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On Regional Integration In Bank Commercial Lending

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ON REGIONAL INTEGRATION IN BANK COMMERCIAL LENDING

Abstract

This paper tests the hypothesis that average interest rates for ten categories of commercial loans (short-term and long-term loans in five size classes) in the regions of the United States behave as if they were generated in an integrated national market. The tests, derived from two models of commercial lending in an integrated market, indicate that all regions are highly integrated in short-term lending in all size classes. In long-term lending, five of the six regions appear to be highly integrated in four of the five size classes. The exceptional region is the Southeast, which seems not only to be poorly integrated with the other regions but also to be far less homogeneous. The exceptional loan-size class is 0 to $10,000.

ON REGIONAL INTEGRATION IN BANK COMMERCIAL LENDING

1. Introduction

An interesting hypothesis about American banking is that the industry operates in a single national market for commercial loans, so that, directly or indirectly, every bank competes with every other in making such loans. This hypothesis cannot be tested with the data now available. The only data bearing on it (described in section 2 below) are aggregated at the regional level, and they pertain only to the larger banks. We shall therefore test the hypothesis that these regional data behave as if they were generated in an integrated national market. The truth of this Integration Hypothesis is necessary but not sufficient for the truth of the stronger hypothesis we'd like to test.

Doubts about the Integration Hypothesis spring mainly from the legal restrictions on branching, which, together with the reluctance of many bankers to lend at a distance,[1] create the potential for geographically segregated markets. There are, however, at least four reasons for considering the hypothesis plausible. First, the bankers in every region encounter extra-regional competition for all classes of loan customers. In their lending to nationally known firms, the bankers must compete with the corporate bond and commercial paper markets; in their lending to large regional firms, they must compete with the loan-production offices and travelling loan officers of banks from other regions; and in their lending to small regional firms, they must compete with trade creditors, who lend to more small businesses than financial institutions do. Second, the practice of selling loans or shares of loans to other bankers tends to integrate the regions by directing the flow of funds toward regions where the demand for commercial loans is high. Third, bank portfolio substitution across categories of assets and across borrowers within the loan category tends to integrate commercial lending in all regions with the national asset markets, for commercial loans compete with debt securities priced in these makets. And fourth, the cost of funding loans (the marginal cost of funds) is essentially the same in all regions. It differs among banks, but only according to their balance sheets and not according to their locations as such, for it is established in the national markets for Federal Funds and negotiable certificates of deposit. All four of these considerations spring from the same source: the search for profitable opportunities. If the regions are not intregrated, many people are overlooking their opportunities.

Recent empirical research on the subject is inconclusive. It consists of one study that attempts to test the Integration Hypothesis and a large group of studies that, though not directed at the hypothesis as such, might be expected to bear on it by implication.

The studies in the large group are those that attempt to determine whether "local-market concentration" affects commercial lending (and other banking services). As the existence of such an effect would refute the Integration Hypothesis, these studies demand a brief summary evaluation. Taken at face value, they are unfavorable to the hypothesis, for the majority of them report a statistically significant (though numerically small) concentration effect.[2] But the proportion of studies reporting such an effect is not the same thing as the proportion of successful searches for it, for a given study typically undertakes several searches. The proportion of successful searches may be half or more in some particular studies, but for the aggregate of studies published in the 15 years to 1980 it is far less than one half.[3] In addition, the findings do not seem very reliable. Consider for instance a study by Paul Meyer (1967). Meyer regressed commercial-loan rates on concentration, loan size, maturity, and several other variables. He reported separate regression equations for four size classes of borrowers and two years (1955 and 1957)--eight regression equations in all. Four of these equations showed statistically significant concentration effects. However, three of these four were for 1955 and the fourth was for 1957 and a different borrower-size class: three classes of borrowers were "affected" by concentration in 1955 but not in 1957 and a fourth class was affected in 1957 but not in 1955. This is not a very reliable effect.[4]

As a group, the concentration studies suffer from too many methodological shortcomings to inspire much confidence in their findings. Their proffered definitions of concentration and "local markets" seem arbitrary and show only the loosest connection to an economic theory of behavior.[5] Moreover, though the studies offer a theoretical rationale of sorts for the variables employed in their regression equations, they offer no rationale at all for the forms of the equations or for the assumed properties of the error terms. In short, while their generally unsuccessful search for concentration effects is consistent with the Integration Hypothesis, the evidence is not very strong.

