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Deposit Interest Ceiling and the Cost of Bank Borrowing*

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1. Introduction

The stated objective of Congress in assigning the Federal Reserve Board and the Federal Deposit Insurance Corporation the joint authority to impose a ceiling on interest rates paid on commercial bank deposits was narrow indeed. Created under the power of the Banking Act of 1933, Regulation Q was designed to control the cost of bank borrowing by curbing competition for deposit liabilities, thought to induce investment in high-yield risky assets. Such alleged practices were widely perceived at the time as having led to the unprecedented wave of bank failures of 1929–30 (see Friedman and Schwartz (1963, pp. 443–4), Benston (1964), and Cox (1966)]. Although the action of Congress in providing for the establishment of the interest ceiling was aimed solely at reducing bank costs, the implementation of the law in the past two decades implies a broader set of regulatory objectives. Recent episodes indicating substantial effects of the ceiling on the allocation of funds among various deposit categories and, more generally, among financial intermediaries and other financial markets led contemporary observers, including Federal Reserve officials, to characterize the ceiling as an important tool of monetary policy [e.g., Tobin (1970)]. This characterization represents an implicit yet important shift in regulatory focus, from bank *cost* of interest paid to depositor *benefit* from interest received.[1] In principle, it is possible that the ceiling is effective when viewed in terms of the regulator's newly defined objectives, yet ineffective in terms of the legislator's intent. Specifically, the purpose of the law would be defeated if competition by non-cash means eliminates the economic rent created by the constraint on cash interest payment, even though the value of interest received is diminished due to the use of inferior payment methods.

The purpose of this study is to determine empirically the effect of the Banking Act on the cost of bank borrowing, thus assessing its impact in terms of the legislative intent behind the interest ceiling. Section 2 deals with the determination of deposit interest rates in the absence of legal restrictions. It also contains a brief review of methods of payment in kind available to a bank seeking to circumvent a binding ceiling. Empirical implications of the analysis are considered in Section 3, followed by a description of the data in Section 4. Test results reported in Section 5 deal with the effect of the Banking Act on the payment of interest through vari-

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[1]Although the congressional debate preceeding the Banking Act contains references to interest received, these were made in a different context. The limitation of interest received on interbank deposits is cited as a means of discouraging pyramiding of funds and their concentration through a few large banks in the securities loan market of New York City [see Linke (1966)].

ous methods and the contribution of the ceiling to this effect.

Empirical results presented in this paper indicate that the Banking Act has been virtually ineffective in constraining bank costs. In particular, a) the law has effected only a 13 percent reduction in the cost of soliciting deposits. This finding is explained by results showing that b) cash payments represented only 15 percent of the total interest paid before 1933 and 11 percent since, while c) preferential credit terms accounted for as much as 80 percent of the interest paid before 1933 and 72 percent since. In view of the composition of interest paid before 1933, it is argued that the ineffectiveness of a regulatory constraint focusing on cash payment of interest could have been predicted prior to enactment. Results further indicate that d) the interest ceiling has contributed to the overall effect of the Banking Act on the cost of bank borrowing, especially during periods of high interest rates. Although these results do not specify the extent of its contribution, they suggest that estimates of the "average" effect of the Banking Act tend to understate the potential impact of a removal of the ceiling if it is timed to coincide with high market interest rates.

2. Theory

A. Deposit Interest under Competitive Behavior[2]

Consider the following simplified balance sheet of a commercial bank with zero net worth. The bank's assets are comprised of loans and investments I providing rate of return r, deposits held in other banks D^a yielding r^{da}, and non-interest bearing reserves R. The liabilities of the bank are represented by demand and time deposits D held by the non-bank private sector, the federal government, and other banks (for a listing of notations see the Glossary). The bank's marginal cost of producing the flow of monetary services associated with a dollar deposit is approximated by the income foregone by virtue of the bank's use of that dollar, that is,

$$MC = i\frac{R}{D} + (i - r)\frac{I}{D} + (i - r^{da})\frac{D^a}{D} \quad (1)$$

where i is the yield of a hypothetical asset whose return is entirely pecuniary.[3] This marginal cost is a weighted average of three rates of marginal opportunity cost: i, $(i - r)$, and $(i - r^{da})$. The first rate, i, is the cost of holding reserves assumed to earn no pecuniary return; the second, $(i - r)$, the cost associated with loans and investments, and the third, $(i - r^{da})$, the cost entailed by holding deposit assets. As indicated by equation (1), the marginal cost of producing monetary services is assumed to exclude costs not marginal to the deposit balance but which may be incurred in servicing accounts in which the balance is carried. Such service costs are assumed to be directly charged to the depositor.

In the absence of legal restrictions upon the payment of interest on deposits, competitive forces induce the bank to pass on to its depositors the entire marginal profit on deposit accounts. As a result, customers' marginal pecuniary cost of holding a dollar of deposits equals the bank's marginal cost of producing the monetary services yielded by that dollar. This equilibrium condition is given by

$$i - r^d = MC \quad (2)$$

where r^d is the average rate paid on bank deposit liabilities. Substitution of (2) into (1) yields

$$(i - r^d) = i\frac{R}{D} + (i - r)\frac{I}{D} + (i - r^{da})\frac{D^a}{D} \quad (3)$$

[2]The analysis through equation (3) follows Klein (1974, pp. 935–937).

