, the amount of such expense is too small to materially affect the conclusions above. 1976 occupancy expenses were only about 10 per cent of operating expenses and 40 per cent of occupancy costs are already allocated to demand deposits.

4. Cross-Section Results

In this section I use a combined time series/cross section analysis to estimate the implicit return to deposits. I then test this rate for constancy over time. Estimates derived in this section are used in Section 5 for an annual time series comparison of the implicit return to a competitive return.

Implicit interest paid by banks are those expenses of banks which are attributable to demand deposits. As banks engage in the joint production of a number of different services, it would be difficult if not impossible to produce a precisely correct accounting with the available data. Fortunately, some simple techniques appear to produce quite reasonable and apparently accurate results.

(In the Appendix, I give the sources for the data used and more precise details on how the series were constructed.)

A net expense figure is calculated for each state and for the District of Columbia. The problem remains as to how to properly distribute this expense among various bank activities. I have chosen to assume that all expenses are due to one of three activities: demand deposits, time deposits, and loans. Thus I assume that there are no (non-interest) expenses arising from investments, bank capital, and "non-fund" activities. This causes a slight upward bias in the attribution of expenses to demand deposits. Using the 1975 FCA figures indicates that these three activities accounted for 93 per cent of all bank operating expenses.

I assume that production of bank services for each activity is independent in the sense that total costs are linear in demand deposits, time deposits, and loans. Thus I estimate the following cross-section equation:

$$NETX = c + r_d D + c_T T + c_L L + e \qquad (3)$$

NETX is total bank expenses for all activities minus service charges; D, T and L a demand deposits, time deposits and loans, respectively. All four are measured in thousands of 1972 dollars.

The data used was from 1973, 1974 and 1975. According to the hypothesis of competitive implicit interest (constant returns to scale, constant factor prices), c should be zero and c_T and c_L should be constant across years. Since a number of bank activities are omitted from the regression, the constant is not actually zero. The F-statistic for the constancy of c_T and c_L is 0.96 which, distributed as $F(4,141)$, cannot be rejected at the 10 per cent level of confidence (or at the 5 per cent level, *a fortiori*).

The equations are estimated by ordinary least squares. Since the unit of observation is the state, there is doubtless some degree of heteroskad-asticity, so that some caution is called for in interpreting standard errors.

Simultaneous equations bias might be more serious in theory, but I suspect it is not in practice. It can be argued that a high service rate attracts deposits rather than more deposits being more expensive to serve. I doubt this is important in this cross-section analysis as depositors are unlikely to move money across state lines for such an incentive (with some possible exception of money center banks).

Regression results for Equation (3) are reported in Table 3. A different implicit rate on deposits and a different constant are allowed for each year. The coefficients indicate that cost of time deposits and loans were 0.93 per cent and 1.4 per cent, respectively. The former is somewhat too high and the latter slightly too low when compared to the FCA data. The constants are significantly different from zero, but are fairly small, on the order of 10 per cent of mean net expenses (as compared to the 7 per cent from other activities according to the FCA data).

The point estimates of implicit returns are 1.43 per cent, 1.57 per cent and 2.09 per cent, respectively. Of greater interest than the point estimates, are the indicated confidence intervals. With a standard error of 25 basis points, one might argue that the true return is 2.5 per cent, or conceivably even 3 per cent, but one can hardly suggest that it is 4 or 5 or 6 per cent.

The F-statistic for equality of the implicit rates in the three years is 31.8, which is obviously rejected. Thus, the modified traditional hypothesis is firmly rejected and the traditional hypothesis is rejected *a fortiori*.

Expense Allocation Regressions

1973-1975

All Insured Commercial Banks

independent variable	NETX	NETX-0.005T
1973 r_d	0.0143 (0.0026)	0.0105 (0.0019)
1974 r_d	0.0157 (0.0027)	0.0119 (0.0021)
1975 r_d	0.0209 (0.0025)	0.0176 (0.0019)
c_L	0.0136 (0.0029)	0.0192 (0.0012)
c_T	0.0093 (0.0020)	--
1973 constant	12902 (6540)	17518 (6245)
1974 constant	29356 (7069)	33952 (6813)
1975 constant	23191 (7732)	28087 (7471)
R^2	.993	.991
s.e.r.	35408	35834
mean dep. variable	285383	250077
nobs	153	153

Table 3

These results are impressive, especially when one considers the degree of multicollinearity in the data. With regard to this problem, I constrained the coefficient on time deposits to a value compatible with the FCA data, one-half of one per cent. The results are reported in the second column of Table 3.