The one recent study of the Integration Hypothesis *per se* (Keleher, 1979) took its basic theoretical framework from the theory of economic integration. This theory, though developed mainly in the context of international trade and lending, clearly provides the right framework and suggests the general character of the data and tests to be used.[6] Keleher's results, though somewhat mixed, were generally favorable to the Integration Hypothesis according to the criteria employed. Again, however, the results are difficult to interpret because the regression equations were not explicitly derived from a theory of commercial lending in integrated markets. The variables of the equations were so derived, but the form of the equations and the assumed properties of the error terms are arbitrary.

2. Data and Method of Analysis

The only useful data for testing the Integration Hypothesis come from a Federal Reserve survey conducted quarterly during the years 1967-1976. (Regional interest-rate data are available for years before 1967 and after 1976, but only in a more aggregated form with respect to maturity and size of loan.) The survey covered 126 banks in 35 reporting centers allocated to six regions (New York City, Other Northeast, North Central, Southeast, Southwest, and West Coast). For each region, average interest rates were reported for commercial loans in three maturity classes and five size classes. One of the maturity classes was "revolving credit," which we shall not analyze. The two maturity classes that we shall analyze are "short term" (up to one year) and "long term" (over one year). The five size classes are:

Class 1: $1000 - $9000

Class 2: $10,000 - $99,000

Class 3: $100,000 - $499,000

Class 4: $500,000 - $999,000

Class 5: $1,000,000 or more

Thus the survey yielded 40 average interest rates in each of ten maturity-size categories in each of six regions.[7] More recent data (if available in suitably disaggregated form) would, of course, be more relevant to the inquiry, for integration is very likely to be increasing as the barriers to nationwide expansion fall.

The survey data pertain to loans made during the first half of the middle month in each quarter. In addition to the survey data we shall use two series of "risk-free" rates: the 3-month Treasury bill rate and the 3-year constant-maturity yield on Treasury securities, both referred to the middle month of each quarter. These rates may also be interpreted as the opportunity cost of funds.

The survey data are not controlled for non-interest terms of lending (such as compensating-balance arrangements or collateral requirements) and thus permit no discrimination between these and other possible sources of interregional differences in the rates.[8] Conceptually, we can divide all sources of interregional differences into two groups: (1) those that may exist within a region, such as interbank differences in risk, non-interest terms, and the distribution of loans within each maturity-size category, and (2) those that exist only because the regions are poorly integrated. We assume that sources of the first kind vary randomly over the sample period and that sources of the second kind do not exist, thus testing the Integration Hypothesis in its null form.

On the Integration Hypothesis, then, movements of the average rate in a specified maturity-size class should be the same in all regions. Clearly, if each region is integrated with a specified region then all regions are integrated with each other. Here we take New York as the specified region. We test the Integration Hypothesis by regressing the data for region k on the data for New York, where region k is each of the other five regions in turn.

The regression equation that connects the data for region k and New York must be derived from a model of commercial lending in integrated markets. Two such models are offered below. One (the Rate Model) produces a regression equation in the observed interest rates; the other (the Premium Model) produces a regression equation in the implied risk premiums. As neither model is rejected by the data, both are used to test the Integration Hypothesis.

3. The Rate Model

The Rate Model is a simple optimization model of bank lending. A given bank in region k at time t makes n_{kt} types of loans within a given maturity and size class. (The loan types differ with respect to borrower characteristics and such non-interest terms as collateral and compensating balances.) Profit is assumed to be separable with respect to maturity and size class. For each of the ten maturity-size categories the profit, π_{kt}, at time t is

$$\pi_{kt} = \sum_j r_{ktj} L_{ktj} - r_t \sum_j L_{ktj} - \phi_{kt}(L_{kt}),$$

where the summation is over j from 1 to n_{kt} and

r_{ktj} = contract lending rate

L_{ktj} = amount loaned

r_t = cost of funds (exogenous to the bank)

L_{kt} = $(L_{kt1}, \ldots, L_{ktn_{kt}})$

$\phi_{kt}(L_{kt})$ = sum of operating costs and bad-debt provisions.