[3]As a matter of convenience only, all costs and benefits in this paper are considered on a pre-tax basis.

In order to obtain a solution for r^d it is assumed that the same ratio of demand to time deposits is maintained on both sides of the bank's balance sheet. Since under competitive conditions only one rate is paid on each type of deposits, it follows that $r^{da} = r^d = r^h$ where r^h is the average rate paid on deposits in the absence of legal restrictions. Substitution of r^h for r^{da} and r^d in (3) yields

$$r^h = r\left(1 - \frac{R}{D - D^a}\right) \quad (4)$$

in which the control-free deposit rate is expressed in terms of observable variables.[4]

The rate given by (4) is adjusted in a minor fashion when applied to the situation of a bank which is a member of the Federal Reserve System in order to account for the subsidy received by such a bank in the form of special privileges [*cf.* Klein (1974)]. If F is the amount borrowed at the preferred rate r^f rather than at the market borrowing rate r, the subsidy per dollar deposit is $(r - r^f)F/D$ and the adjusted control-free rate is

$$r^h = r\left(1 - \frac{R}{D - D^a}\right) + (r - r^f)\frac{F}{D} \quad (5)$$

B. Interest Payment in Cash and in Kind

Deposit interest rate limits have been interpreted by regulatory authorities as applying primarily to the payment of interest in cash. If, however, a bank is induced to pay a percentage point of interest in kind for each percentage point which it may not pay in cash, it again is led into a position of earning zero marginal profit on deposit accounts.[5] Thus, the existence of a ceiling on cash interest payment does not necessarily reduce the total rate paid by a competitive banking industry. Such a reduction can be effected, however, by a regulatory package which establishes market conditions causing a reduction in the total rate banks *seek* to pay. It is conceivable that various forms of regulatory control imposed by the Banking Act of 1933 create these very market conditions in which the total rate paid by banks is less than the control-free rate.[6]

The total rate actually paid by banks, r^t, is the sum of the rate paid in cash r^c and the rate paid in kind r^k. To the extent that various regulatory devices introduce a monopsonistic element into the deposit market, the total rate actually paid may be lower than the hypothetical competitive rate, that is

$$r^t = qr^h; \quad 0 \leq q \leq 1 \quad (6)$$

The ratio $q = r^t/r^h$ defines an index of effective competition. Effective regulation should result in a decrease in this index by Δq, generating an increase of $r^h\Delta q$ in bank profits.

C. Methods Used to Avoid the Ceiling

In the competitive process of soliciting deposits, banks might be forced to attempt to circumvent the interest rate ceiling associated with the regulatory package. Methods used in this attempt are considered next.

Remitted checking account service charges. Commercial banks are not restrained from undercharging customers for checking account services rendered.[7] The lack of regulatory attention to this form of implicit inter-

[4]Following Hodgman (1961), Klein (1970, 1973, 1974) uses the simplified formulation $r = r^h(1 - R/D)$. The difference between the two expressions is not eliminated by aggregation. This is the case even in a closed system in which banks maintain deposits only with each other.

[5]Considering the involuntary nature of this substitution, the change in the form of payment is likely to involve a decrease in the value of interest *received* even if competition assures no change in the gross rate *paid*. This effect has no bearing upon the present discussion, except for the requirement that the marginal value of interest received in kind be positive.

[6]For an analysis of the increased regulatory intervention following the depression see Friedman and Schwartz (1963, pp. 420–462).

[7]Evidence for the prevalence of this practice is found in *Federal Reserve Bank of Boston* (1958–1969), Pugh and Wood (1966), Bell and Murphy (1967), Hazleton (1968), Weiss (1969), and Barro and Santomero (1972).

est payment can be attributed to its apparent limited effectiveness reflected in these features: Demanded services do not maintain a fixed proportion to account balances;[8] the cost of reselling these services is prohibitive; service costs are typically small when translated to a rate of interest.[9]

Compensating balance and preferential credit terms. Commercial lending arrangements commonly include a compensating balance provision specifying an average deposit balance to be maintained by the borrower for the duration of the loan.[10] Hodgman (1961) and Davis and Guttentag (1962, 1963) show that deposit balance requirements are consistent with profit maximization only if the bank reciprocates by cutting the rate charged on the loan while the terms of the agreement are freely negotiated between the parties. Friedman (1970) and Klein (1970, 1974) argue that this arrangement results in the payment of implicit interest whether or not it is designed to do so. Compensating balance provisions were known long before the ceiling went into effect [see Mayer and Scott (1963), and Gibson (1965)] and have remained in use under somewhat restrictive conditions since. The introduction of the ceiling marks the inception of the uniform prime lending rate [see Hodgman (1961)], a convention which, at least in principle, limits bank freedom in lowering individual loan rates to attract deposits. If alternative ways of adjusting the rate of implicit interest paid via this method (by increasing loan size and relaxing collateral requirements) are less economical, it can be argued that involuntary adherence to the prime convention may impede payment of implicit interest.