Not surprisingly, the loan expense coefficient is higher by about 60 basis points. Slightly more surprisingly, the demand deposit rates are all slightly lower. This regression also rejects an implicit interest rate near the competitive level.

These results apparently reject both the traditional and competitive hypotheses in favor of a more intermediate position. This is tested more formally in Section 5.

5. Time Series Test

Given a measure of implicit interest, it is possible to make a straightforward statistical test of the three hypotheses by regressing r_d on $(1 - c)r_A$ and testing the coefficient for equality to one. In this section I discuss the components of the regression and then perform the actual test.

The "reserve ratio," c, consists of two components, average reserves against demand deposits and items in process of collection against demand deposits. The latter is measured as total items in process of collection minus one per cent of time deposits, this being the procedure used in the FCA analysis. The fraction available for loans ranges from 70 to 78 per cent (and is not trended).

There is no clear rule on how to measure r_A. I first use the rate on five to seven year government notes, as this is a very "clean" rate. Second, I use the actual average net return on bank loans. This figure is gross income on loans minus loan losses minus the implied costs of servicing loans. The loan yield figure has the major virtue of being the actual return for banks, but the disadvantage of having noise introduced by the two subtracted figures, neither of which is precise. I also used, but do not report here, the three month treasury bill rate. The tests with this rate substantially confirm the results reported below, although the relation to implicit interest is not nearly so linear.

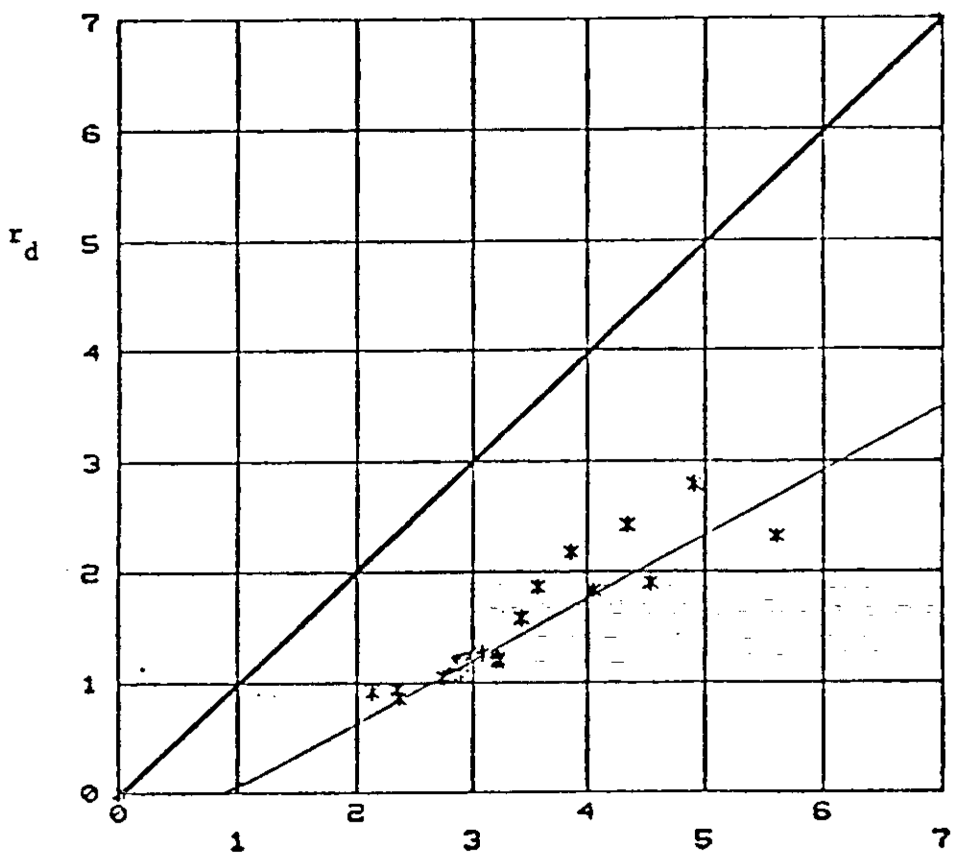
r_d was calculated by using the coefficients from the time series/cross section regressions. From net expenses in each year, I subtracted the costs imputed to loans and time deposits. The remainder was imputed as costs of demand deposits. This results in a slight overestimate of r_d, since the (positive) constant was not subtracted from expenses.