The first-order optimality condition for loans of type j is

(1) $$\partial\pi_{kt}/\partial L_{ktj} = r_{ktj} + L_{ktj}\partial r_{ktj}/\partial L_{ktj} - r_t - \partial\phi_{kt}(L_{kt})/\partial L_{ktj} = 0.$$

Define e_{tj} as the elasticity of demand for type j loans:

(2) $$e_{tj} = \frac{\partial L_{ktj}}{\partial r_{ktj}} \cdot \frac{r_{ktj}}{L_{ktj}},$$

from which the regional subscript, k, is omitted on the implication of the Integration Hypothesis that the elasticity of demand for a given type of loan is the same in every region. Also define variables f_{tj} and y_{ktj},

(3) $$f_{tj} = e_{tj}/(1 + e_{tj})$$

$$y_{ktj} = f_{tj}\,\partial\phi_{kt}(L_{kt})/\partial L_{ktj},$$

so that (1) can be expressed in the equivalent form,

(4) $$r_{ktj} = f_{tj}r_t + y_{ktj}, \quad j=1,\ldots,n_{kt}.$$

These optimality conditions cannot be expected to hold exactly because of the banker's imperfect knowledge of f_{tj} and y_{ktj}, but they should fail only by a deviation u_{ktj} that would eventually reach zero if market conditions were stable. Inserting u_{ktj} into eqs. (4), multiplying each equation by L_{ktj}, adding the resulting equations over the n_{kt} loan types, and dividing the sum by the total value of loans, we obtain

$$(5) \qquad r_{kt} = f_{kt}r_t + y_{kt} + u_{kt},$$

where r_{kt}, f_{kt}, y_{kt}, and u_{kt} are the value-weighted averages of r_{ktj}, f_{tj}, y_{ktj}, and u_{ktj}, respectively, in a given bank in region k. This model is stable only if $f_{kt}>0$, which we henceforth assume.

Equation (5) holds within each maturity-size category for a given bank in region k. If it is averaged over all the banks in that region the same form will result, so let us simply reinterpret the variables accordingly. As reinterpreted, eq. (5) expresses the average contract rate r_{kt} in region k at time t in terms of the marginal cost of funds r_t, which is common to all regions, and the variables f_{kt}, y_{kt}, and u_{kt} that take values specific to region k. (The value of f_{kt} is specific to the region in spite of our assumption that the elasticity of demand for a given type of loan is the same for all regions because this variable depends on the distribution of loan types, which can differ between regions.)

When applied to regions 1 and 2, eq. (5) implies

$$(6) \qquad r_{1t} = [y_{1t} - y_{2t}f_{1t}/f_{2t} + u_{1t} - u_{2t}f_{1t}/f_{2t}] + r_{2t}f_{1t}/f_{2t}.$$

Assuming that f_{1t}/f_{2t} has a value λ that is independent of time, eq. (6) has the form of a linear regression equation

(7) $r_{1t} = \alpha + \lambda r_{2t} + \epsilon_t$,

where α is the sample-period average value of the bracketed term in (6) and the error term ϵ_t is the time-t deviation of the bracketed term from α. We omit the regional subscripts from α, λ, and ϵ_t because we henceforth confine our attention to regions 1 and 2, as explained below.

The error term ϵ_t moves inversely to y_{2t} and u_{2t}, which are positively correlated with the independent variable r_{2t} (see eq. (5)). Hence the error term is negatively correlated with the independent variable. The ordinary least squares estimate of λ is therefore biassed downward and the calculated R^2 (which is proportional to λ^2) will be below its "true" value.[9] These biases, which are unfavorable to the Integration Hypothesis, are discussed below.

The correlation between independent variable and error term transmits to the error term any autocorrelation that is present in the independent variable. As the independent variable is very strongly autocorrelated over the sample period, we expect the error term to be autocorrelated too. This autocorrelation does not, therefore, necessarily indicate a defect in the model or in the Integration Hypothesis, although such a defect cannot, of course, be ruled out a priori.

It is clear from eq. (5) that f_{kt} is positive, whence λ in the regression equation (R) is also positive. No further properties of λ, and none of α, can be derived from the model. The value of λ depends on the types of loans made in regions 1 and 2; that of α depends on these types and on the operating costs in the regions. Our data provide no information about these matters.

In testing the Integration Hypothesis we take New York City as region 2 and each of the other regions, in turn, as region 1. Since there are five "region 1s" and five loan-size classes, there are twenty-five regressions for each of the two maturity classes. In each regression the estimate of λ should exceed 0 statistically. The adjusted R^2 ($\overline{R}^2$) should be high in all regressions but it should not be as high in the long-term regressions as in the short. This is because of the tendency of bankers to borrow short. This tendency creates more uncertainty about the costs of funding long-term loans, thus leaving room for greater differences of opinion about optimal long-term lending rates. Such differences produce larger error terms. Therefore, if the model is correct, the long-term regressions should have smaller $\overline{R}^2$s.