Other methods. Waiver of checking account charges and preferential credit terms are closely associated with demand as opposed to time deposits. Use of these methods prior to the late 1960's—the period during which the ceiling on time interest became binding for the first time—lends support to this conjecture. Since then the use of avoidance methods aimed at time as well as demand deposits seems to have varied directly with market interest rates. Initially ranging from gimmicks directed at small deposits, such as frequent compounding of legal interest, to elaborate schemes attracting large deposits, such as transfer of deposits to foreign branches exempt from the ceiling [*cf.* Friedman (1969)], these practices evoked little resistance by the Fed. With further increases in market interest rates in the late 1970's and the associated competitive pressure on banks, this resistance has all but disappeared, most recently inviting avoidance through open and effective devices such as writing checks on savings accounts.[11]

3. Empirical Implications

Effective enforcement of the interest rate ceiling is expected to result in a situation in which changes in market interest rates are fully reflected in variations in bank operating earnings. The observed limited sensitivity of bank earnings to changes in market interest rates is interpreted by Friedman (1970) as evidence that banks successfully avoid the deposit interest rate ceiling. Banks are induced by competitive forces to substitute payment of interest in kind for payment in cash. As a result, changes in market rates of interest generate little change in bank earnings.

Overall payment of interest. Successful avoidance can be detected by comparing changes in potential operating earnings with changes in actual earnings, both measured before the deduction of cash interest payment. Changes in potential operating earnings, although not directly observable, are by definition equal to changes in potential investment revenue $\Delta(rI)$. Thus any change in the amount of interest paid in kind is given by the difference between these changes and those of actual earnings ΔE,[12]

$$\Delta(r^k D) = \Delta(rI) - \Delta E \tag{7}$$

where the change in the rate paid in kind is

$$\Delta r^k = \Delta\left(\frac{rI - E}{D}\right) \tag{8}$$

Since $r^l = r^c + r^k$, equation (6) is rewritten as

$$\Delta\left(r^c + \frac{rI - E}{D}\right) = q\Delta\left[r\left(1 - \frac{R}{D - D^a}\right) + (r - r^f)\frac{F}{D}\right] \tag{9}$$

in which a change in the total rate paid Δr^l is expressed as a fraction q of the contemporaneous change in the hypothetical competitive rate Δr^h. The pre- and post-regulation value of q is estimated on the basis of this relationship. Since linearity in first differences implies linearity in original values, a similar test is conducted utilizing the following relationship in original values

$$r^c + \frac{rI - E}{D} = \text{constant} + q\left[r\left(1 - \frac{R}{D - D^a}\right) + (r - r^f)\frac{F}{D}\right] \tag{10}$$

where a constant is added to account for unknown components of E which are insensitive to movements in market interest rates and thus irrelevant for payment of implicit interest.

Specific payment methods. Disaggregated data permit testing for effects of the ceiling on interest payment via avoidance methods discussed in Section 2. This involves recalculating q in equations (9) and (10) after substituting in the left hand side relevant revenue and cost items. In terms of equation (9), the effect on interest payment through remitted checking account service charges requires the use of a dependent variable defined by the ratio of service charge income E_1 to deposit liabilities, where an implicit rate change is denoted by $\Delta r_1^k = -\Delta(E_1/D)$. Tests intended to determine the effect of the ceiling on payment through the compensating balance method use instead a rate change denoted by $\Delta r_2^k = \Delta[(rI - E_2)/D]$, a ratio relating the difference between potential loan revenue rI and actual revenue E_2 to deposit liabilities. The difference in the construction of these variables reflects the assumption that changes in market interest rates have no direct impact on deposit service costs but do have an impact on potential revenue derived from loan balances. Lastly, the effect of the ceiling on cash interest payment is determined by using Δr^c as the dependent variable.

4. Data

Tests are conducted on annual time series of aggregate member bank data for the period 1919–1977, using the following empirical definitions.

Independent variable, equations (9) and (10)

R = average dollar reserves held against demand and time deposits,

[8]For evidence that servicing larger accounts involves higher costs see *Federal Reserve Bank of Boston* (1958–1969), Hazelton (1968), and Weiss (1969).

[9]See *Federal Reserve Bank of Boston* (1958–1969), Bell and Murphy (1967, 1968), *Federal Reserve: Performance Characteristics* (1969), *Federal Reserve: Functional Cost Analysis* (1969), Barro and Santomero (1972), and Yaari (1972).

[10]The extent to which it is practiced is measured and reported by Cagle (1956), Mayer and Scott (1963), Baxter and Shapiro (1964), and Gibson (1965).

[11]There is little doubt that this acquiescence on the part of the Fed reflects a fear that effective enforcement will lead to a reduction in the value of interest received whatever the effect on the rate paid, risking a mass withdrawal of bank deposits.