Statistical tests aside, the evidence is against all three hypotheses, if any credence at all is given to the estimates of the implicit rate of interest. Table 4 reports the estimates implicit rate and the reserve adjusted loan rate. Over two decades, the rate on deposits has been on the order of half the adjusted loan rate.

Since it is difficult to know the precise functional form for the test (for example, bankers probably respond with a lag), I have graphed implicit interest against the net adjusted loan yield in Figure 2. The points are all well below the 45 degree line, clearly

Figure 2

1954-1975 Implicit Interest



adjusted net loan yield

Source: Table 4

year	Implicit Interest on Demand Deposits "r_d" (a)	(b)	(c)	Competitive Rate on Demand Deposits "$(1-c)r_A$" (d)	(e)
54	.851160	.714835	1.47189	2.36774	1.93478
55	.905550	.716849	2.03801	2.12726	1.70642
56	.928590	.735517	2.63785	2.35727	1.93394
57	1.04196	.849162	2.69724	2.75266	2.32906
58	1.05996	.882679	2.79081	2.80269	2.37211
59	1.14471	.928655	3.66591	2.89989	2.47311
60	1.26637	1.04769	2.72512	3.10301	2.68062
61	1.19594	.989900	2.77532	2.91516	2.49808
62	1.19036	.970554	2.62691	2.89490	2.47039
63	1.23182	.992732	3.06724	3.00135	2.57056
64	1.14678	.909054	3.04272	2.91134	2.49213
65	1.07157	.806709	3.42643	2.89808	2.47508
66	1.16285	.908554	3.99483	3.22678	2.81618
67	1.21917	.970417	4.09802	3.23537	2.83115
68	1.57511	1.31354	4.09350	3.44525	3.03932
69	1.82214	1.48512	5.43800	4.07395	3.67848
70	2.42028	2.11980	4.61963	4.36113	3.96024
71	2.17040	1.88453	4.13798	3.87741	3.46874
72	1.85507	1.54033	4.50494	3.59537	3.18124
73	1.89442	1.52157	5.14192	4.55407	4.13564
74	2.32435	1.94872	5.65005	5.63106	5.21672
75	2.79523	2.47409	5.78340	4.92334	4.49889

(a) projected from coefficients of expense allocation regression
(b) as in (a), but constraining time deposit cost
(c) adjusted rate on five to seven year government notes
(d) adjusted net yield on bank loans
(e) as in (d), but using constraint as in column (b)

Table 4

rejecting the hypothesis of full competitive payments. Just as clearly, the line is not horizontal, rejecting the modified traditional hypothesis. The strict traditional hypothesis is completely refuted.

Formal regression results are presented in Table 5. In order to establish the facts most firmly, I present several variations. Both the straightforward estimates of r_d and those made constraining c_T to one-half of one per cent are used. Both the rate on government notes and the net yield on loans is used for r_A. The regressions are then repeated correcting for serial correlation.

Statistically, all three hypotheses are decisively rejected. The hypothesis $d = 1$ is rejected at six or more standard errors. The hypothesis $d = 0$ is rejected at four or more standard errors. The position that implicit interest is paid at one-third to one-half the competitive rate summarizes the positive findings.

6. Implications for the Money Stock

In this section I examine what the findings here imply about monetary policy when a switch is made to explicit interest payments. While the very simple model includes only demand deposits, the qualitative results would hold more generally. Three questions are

Comparisons of Implicit Interest to Competitive Rates

Independent variable	constant	Competitive rate	R^2	S.E.R.	D.W.
ordinary least squares					
rate on gov't notes	0.002 (0.202)	0.401 (0.053)	.74	.288	1.25
net yield on loans	-0.480 (0.189(	0.580 (0.055)	.85	.220	1.48
using constrained c_T					
rate on gov't notes	-0.067 (0.202)	0.351 (0.053)	.69	.288	1.21
net yield on loans	-0.292 (0.170)	0.511 (0.055)	.81	.225	1.47
corrected for serial correlation					rho
rate on gov't notes	0.082 (0.319)	0.379 (0.079)	.55	.274	.36
net yield loans	-0.385 (0.251)	0.555 (0.070)	.85	.221	.25
using constrained c_T					
rate on gov't notes	-0.021 (0.315)	0.337 (0.078)	.71	.275	.35
net yield on loans	-0.247 (0.221)	0.498 (0.070)	.81	.227	.22

Notes: Interest rates are in percentage points so that the constant is interpreted in percentage points.

The sample period is 1954-1975 (22 annual observations) for the OLS regressions. The first observation is dropped for the second set.