Table 1 gives the details of the twenty-five regressions in short-term rates. As all but four of these regressions had unacceptedly low Durbin-Watson statistics when estimated by ordinary least squares, they were reestimated by the Cochrane-Orcott method. All the tabulated details refer to the re-estimated equations. The column headed "Rho" contains the Cochrane-Orcutt estimates of the first-order autocorrelation coefficients. As the table shows, every $\overline{R}^2 > .98$ and every estimated λ is significantly greater than 0. Judging by the significance of λ and the fit of the equations, we cannot reject the joint hypothesis that the Rate Model is true and the regions are integrated in short-term lending.

Table 2 shows the twenty-five regressions in the long-term rates. Here again the Cochrane-Orcutt estimates are reported for the equations that suffered from significant first-order autocorrelation (these are the nine equations for which an estimate of rho is reported). The estimates of λ shown in Table 2, like those shown in Table 1, statistically exceed 0 at the five percent level. The $\overline{R}^2$s, though large enough by most standards, are noticeably lower than those of Table 1. As explained above, this difference in $\overline{R}^2$s is consistent with the Integration Hypothesis and the Rate Model; indeed, it is required by the model.

The model does not explain the considerably lower $\overline{R}^2$s of the Southeast and Class 1 regressions in Table 2. One way to evaluate these interregional, intraclass regressions is to compare them with intraregional, interclass regressions of the same form. Let us reinterpret eq. (7) by defining r_{2t} as the contract rate for loans in size-class 2 and r_{1t} as the contract rate for loans in a different size class but in the same region. The indicated regressions should not be better than those of Table 2 if the Integration Hypothesis is true. Clearly, only the long-term regressions need to be evaluated in this manner.

Table 3 reports the intraregional regressions. Examining first the Southeast regressions, note their low $\overline{R}^2$s as compared with those of other regions. This region is far less homogeneous than any of the others.[10] Even so, no Southeast $\overline{R}^2$ in Table 3 differs significantly at the 5-percent level from its counterpart in Table 2. We cannot reject the hypothesis that southeastern Class i (i=1,3,4,5) rates move as closely with New York Class i rates as they do with southeastern Class 2 rates. This, of course, is cold comfort in view of the heterogeneity of the Southeast.

Turning next to the Class 1 regressions of Table 3, we note that the Other Northeast, North Central, Southeast, and Southwest $\overline{R}^2$s show no tendency to be lower in the Class 1 regressions than in the regressions for Classes 3, 4, and 5. Moreover the $\overline{R}^2$s are higher than their counterparts of Table 2. The Class 1 rate in each of these regions moves more closely with the Class 2 rate there than with the Class 1 rate in New York. The problem, however, seems to lie mainly with the New York Class 1 rate, which, as shown in Table 3, doesn't move with New York Class 2 rates as closely as the other New York rates do. In other words, the relatively low Class 1 $\overline{R}^2$s in Table 2 appear to result, in part, from some peculiarity in the New York Class 1 rates as reflected in Table 3. (Table 3 indicates a similar peculiarity in the West Coast Class 1 rates.) Finally, in all regions but the Southeast and all Classes except 1, a comparison of the corresponding $\overline{R}^2$s of Tables 2 and 3 reveals no pattern. Of the twelve pairs of corresponding $\overline{R}^2$s, seven are higher in Table 3, three are lower, and two are equal. In no case do the members of a pair differ significantly at the 5-percent level.

In summary, the long-term rates display two anomalies: (1) the Southeast does not seem well integrated with the rest of the country, possibly because it is not itself a well-integrated region, and (2) rates on the smallest loans in the other regions do not seem to move very closely with those in New York and the West Coast, possibly because of peculiarities in the small loans of these regions. The short-term rates display no anomalies. As far as the Rate Model goes, therefore, we cannot reject the Integration Hypothesis in relation to short-term loans of any size in any region; and while we cannot reject the hypothesis in relation to long-term loans we find it somewhat doubtful when referred to the Southeast or to the smallest loans.