[12]In an otherwise excellent study Startz (1979) estimates implicit interest paid on demand deposits based solely on variations in bank book costs. This approach leads to understatement of this rate to the extent that bank opportunity cost includes revenue foregone, for example, due to reductions in loan rates in conjunction with compensating balance arrangements.

including vault cash[13] and reserves held with reserve banks;[14]

D = average adjusted deposit liabilities, including demand and time balances held by the public,[15] the federal government (including time deposits of the postal savings system),[16] and other banks;[17]

D^a = average deposit assets held by member banks with member and other banks;[18]

r = average market yield on 4–6 month prime commercial paper;[19] this choice of a "market" rate is unavoidably arbitrary;

F = average Federal Reserve Bank credit to members, extended by discount through the Fed window;[20]

[13]Sources: 1919–1942, Friedman and Schwartz, *Monetary Statistics,* pp. 384–393, Table 25; the January–June 1919 average unavailable for Nonweekly Reporting Members is extrapolated based on the ratio of Weekly Reporting to Nonweekly Reporting figures during the second half of 1919; 1943–1960, *Federal Reserve Bulletin,* tables entitled "Reserves and Liabilities of Banks in Leading Cities" and "Reserves and Liabilities of Commercial Banks by Class"; the unavailable annual average cash in vault of member banks is estimated by extrapolating the average cash balance calculated from the first table using the ratio of the cash figure of all Members to Weekly Reporting Members on the same date (twice a year); slightly different averages would have been implied by Member Banks Call Dates figures published in the *Supplement,* Section 2, Table 1/A, pp. 10–11; 1961–1977, see fn. 19.

[14]Sources: 1919–1960, *Supplement,* Section 10, Table 1/A, p. 14; 1961–1977, *Bulletin,* tables entitled "Member Bank Reserves, FRB Credit, and Related Items" and "Reserves and Borrowings, Member Banks"; figures since 1961 include vault cash.

[15]Sources: January–June 1919, *Banking and Monetary Statistics,* Table 18, p. 73; July 1919–December 1945, Friedman and Schwartz, *Monetary Statistics,* Table 36, columns 1, 4, pp. 504–515; 1946–1977, *Bulletin,* tables entitled "Principal Assets and Liabilities and Number of All Banks, by Classes" and "Commercial Bank Assets and Liabilities."

[16]Sources: 1919–1941, *Statistics,* Table 18, pp. 73, 75 (figures for the period December 31, 1918–April 28, 1921, are slightly adjusted upward to correct for the fact that prior to June 30, 1921, Postal Savings balances are reported for National Banks only); 1942–1966, *Supplement,* Section 2, Table 1/E, pp. 18–19; 1967–1977, *Bulletin,* tables entitled "Reserves and Liabilities by Class of Bank" and "Liabilities and Capital by Class of Bank."

[17]The figures for deposit liabilities held by other banks and deposit assets held in other banks and deposit assets held in other banks (D^a, see below) are arrived at in two steps. The second step is identical for both types of deposits, but the *first step* differs, and is as follows. Deposits due to banks (included in D): 1919–1938, *Statistics,* Table 18, pp. 73, 75; 1939–1959, *Supplement,* Section 2, Table 1/B, pp. 12–13; 1960–1977, *Bulletin,* tables entitled "Principal Assets and Liabilities and Number of All Banks, by Classes" and "Commercial Bank Assets and Liabilities." Deposits due from banks (D^a): 1919–1938, *Statistics,* Table 18, pp. 72, 74; the 1919–1926 figures are adjusted upward to compensate for the missing data on foreign deposits, by extrapolating the average ratio between foreign and domestic deposits in 1927–1928; 1939–1966, *Supplement,* Section 2, Table 1/A, pp. 10–11; 1967–1977, *Bulletin,* table entitled "Reserves and Liabilities by Class of Bank"; January 1967–June 1969 figures are increased by adding estimated all Member balances with foreign banks, calculated from the foreign balances held by Weekly Reporting Members during the same period, reported in the *Bulletin,* tables entitled "Assets and Liabilities of Large Commercial Banks" and "Assets and Liabilities of Banks in All Leading Cities"; the calculation calls for extrapolating the ratio of foreign to domestic balances held by all Members to those held by Weekly Reporting Members in 1965–1966 (see above); July 1969–December 1977 figures are also increased by adding estimated balances held with foreign banks, which is done by extrapolating the ratio of foreign to domestic balances held by all Members during January 1967–June 1969, based on the above estimates of foreign balances and available data on domestic balances. In the *second step,* the above estimated sums of deposit liabilities and assets for the period June 30, 1942–December 31, 1977, are adjusted upward to reflect the fact that beginning in the middle of 1942 banks reported interbank deposits on a net basis. It is assumed that the *ratio* of gross to net interbank deposits has not changed since June 30, 1942, a date for which this ratio can be calculated (see *Supplement,* Section 2, p. 8).

[18]For data sources, see fn. 17.