Table 5

raised. (i) How has ignoring implicit interest biased current estimates of money demand equations? (ii) What one-time change in the money stock would be needed at the point when explicit payments are first allowed? (iii) How will the slope of the money demand function change?

$$M^d = b(r_{dx} + ar_{di} - r_A) \tag{4}$$

$$r_{dx} = (1 - c)r_A \quad \text{and} \quad r_{di} = 0 \tag{5}$$

$$r_{di} = d(1 - c)r_A \quad \text{and} \quad r_{dx} = 0 \tag{6}$$

Equation (4) is a money demand function which suppresses all arguments except the interest rate. I assume it to be linear and to depend only on the difference between the rate on money and the rate on the alternative asset, this being the opportunity cost of holding money. Implicit and explicit rates on money are r_{di} and r_{dx}, respectively. Equation (6) summarizes the banking system under the current regime; equation (5) under the new regime.

The assumption built into equation (5), that with explicit interest payments the banking system would indeed by competitive, is not tested in this paper. However, evidence from the New England NOW account experiment strongly supports such a belief. With a legal ceiling rate of 5 per cent, the average NOW account interest is 4.95 per cent. With the addition of some continued implicit interest, the FCA data indicate that NOW accounts break even or conceivably lose a little money for banks.

It should be noted again that my estimate of the implicit interest rate is an average rather than a marginal return. It is difficult to say whether the marginal return is substantially smaller than the average, but it is worth noting that the correlation between the Barro-Santomero marginal measurement and my average measure is .78, which is quite high when one considers both the different measurement techniques and that they examined only household accounts where I include all demand deposits.

I have measured implicit interest at the cost to banks. As mentioned earlier, the value of these payments to consumers is presumably less than their cost. The coefficient "a" in the money demand function takes on a value less than one for this reason.

There is little hard evidence on which to base a value of a. Some anecdotal evidence suggests that consumers cut back substantially on the number of checks when charges are instituted on previously free accounts. The activity level of special checking accounts is only about three-quarters that of free accounts, according to the Function Cost Analysis data, but there is a substantial problem of self-selection here. It may also be useful to note that processing makes up about two-thirds of the total expense of carrying demand deposits at present. I will choose a equal to $^3/_4$ as a reasonable guess for the calculations which follow.

I have estimated d by a number of different methods. Little violence is done by placing it at one-half. The fraction (1 - c) has been about 0.75. Two special caveats should be observed. First, nothing has been said about the timing of the response of either money demand or changes in the rate on money. Both a and d might be much smaller on a quarter to quarter basis than the values given. Second, current legislation does not apply to all demand deposits and includes changes in reserve ratios.

Since implicit interest has in fact been paid, econometric estimates of b, the partial derivative of money demand with respect to market interest rates, are biased. The usual solution, throwing the estimated implicit rates into a money demand regression, is rather unattractive because of the limited number of observations. Fortunately, some rule of thumb analysis allows us to estimate b fairly well.

Under the current regime, the total derivative of money, with respect to r_A, is:

$$b(ad(1 - c) - 1) \tag{6}$$

It is quite reasonable to believe that current estimates of this total derivative, which are now labeled b, are fairly accurate (Klein mentions this point in his conclusion). Using the parameters suggested above, the true value of b is about 40 per cent larger than the value usually given. (Assuming a equal to one would raise the bias to about 60 per cent.)

The diagram in Figure 3 can be used to show both the one-time shift in money demand and the change in the effectiveness of monetary policy.

The market interest rate is on the horizontal axis and the effective interest rate on deposits is on the vertical. M^d is the money demand equation, relating the two interest rates at a fixed level of the money stock.