4. The Premium Model

Commercial loans by banks are substitutes for equity and marketable debt as sources of funds for borrowers. As uses of funds by banks, these loans are substitutes for securities that are themselves substitutes for corporate instruments in the financial markets. Hence commercial loans must be priced in a manner that does not depart too far from the pricing relations governing tradable instruments. We shall consider two such relations, namely those deriving from the Capital Asset Pricing Model (CAPM) and the Proportionality Model of Tradable Debt (PMTD).[11]

CAPM. Suppose the expected return, E_{ikt}, on the i^{th} loan in region k at time t is governed by

$$(8) \qquad E_{ikt} - R_t = \beta_{ikt}(E_{mt} - R_t) + u_{ikt},$$

where R_t is a risk-free rate, E_{mt} is the expected return on the market portfolio, β_{ikt} is the beta of the loan (i.e., its systematic risk relative to that of the market), and u_{ikt} is a random variable averaging zero in the long run. The random variable is in this equation because bank loans have only the bilateral negotiations of banker and borrower to keep them in line with tradable instruments, and though these negotiations are successful in the long run if the Integration Hypothesis is true (and credit conditions are stable), they lack the period-to-period accuracy possessed by trading in open markets.

If eq. (8) is averaged over all the loans in the region, the result has the same form as (8) except that subscript i is omitted in order to show that E_{kt}, β_{kt}, and u_{kt} are regional averages. The regional average expected return, E_{kt}, is not observable but is related to the observed average contract rate, r_{kt}, by

$$(9) \qquad r_{kt} = E_{kt} + d_{kt},$$

where d_{kt} is the average deviation of the contract rate from the expected return and is very likely to be positive. Defining the premiums, p_{kt} and p_t, by

$$(10) \qquad p_{kt} = r_{kt} - R_t, \qquad p_t = E_{mt} - R_t,$$

we obtain from (8) the relation

$$(11) \qquad p_{kt} = \beta_{kt} p_t + d_{kt} + u_{kt}.$$

With v_t defined as

$$(12) \qquad v_t = d_{1t} - d_{2t}\beta_{1t}/\beta_{2t} + u_{1t} - u_{2t}\beta_{1t}/\beta_{2t},$$

eq. (11) implies

$$(13) \qquad p_{1t} = v_t + p_{2t}\,\beta_{1t}/\beta_{2t}.$$

Assume that β_{1t}/β_{2t} has a constant value β over the sample period, define α as the average value of v_t over the sample period, and define δ_t as $v_t - \alpha$. We then have the linear regression equation (14),

$$(14) \qquad p_{1t} = \alpha + \beta p_{2t} + \delta_t.$$

The error term, δ_t, is inversely related to $d_{2t} + u_{2t}$, which is positively correlated with p_{2t} (see eqs. (11) and (12)). Hence the error term and independent variable are negatively correlated and the ordinary least squares estimate of β is biassed downward. This bias lowers the R^2 of the regression equation (which is proportional to β^2) and is, therefore, unfavorable to the Integration Hypothesis as we test it.

The assumption that β_{1t}/β_{2t} is constant over the sample period is, of course, weaker than the assumption, so often invoked in tests of the CAPM, that the individual betas are stationary. (See Cheng and Grauer (1980) for a discussion.)

PMTD. The Proportionality Model of Tradable Debt derives from the assumption that D_{kt}, the market value of borrower k's debt at time t, is proportional to the value, D_t, of risk-free debt that promises the same stream of payments. The proportionality is expressed as

(15) $$D_{kt} = H(x_{kt})D_t,$$

where x_{kt} is a vector of characteristics of borrower k, not including the maturity of the debt, and $H(x_{kt}) < 1$. (In this discussion maturity is held constant.) Assuming continuous compounding,

(16) $$D_t = F_{kt}\, e^{-R_{kt}T_{kt}}$$

where

T_{kt} = maturity of borrower k's debt

F_{kt} = face value of borrower k's debt

R_{kt} = yield on riskless debt of maturity T_{kt}.

With r_{kt} denoting the promised yield on borrower k's debt, we have

(17) $$r_{kt} = \ln(F_{kt}/D_{kt})/T_{kt}.$$

Equations (15) - (17) imply

(18) $$r_{kt} - R_{kt} = h_{kt}/T_{kt},$$

where

$$h_{kt} = -\ln H(x_{kt}) > 0.$$

Choose a fixed maturity T (three months for the short-term regressions, three years for the long-term) and put

$$a_{kt} = T_{kt}/T \quad > 0$$

$$w_{kt} = h_{kt}/a_{kt} > 0,$$

so that (18) becomes

(19) $$r_{kt} - R_{kt} = w_{kt}/T.$$

Now let us reinterpret (19) so that r_{kt} is the average promised yield (contract interest rate) in region k and R_{kt} is the risk-free rate on loans with maturity equal to the average maturity of the loans in region k. Letting R_t be the yield on three-period Treasury instruments (three-month bills for the short-term regressions and three-year bonds for the long-term regressions), and introducing the variable c_{kt} to account for differences in the region-k average maturities from three periods, we can write