[19]Sources: 1919–1941, New York City rates, *Statistics,* Table 120, p. 448; 1942–1950, *Supplement,* Section 12, Table 5/A, p. 37; 1951–1977, national average rates, *Bulletin,* tables entitled "Money Market Rates" and "Interest Rates, Money and Capital Markets."

[20]Sources: 1919–1929, *Statistics,* Table 101, pp. 369–371; 1929–1960, *Supplement,* Section 10, pp. 50–60 (because of a descrepancy, both 1929 figures are used in calculating the first differences; where possible, a similar procedure was followed in all cases involving a change in the measurement of a variable); 1961–1977, *Bulletin,* table entitled "Reserves and Borrowings of Member Banks."

r^f = average Federal Reserve Bank discount rate on eligible paper;[21]

Dependent variable, equations (9) and (10)

r^c = average rate of cash interest paid on time and demand deposits held by the public, the federal government, and banks; calculated by dividing the annual sum of interest paid by the average deposit liability balance;[22]

I = average loans and other interest-bearing investments, excluding deposits held in banks (D^a);[23]

E = operating earnings before cash interest payment on deposit liabilities;[24]

E_1 = service charges on deposit accounts; reported separately only since 1933;

E_2 = interest and discount on loans; due to official changes in variable definition, data is available in first differences only.

5. Tests

The statistical analysis employs the following dummy variables in conjunction with variables appearing in equations (9) and (10).

D_1 = intercept dummy, assuming the value 0 in pre-regulation years (1919–1933) and the value 1 in regulation years (1934–1977);

D_2 = intercept dummy, assuming the value 0 in years of low (submedian) rate of *warranted* non-cash interest ($r^h - r^c$) and the value 1 in high rate years;[25]

$DD = D_1 \times D_2$, interaction intercept dummy;

$r^hD_1 = r^h \times D_1$, before/after regulation slope dummy;[26]

$r^hD_2 = r^h \times D_2$, a slope dummy for low/high warranted non-cash interest;

$r^hDD = r^h \times D_1 \times D_2$, interaction slope dummy.

A. Overall Payment of Interest

Test results based on equations (9) and (10) pertaining to the overall payment of interest before and after 1933 are reported in Table 1. Cursory examination of the results reveals a very high $\bar{R}^2$ in all six regressions and high serial correlation of residuals in those which employ original, undifferenced values. The first feature is explained by the fact that variations on both sides of these equations are dominated by movement in "the" market interest rate. This, of course, is the essence of the claim that bank costs have varied along with market interest rates despite the ceiling. The serial correlation was treated using the Cochrane-Orcutt adjustment in all reported regressions.

Equations (i), (ii), and (iii) are estimated utilizing original values of the variables as indicated by equation (10). The estimated coefficient of r^h, representing the pre-control value of $q = r^t/r^h$, is significantly positive as expected. Its value of 1.204 in regression (i) exceeds the theoretical maximum of unity,

[21]Sources: 1919–1941, *Statistics,* Table 115, pp. 439–442; 1942–1963, *Supplement,* Section 12, Table 1/A, p. 31: 1964–1970, *Bulletin,* February 1972, table entitled "Summary of Earlier Changes"; 1971–1977, *Bulletin,* March 1978 table entitled "FRB Interest Rates." New York City rates are used due to completeness of series.

[22]Interest data sources: 1919–1941, *Statistics,* Table 57, pp. 262–263; 1941–1965, *Supplement,* Section 6, table 1, pp. 6–7; 1966–1969, *Bulletin,* table entitled "Member Bank Earnings, All Member Banks, by Class"; 1970–1977, *Bulletin,* June 1978, Table A.2, p. 447.

[23]Sources: 1919–1941, *Statistics,* Table 18, pp. 72, 74: 1942–1962, *Supplement,* Section 2, pp. 10–11; 1963–1977, *Bulletin,* tables entitled "Principal Assets and Liabilities and Number of All Banks, by Classes" and "Commercial Bank Assets and Liabilities."

[24]Data sources of this and the following two variables are the same as those of r^c (see fn. 22).

[25]The average rate of two consecutive years is used in conjunction with first differences.

[26]The notation $\Delta r^hD_1 = (\Delta r^h \times D_1)$ is used with first differences. Similar notation is used for the next two variables in the difference form.