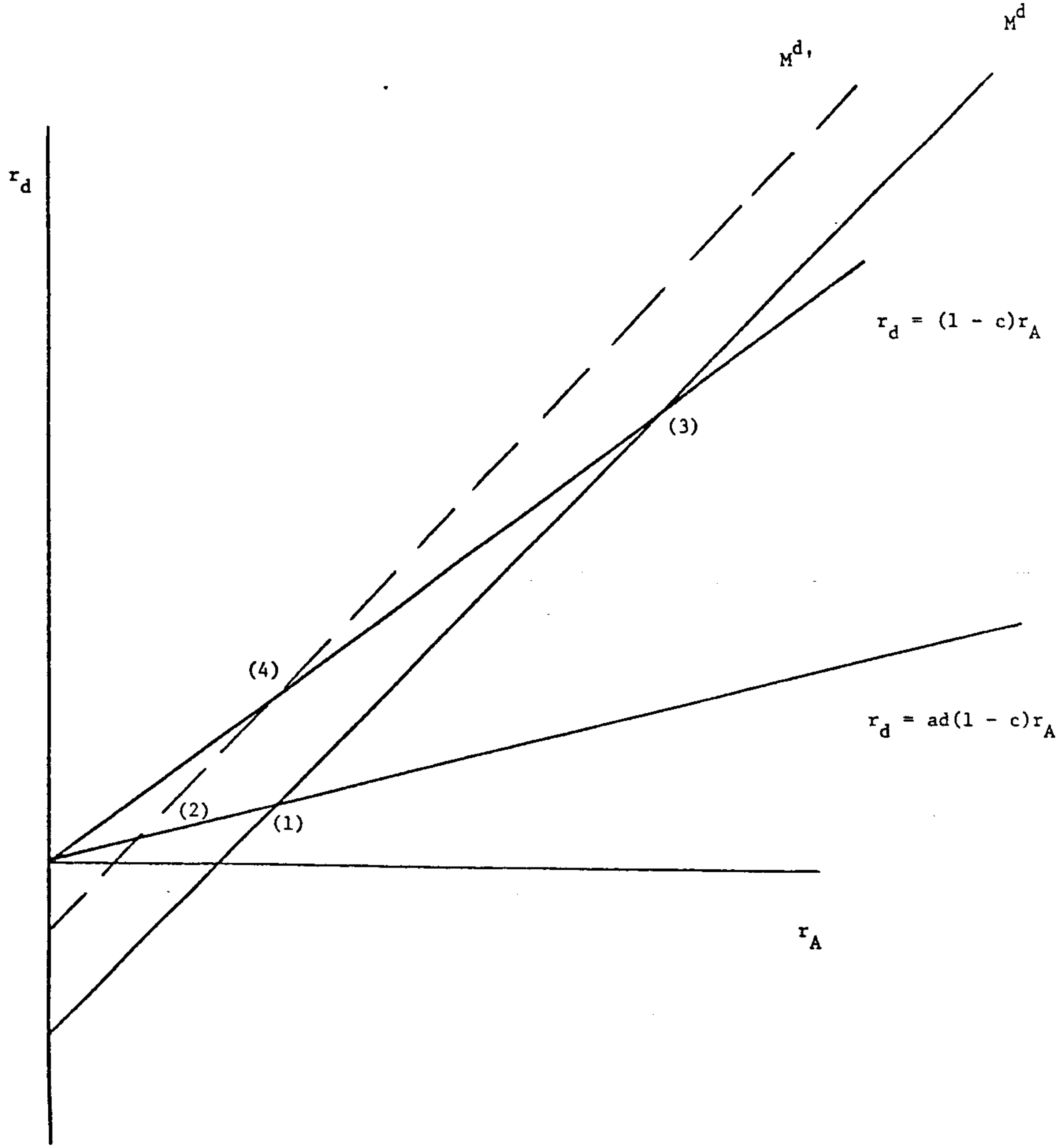
When implicit interest is paid, the effective deposit interest rate is $ad(1 - c)r_A$. Thus the current interest rate is at point (1). After explicit payments are allowed, the deposit rate will be $(1 - c)r_A$. Keeping the money stock fixed would cause a one-time increase in interest rates from (1) to (3).

An increase in the money stock is shown by a vertical move from M^d to $M^{d'}$. An increase in the money stock of dM causes a vertical shift in the money demand schedule of $(1/b)dM$. Under the old regime this shift would move interest rates from (1) to (2). With explicit payments, the change is from (3) to (4). It can be seen in the diagram that a change in the money stock is considerably more effective at changing interest rates when explicit interest is allowed. The total derivative of r_A with respect to the money stock increases (in absolute value) from $1/b(1-ad(1-c))$ to $1/bc$.

While bearing in mind the limits of the model here, it is possible to make a rough guess as to the effect on monetary policy

Figure 3

Comparative Monetary Policy
Under Implicit Versus Explicit Interest



of going over to explicit payments. A given change in the money stock will move the market interest rate about 2.9 times as much as it does presently. (The traditional theory would indicate a factor of four; the position of current fully competitive implicit interest indicates, of course, no change.) A substantial one-time increase in the money supply would be necessary to keep market interest rates at their current level. Even though these actual estimates are seriously limited, especially because the currency component of the money stock has been ignored, the fact that a change to an explicit interest rate regime would have a dramatic impact is an inescapable conclusion.