$$R_{kt} = R_t + c_{kt}.$$

Hence, by substitution in (19) and the definition of p_{kt} in (10),

$$(20) \qquad r_{kt} - R_t = p_{kt} = w_{kt}/T + c_{kt}.$$

Solving this equation simultaneously with k=1 and k=2, we obtain

$$(21) \qquad p_{1t} = [c_{1t} - c_{2t}w_{1t}/w_{2t}] + p_{2t}w_{1t}/w_{2t}.$$

With the average value over time of the bracketed term identified as α, the time-t deviation from that average as δ_t, and the (assumed) time-invariant value of w_{1t}/w_{2t} as β, (21) has the form of eq. (14).

From eqs. (20) and (21) it is clear that the error term is again negatively correlated with the independent variable. Thus whether we derive eq. (14) from the CAPM or the PMTD, we expect the ordinary least squares estimate of β to be biassed downward and the calculated $\overline{R}^2$ to be lower than it would be if the estimate of β were unbiassed. We also expect the long-term regressions to have somewhat lower $\overline{R}^2$s, on the same reasoning that was offered in connection with the Rate Model.

Table 4 reports the regression analysis of eq. (14) for short-term premiums (New York City is region 2). All but three of the regressions had unacceptedly low Durbin-Watson statistics when estimated by ordinary least squares and were reestimated by the Cochrane-Orcutt method.[12] The $\overline{R}^2$s have been adjusted for the degree of freedom lost in estimating rho. As shown in the table, the $\overline{R}^2$s are very high, though not quite so high as for eq. (7), and all the estimated βs are significantly greater than zero. These results provide no grounds for rejecting the Integration Hypothesis and the Premium Model.

Table 5 shows the regression results for long-term premiums. The comparison with Table 4 is substantially the same as that of Table 2 with Table 1: the $\overline{R}^2$s of the long-term regressions are lower than those of the short-term regressions, and the difference is especially pronounced in size-class 1 and in the Southeast. Again, however, when we compare these interregional regressions with intraregional regressions of the same form (which are reported in Table 6, where the independent variable refers to size-class 2), we find no differences worth talking about that have not already been discussed in connection with the Rate Model.

5. Additional Tests

Equation (14), which was obtained above from the Premium Model, may also be obtained from the Rate Model. Returning to section 3, subtract r_t from both sides of (5) and put

$$p_{kt} = r_{kt} - r_t,$$

so that

$$p_{kt} = (f_{kt} - 1)r_t + y_{kt} + u_{kt}.$$

(Here we have $f_{kt}-1>0$, which follows from our assumption that $f_{kt}>0$ and the negativity of the elasticity of demand.) This equation implies

$$(22) \quad p_{1t} = [y_{1t} - y_{2t}(f_{1t}-1)/(f_{2t}-1) + u_{1t} - u_{2t}(f_{1t}-1)/(f_{2t}-1)] + p_{2t}(f_{1t}-1)/(f_{2t}-1).$$

Assume that $(f_{1t}-1)/(f_{2t}-1)$ has a constant value β, define the time-average value of the bracketed term of eq. (22) as α, and let the time-t deviation of the bracketed term from its average be δ_t, and we obtain eq. (14). Under this new interpretation of the coefficients of eq. (14), we may subject the Integration Hypothesis to three further tests A, B, and C.

(A). Since both f_{kt} and $f_{kt}-1$ are positive, a comparison of eqs. (6) and (22) shows that the λ in eq. (7) should be related to the β in eq. (14) as follows:

$$\lambda = 1 \quad \text{iff} \quad \beta = 1$$
$$\lambda < 1 \quad \text{iff} \quad \beta < \lambda$$
$$\lambda > 1 \quad \text{iff} \quad \beta > \lambda.$$

As Tables 2 and 5 show, these relations hold for 22 of the 25 long-term regressions.[13] The three regressions for which the relations fail are (i) the Other Northeast Class 1, where λ = .333 but β = .539, (ii) the Southeast Class 2, where λ = .817 but β (= .815) does not differ significantly from 1, and (iii) the Southwest Class 1, where λ = .009 but β = .160. The exceptions are thus confined to Class 1 or the Southeast.

(B). When β does not differ significantly from 1, the constant term α derived from eq. (22) should not differ significantly from that (α) derived from eq. (6). In Table 5, there are six regressions in which β does not differ significantly from 1. In every one of these six regressions, γ does not differ statistically from the value of α in the corresponding regression shown in Table 2.