TABLE 1 Overall Payment of Interest, 1919–1977

Data Form	Dependent Variable	Equation Number	Constant Term	Intercept Dummies D_1	Intercept Dummies D_2	Intercept Dummies DD	Variable r^h	Slope Dummies r^hD_1	Slope Dummies r^hD_2	Slope Dummies r^hDD	$\bar{R}^2$ D-W	C-O Rho
Original values	r^t	(i)	−1.747	.441			1.204	−.160			.99	.765
			(−6.371)	(1.682)			(19.611)	(−2.327)			2.48	(9.050)
		(ii)	−1.464	.472	−.672		1.100	−.132	.126		.99	.475
			(−5.834)	(1.982)	(−4.145)		(15.082)	(−2.276)	(2.505)		2.29	(4.111)
		(iii)	−1.195	.169	−1.480	.954	1.021	−.056	.306	−.193	.99	.599
			(−3.120)	(.450)	(−2.558)	(1.607)	(7.682)	(−.402)	(1.946)	(−1.173)	2.47	(5.701)
							Δr^h	Δr^hD_1	Δr^hD_2	Δr^hDD		
First Differences	Δr^t	(iv)	.039	−.038			1.205	−.142			.96	−.394
			(.752)	(−.655)			(17.257)	(−1.829)			2.11	(−3.234)
		(v)	.008	−.021	.021		1.037	−.145	.187		.96	−.430
			(.124)	(−.353)	(.441)		(8.805)	(−1.906)	(1.679)		2.14	(−3.599)
		(vi)	−.059	.047	.096	−.077	.900	.016	.334	−.172	.96	−.439
			(−.389)	(.305)	(.566)	(−.437)	(3.138)	(.048)	(1.094)	(−.491)	2.10	(−3.686)

Note: Variables are expressed in percentage points. Numbers in parentheses are t-values.

perhaps as a result of the simplicity of the underlying model and the use of annual data. This estimated coefficient, rather than unity, is used as a benchmark for assessing the effect of the Banking Act upon the overall payment of interest. This effect is ascertained by examination of the estimated coefficient of r^hD_1 in the same regression. With a value of −.160, which is significant at the .05 level, this coefficient indicates that the cost of soliciting deposits has been 13 percent lower since 1933 than it would have been in the absence of the body of regulations produced by the Act.

Regressions (ii) and (iii) are designed to detect the effect of the interest ceiling, as opposed to the entire regulatory package, upon the decline of q. This is done in an indirect manner based on the following argument. To the extent that the ceiling has contributed to the decline of q, that decline is likely to be greater in years typified by a more binding interest constraint. Gauging the "tightness" of the constraint by the difference $r^h - r^c$, a dummy variable D_2 is set at zero for years in which the difference is beneath the median difference, and at one for years in which it is above the median difference. Regression (iii) additionally contains the interaction dummy DD and is interpreted in the following way. The coefficient of r^h and the summed coefficients of r^h and r^hD_2 give the pre-control q under loose and tight interest constraints, respectively. Similarly, the summed coefficients of r^h and r^hD_1 give the post-control q under loose interest constraint, while the summed coefficients of r^h, r^hD_1, r^hD_2, and r^hDD give the post-control q under tight interest constraint.

The contribution of the ceiling to the decline in q is confirmed by the greater decline observed in post-control years characterized by a tight interest constraint, as indicated by the significant coefficient of r^hDD valued at −.193.[27] Although this result is tentative from a statistical viewpoint due to strong collinearity among the slope variables (suggested by similarity of the sum of their coefficients in the three regressions), it is supported by the evidence of disintermediation and other market phenomena indicating a decline in the fraction of interest received during periods of high interest rates since the late 1960's (e.g., *Bulletin,* September 1978).

Equations (iv), (v), and (vi) are estimated

[27]This coefficient represents the difference between the post-regulation decline of q in years of tight (−.249) and loose (−.056) interest constraints.

utilizing variables in first-differences form as in equation (9). These regressions show a pattern of results similar to that of the first set of regressions. The pre-control q indicated by regression (iv) is 1.205 which is virtually identical to that given by regression (i). Similarly, the post-control change in q is −.142, a 12 percent decrease as compared with the 13 percent decrease indicated by regression (i).

B. Specific Payment Methods

Test results based on equation (9) pertaining to specific payment methods are reported in Table 2. The first-differences form is selected to avoid inconsistencies in the data, produced by official changes in the definition of a number of variables. Interpretation of the results assumes an additive relationship among rates of interest paid via various methods, including those tested for here. This assumption is reflected in the use of disjoint components of the operating earnings figure in calculating the three dependent variables. Representing only three out of an unknown number of potential methods, slope coefficients estimated for these methods may not sum to the total value of q estimated for the overall interest payment.

Cash interest. The coefficient of r^h in regression (i), showing the contribution of cash interest to the overall pre-regulation interest payment, is positive and significant at the .05 level. Its value of .179 represents only 15 percent of the overall q estimated by regressions (i) and (iv) in Table 1. This surprisingly low figure suggests that the limited effect of a cash interest ceiling on the total interest paid, as reflected in Table 1, could have been predicted as early as 1933. The effect of the Banking Act on this form of payment is given by the coefficient of Δr^hD_1 which is negative but insignificant. Its insignificance is consistent with an interest ceiling that is insensitive to fluctuations in market and reserve rates. Its value of −.065 implies a post-control coefficient of .144, representing only 11 percent of the overall q estimated for the same period. This represents a slight decrease as compared with the pre-control figure of 15 percent.

Remitted account charges. Data limitations do not allow testing for the use of this method in the pre-regulation era. Low and insignificant coefficients of Δr^h and Δr^hD_2 in regressions (ii) and (iii) support theoretical arguments (Section 2) suggesting that remittance of account charges is an uneconomical way of paying interest on deposits.