7. Summary

The great bulk of this paper has involved the empirical measurement and estimation of implicit interest rate on demand deposits. This has been measured as net bank expenses on demand deposits, a measure which is recognized to be higher than the value of the implicit rate effectively received by consumers. Several different measures all produce estimates of the implicit rate that are about one-half of the competitive rate. The hypothesis that earnings are fully passed on is rejected by the available data. The more traditional assumption that implicit interest is negligible is also refuted.

Estimates of the implicit rate come from three sources. The first is the Functional Cost Analysis data. Estimates of the competitive pass through at the margin are 0.34 for a series on small banks and .58 for a shorter series on a larger sample of banks. The second estimates come from three years of cross section/time series analysis. The implicit rates estimated are 30 to 40 per cent of adjusted yields in those years. Combining information from this analysis with a longer time series on expenses again produced estimates of the pass-through rate being between .34 and .58.

The statistical tests in this paper are certainly open to formal criticism because neither the functional nor the stochastic specifications are precisely correct. For this reason, several graphs and tables are included which show the actual measured rates. A more serious problem is potential bias in the collection and estimation of the underlying data. One suspects that there is a tendency for some costs to be left out, so that the implicit deposit rate is actually closer to the competitive level than the estimates here show. As one example, secondary reserves are held for added protection against the fluctuations in deposit balances. The difference between earnings on these secondary reserves and the higher return available on less liquid alternative assets ought to be considered a cost of servicing demand deposits. As a second example, some deposit interest is paid in the form of lower loan rates in return for compensating balances. This is not included as part of the expense of deposits. (However, the "competitive rate" measurements which are based on bank portfolio rather than a market rate are also lower when compensating balances are used in this fashion. The regressions based on the bank loan rate, in Table 5, ought to be more or less immune to this particular source of error.)

Even acknowledging statistical and measurement problems, the evidence appears to be strong. All estimates of the implicit demand deposit rate have been well below the competitive rate, well above zero, and responsive to the market interest rate.

Data Appendix

The purpose of this appendix is to describe how the data series used in the paper were created. The three main sources were the Functional Cost Analysis data, the annual Report of Income, and December Report of Condition. The two latter are reported in Bank Operating Statistics, Assets and Liabilities -- Commercial and Mutual Savings Banks, and the Annual Report of the Federal Deposit Insurance Corporation. The rate on government notes was taken from the MPS data bank (fourth quarter figures).

The figures used in the Functional Cost Analysis computations were all taken directly from the summary statistics published by the Federal Reserve Banks. Data prior to 1965 was made specially available by the Federal Reserve Bank of Boston. The average national figures represent a weighted average of figures for the three reported categories of banks, under 50 million, 50 to 200 million, and over 200 million. The weights are the approximate bank shares in 1975, 23 per cent, 18 per cent and 59 per cent.

The data for the time series/cross section analysis covers all insured commercial banks in the 50 states and the District of Columbia. Demand and time deposits are the totals from the December call reports. Loans are "other loans." Gross expenses are the sum of "salaries and wages," "pensions and other employee benefits," "net occupancy expense," "furniture and equipment, depreciation, rental costs, servicing, etc.," and "other operating expenses."

Net expenses are gross expenses minus explicit payments, "service charges on deposit account" and "other service charges, collection and exchange charges, commissions, and fees."

The data from the time series analysis is basically as above, but with occasional very minor deviations as reporting standards changed. Some of the data includes United States banks outside the 50 states and D.C., but these are very small. The gross yield on loans is "interest and fees on loans." The net yield is the gross yield minus loan losses and the imputed costs of servicing loans. From 1969 and on, loan losses are measured as "provision for loan losses." Before 1969, loan losses are estimated by current losses plus the losses charged to reserves. Neither loss calculation is as accurate as might be desired.

The reserve factor, c, is composed of two parts, required reserves and float. Required reserves is measured as the "Implicit Reserve Requirement against Net Demand deposits," (ZRD) and comes from the MPS data bank (fourth quarter figures were used). Float is measured as "items in process of collection" from the Report of Condition. Part of the float is due to time deposits. I follow the FCA procedure by subtracting one per cent of time deposits from total float, to generate IPC. The actual fraction of the portfolio available to be loaned is $(1 - c) = (1 - ZRD)(1 - IPC)$. Note that the FCA analysis used the net adjusted yield on portfolio as calculated by the FCA.

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