(C) The error terms δ_t and ϵ_t are related as follows:

$$\delta_t - \epsilon_t = (\lambda - \beta)(u_{2t} + y_{2t} - u_2 - y_2).$$

On the whole, the estimate of λ exceeds that of β, so $(\lambda - \beta)$ magnifies the time-t deviations of u_{2t} and y_{2t} from their means u_2 and y_2. This causes the absolute value of δ_t to exceed that of ϵ_t and implies that the $\overline{R}^2$ for eq. (14) should be less than that for eq. (7). This is exactly what we have found, and it explains why eq. (7) fits the data better.

6. Concluding Comments

1. Under the interpretation of eq. (14) proposed in the preceding section, the variables p_{kt} are not premiums over the risk-free rate but are interest margins (lending rates minus the opportunity cost of funds). The regression analysis of eq. (14) shows that these margins behave as if they were the risk premiums determined by the CAPM or PMTD -- i.e., as if they were generated by trading in open markets.

2. As noted above, the least-squares estimates of λ and β are biassed downward because of the negative covariance between the independent variable and the error term. However, when the error term is small the bias should also be small. Small error terms mean high $\overline{R}^2$s, as in the short-term regressions, so, with some risk, we can try to interpret the meaning of the short-term estimates on the assumption that their biases are small. Focusing on β, which, as explained above, has a more interesting interpretation than λ, we see from Table 4 that the estimates differ but little from 1. (Only 8 of the 25 values differ significantly from 1 at the five percent level; of these, only three differ by more than 10%, and they are all for Class-1 regressions.) A β of 1 means that regions 1 and 2 face the same average elasticity of demand for loans (on the most recent interpretation of eq. (14)) or that they deal in loans of the same average

riskiness (on the Section 4 interpretation of eq. (14). Equal elasticities or risk clearly do not justify rejection of the Integration Hypothesis.

3. In order to test the assertion that the long-term regressions contain more ordinary-least-squares bias, we re-estimated eq. (14) for long-term rates by the instrumental-variable method. Our instrumental variable was taken to be the average long-term rate for all the regions (in a given size class) minus the risk-free rate. There is, of course, no guarantee that this variable is correlated with the independent variable but not with the error term. For what they are worth, the results of the instrumental-variable regressions for the Other Northeast and Southwest regions are shown in Table 7.[14] Apart from the estimates for Class 1, which are still anomalous, these $\overline{R}^2$s and βs exceed their counterparts shown in Table 5. Most of them reach the neighborhood of the short-term estimates shown in Table 4, thus providing further support for the Integration Hypothesis.

4. The regions appear to be well integrated in short-term lending. While the regions are generally well integrated in long-term lending there appear to be two anomalies: (1) The Southeast is not very well integrated with the other regions and indeed appears not to be very homogeneous. (2) All regions are poorly integrated in long-term lending of small loans (under $10,000). These anomalies remain as a challenge to further research.

Table 1. Estimates of Equation (7) for Short-Term Rates
(Standard Errors in Parentheses)

Region	Size Class	Estimates α		λ		Rho	DW	$\bar{R}^2$
Other Northeast	1	.984	(.464)	.941	(.051)	.796	2.34	.99
	2	.528	(.134)	.990	(.016)	.441	2.00	.996
	3	.524	(.106)	.993	(.013)	.350	2.07	.997
	4	.216	(.083)	1.04	(.011)	-	1.72	.996
	5	.147	(.173)	1.03	(.022)	.521	1.82	.99
North Central	1	1.53	(.287)	.796	(.033)	.633	2.04	.98
	2	.738	(.126)	.913	(.015)	.403	1.97	.996
	3	.680	(.149)	.937	(.019)	-	1.77	.98
	4	.304	(.101)	.986	(.013)	.243	1.94	.996
	5	.233	(.087)	.990	(.011)	-	1.62	.99
Southeast	1	4.17	(.558)	.580	(.040)	.946	2.20	.99
	2	3.16	(.362)	.667	(.028)	.933	2.17	.99
	3	2.36	(.320)	.721	(.032)	.870	1.97	.99
	4	1.07	(.323)	.871	(.040)	.710	2.13	.98
	5	.283	(.272)	.978	(.035)	.533	2.13	.98
Southwest	1	2.80	(.414)	.669	(.046)	.778	1.80	.98
	2	1.09	(.168)	.859	(.020)	.373	1.87	.99
	3	.914	(.137)	.888	(.017)	.384	1.70	.99
	4	.754	(.142)	.922	(.018)	.302	2.06	.99
	5	.508	(.110)	.956	(.015)	-	1.66	.99
West Coast	1	1.46	(.176)	.833	(.021)	.204	1.98	.99
	2	1.43	(.131)	.863	(.016)	.390	1.98	.99
	3	1.20	(.115)	.878	(.014)	.318	2.04	.99
	4	.533	(.139)	.961	(.018)	.404	2.15	.99
	5	.576	(.272)	.952	(.033)	.771	2.59	.99