Preferential credit terms. The coefficients of Δr^h and Δr^hD_1 in regression (iv) are highly significant and have the expected signs. In view of results of regression (vi) in Table 1,

TABLE 2 Interest Payment Methods

Regression and Period	Dependent Variable	Equation Number	Constant Term	Intercept Dummies D_1	Intercept Dummies D_2	Intercept Dummies DD	Variable Δr^h	Slope Dummies Δr^hD_1	Slope Dummies Δr^hD_2	Slope Dummies Δr^hDD	$\bar{R}^2$ D-W	C-O Rho
Cash Interest	Δr^c	(i)	.011	.065			.179	−.065			.23	−.020
1919–77			(.144)	(.746)			(2.176)	(−.707)			1.93	(−.153)
Remitted	Δr^k_1	(ii)	−.002				−.001				.38	.609
Account			(−.551)				(−.580)				2.00	(5.033)
Charges		(iii)	−.000		−.003		.003		−.004		.40	.646
1933–77			(−.087)		(−.724)		(.748)		(−.936)		2.04	(5.552)
Preferential	Δr^k_2	(iv)	.120	−.211			.960	−.199			.92	.330
Credit			(1.163)	(−1.836)			(14.444)	(−2.646)			2.21	(2.635)
Terms		(v)	.199	−.242	−.097		1.099	−.190	−.153		.93	.317
1919–77			(1.713)	(−2.116)	(−1.180)		(8.749)	(−2.518)	(−1.349)		2.19	(2.527)
		(vi)	.127	−.187	−.089	.050	.726	.368	.247	−.599	.94	.363
			(.814)	(−1.112)	(−.530)	.263	(3.782)	(1.661)	(1.253)	(−2.634)	2.16	(2.942)

Note: Variables are expressed in percentage points. Numbers in parentheses are t-values.

these coefficients show that preferential credit terms have been the most important method of payment, contributing 80 percent of the interest paid prior to 1933 and 73 percent thereafter. The decline in the relative importance of this method is surprising in view of the regulators' focus on overt payment of interest. It may be attributable to the use of the prime rate convention to limit covert payment by tying preferential credit terms to the maintainance of compensating balances, a method widely used prior to the regulation. Regression (iv) provides evidence concerning the effect of this limitation on the extent of interest payment through this method.

The foregoing interpretation of the prime rate convention suggests that the combination of a deposit rate ceiling and a lending rate floor should limit interest payment through preferential credit terms more effectively during periods of high interest rates. In principle, the prime rate could be set sufficiently low to accomodate rate concession to all customers, including those characterized by low non-preferential rates. Yet, consistent with the above interpretation, casual observation showing a stable rate differential between the prime and various market rates indicates that the *proportion* of allowable concession limited by the prime floor is inversely related to the level of those rates.

Based on this interpretation of the role played by the prime rate, results reported in regression (vi) offer a meaningful explanation for the results of regression (iv). For low-rate years, the post-control coefficient of interest paid through preferential credit terms (.726 + .368 = 1.094) is significantly higher than the pre-control coefficient (.726). For high-rate years, however, the post-control coefficient (.726 + .368 + .247 − .599 = .742) is lower than that of the pre-control period (.726 + .247 = .973). Thus, the selective impact of the Banking Act upon interest implicitly paid through preferential credit terms is apparent only in high-rate years. This result indicates two reasons for the apparently lower fraction of interest *received* during periods of higher interest rates: a lower fraction q of the total interest paid and a switch to less economical methods of payment.

6. Summary and Conclusions

The establishment of a deposit interest ceiling provided by the Banking Act was intended to increase commercial bank profits by decreasing the cost associated with competition for deposits. Although a number of studies in recent years have sought to assess effects of the ceiling on the value of interest received by depositors, no similar attempt has been made to determine its impact upon bank costs. Estimates offered by this study show that the Banking Act in general and the ceiling in particular have been quite ineffective in decreasing bank costs. This finding is explained by evidence that direct payment of interest, the subject of regulatory attention, has represented only a small fraction of depositors' overall compensation. Since according to this evidence indirect payment played a major role prior to enactment, it can be argued that the limited effectiveness of a ceiling excluding such payments was virtually assured. Notwithstanding long-term effects, there is some indication that the ceiling has been more effective during periods of high market interest rates.

Glossary

I loans and investments;
R reserves;
D deposit liabilities;
D^a deposit assets;
F Federal Reserve credit to member banks;
i pure pecuniary yield of a hypothetical non-liquid asset;
r average yield on loans and investments;
r^d average rate of interest paid on deposit liabilities;
r^{da} average rate of interest earned on deposit assets;
r^h hypothetical control-free competitive average rate of interest paid on deposits;
r^f preferred discount rate offered by the Fed to member banks;
r^c average rate of cash interest paid on deposits;
r^k average rate of implicit interest paid on deposits;
r^t average rate of total interest paid on deposits, where $r^t = r^c + r^k$;
q index of effective competition for bank deposits, where $q = r^t/r^h$;
r_1^k average rate of implicit interest paid on deposits through remittance of charges on checking accounts;
r_2^k average rate of implicit interest paid on deposits through preferential credit terms;
E operating earnings gross of cash interest payment on deposits;
E_1 service charges on deposit accounts;
E_2 interest earned on loans.

REFERENCES

Barro, Robert J., and Santomero, Anthony M. "Household Money Holdings and the Demand Deposit Rate," *Journal of Money, Credit and Banking,* 4 (May 1972), 397–413.

Baxter, Nevins D., and Shapiro, Harold T. "Compensating-Balance Requirements: The Results of a Survey," *Journal of Finance,* 19 (September 1964), 483–496.

Bell, Frederick W., and Murphy, Neil B. "Bank Service Charges and Costs" *National Banking Review,* 4 (June 1967), 449–457.

———. *Costs in Commercial Banking: A Quantitative Analysis of Bank Behavior and Its Relation to Bank Regulation,* Federal Reserve Bank of Boston, Research Report No. 41 (April 1968).

Benston, George J. "Interest Payments on Demand Deposits and Bank Investment Behavior," *Journal of Political Economy,* 72 (October 1964), 431–449.

Cagel, Caroline H. "Credit Lines and Minimum Balance Requirements," *Federal Reserve Bulletin,* 42 (June 1956), 573–579.

Cox, Albert M. *Regulation of Interest on Bank Deposits,* Michigan Business Studies, 17, No. 4, University of Michigan, Ann Arbor, Michigan, 1966.

David, Richard G., and Guttentag, Jack M. "Are Compensating Balance Requirements Irrational," *Journal of Finance,* 17 (March 1962), 121–126.

———. Balance Requirements and Deposit Competition," *Journal of Political Economy,* 71 (December 1963), 581–585.

Friedman, Milton "The Euro-Dollar Market: Some First Principles," *Morgan Guaranty Survey* (October 1969).

———. "Controls on Interest Rates Paid by Banks," *Journal of Money, Credit and Banking,* 2 (February 1970), 15–32.

———, and Schwartz, Anna J. *A Monetary History of the United States, 1867–1960,* Princeton University Press, Princeton, N.J., 1963.

———. *Monetary Statistics,* Princeton University Press, Princeton, N.J., 1970.

Gibson, William E. "Compensating Balance Requirements," *National Banking Review,* 2 (March 1965), 387–395.

Hazleton, Jared "Bank Service Charges in New England," *New England Business Review,* (May 1968), 1–6.

Hodgman, Donald R. "The Deposit Relationship and Commercial Bank Investment Behavior," *Review of Economics and Statistics,* 63 (Autust 1961), 257–268.

Klein, Benjamin "The Payment of Interest on Commercial Bank Deposits and the Price of Money: A Study of the Demand for Money." Unpublished Ph.D. Dissertation, University of Chicago, 1970.

———. "Income Velocity, Interest Rates and the Money Supply Multiplier: Reinforcement of the Long-term Evidence," *Journal of Money, Credit and Banking,* 5 (May 1973), 656–668.

———. "Competitive Interest Payments on Bank Deposits and the Long-Run Demand for

Money," *American Economic Review,* 64 (December 1974) 931–949.

Linke, Charles, M. "The Evolution of Interest Rate Regulation on Commercial Bank Deposits in the United States," *National Banking Review,* (June 1966), 449–469.

Mayer, Thomas, and Scott, Ira O., Jr. "Compensatory Balances: A Suggested Interpretation," *National Banking Review,* 1 (December 1963), 157–166.

Pugh, Olin S., and Wood, Oliver G., Jr. "Bank Service Charges in the South," *National Banking Review,* 4 (December 1966), 175–181.

Startz, Richard "Implicit Interest on Demand Deposits," *Journal of Monetary Economics,* 5 (October 1979), 515–534.

Tobin, James "Deposit Interest Ceilings as a Monetary Control," *Journal of Money, Credit and Banking,* 2 (February 1970), 4–14.

U.S. Board of Governors of the Federal Reserve System, *Banking and Monetary Statistics.* 1943.

____. *Federal Reserve Bulletin.*

____. *Functional Cost Analysis, 1969 Average Banks.* 1970.

____. *Performance Characteristics of High Earning Banks, Functional Cost Analysis 1968.* August 1969.

____. *Supplement to Banking and Monetary Statistics.* Section 2 (1967), Section 6 (1966), Section 10 (1962), Section 12 (1966).

U.S. Federal Reserve Bank of Boston, *Functional Cost Analysis Comparative Study,* New England Banks, 1958–1969.

Weiss, Steven, J. "Commercial Bank Price Competition: The Case of 'Free' Checking-Accounts," *New England Economic Review* (September–October 1969).

Yaari, Uzi "The Regulation of Interest Paid by Banks on Demand Deposits." Unpublished Ph.D. Dissertation, University of Chicago, 1972.