Table 2. Estimates of Equation (7) for Long-Term Rates (Standard Errors in Parentheses)

Region	Size Class	Estimates α	λ	Rho	DW	$\bar{R}^2$
Other Northeast	1	6.62 (1.25)	.333 (.148)	.789	2.13	.77
	2	1.95 (.359)	.825 (.044)		1.69	.90
	3	1.25 (.331)	.872 (.041)		1.55	.92
	4	1.31 (.420)	.845 (.052)		2.30	.87
	5	1.11 (.385)	.877 (.048)		2.04	.90
North Central	1	2.21 (.671)	.797 (.088)		1.60	.69
	2	2.29 (.363)	.750 (.044)		1.62	.88
	3	1.19 (.335)	.869 (.045)		1.66	.92
	4	.893 (.379)	.906 (.047)		1.68	.90
	5	.681 (.450)	.934 (.042)	-.332	2.13	.88
Southeast	1	2.57 (1.15)	.739 (.152)	.427	2.14	.65
	2	1.78 (.640)	.817 (.078)		2.07	.74
	3	2.25 (1.01)	.780 (.122)	.340	2.14	.75
	4	2.88 (2.07)	.888 (.243)	.539	1.64	.56
	5	2.54 (.733)	.720 (.089)	-.329	2.07	.53
Southwest	1	9.12 (1.66)	.009 (.166)	.869	2.49	.78
	2	1.57 (.292)	.856 (.036)		1.85	.94
	3	1.34 (.327)	.854 (.040)		1.83	.92
	4	.891 (.315)	.917 (.039)	-.282	2.07	.90
	5	1.43 (.380)	.842 (.047)		2.13	.89
West Coast	1	2.86 (.814)	.756 (.107)		1.83	.58
	2	1.68 (.397)	.845 (.048)	.294	1.80	.94
	3	1.41 (.395)	.838 (.048)		2.27	.88
	4	.691 (.546)	.937 (.067)		2.19	.84
	5	1.84 (.388)	.766 (.048)		1.76	.87

Table 3. Intraregional Estimates of Equation (7) for Long-Term Rates, Where Size Class 2 is the Independent Variable (Standard Errors in Parentheses)

Region	Size Class	Estimates: α	λ	Rho	DW	$\bar{R}^2$
New York	1	1.88 (.484)	.709 (.060)		1.98	.80
	3	.189 (.313)	.973 (.038)		1.68	.94
	4	-.059 (.381)	.989 (.046)		2.12	.92
	5	-1.02 (.440)	1.10 (.054)		2.08	.92
Other Northeast	1	1.66 (.967)	.848 (.110)	.456	2.21	.84
	3	-.543 (.307)	1.02 (.035)		1.59	.96
	4	-.178 (.766)	.952 (.087)	.321	2.01	.87
	5	-1.48 (1.07)	1.10 (.121)	.418	1.88	.85
North Central	1	.843 (.445)	.896 (.053)		1.70	.88
	3	-.055 (.627)	.986 (.073)	.481	2.13	.94
	4	1.47 (.610)	1.14 (.073)		1.96	.86
	5	-2.96 (.692)	1.32 (.082)		1.66	.87
Southeast	1	1.75 (.690)	.768 (.081)		1.63	.69
	3	.632 (.730)	.938 (.086)		2.00	.75
	4	1.85 (1.87)	.770 (.205)	.591	1.69	.63
	5	2.00 (1.37)	.737 (.160)		2.43	.35
Southwest	1	1.46 (1.38)	.870 (.155)	.694	2.42	.87
	3	-.068 (.348)	.975 (.041)		1.84	.94
	4	-.799 (.649)	1.05 (.075)	.226	2.07	.89
	5	-1.78 (.928)	1.16 (.106)	.500	2.07	.89
West Coast	1	1.95 (.538)	.788 (.063)		2.22	.80
	3	.000 (.409)	.959 (.048)		2.08	.91
	4	-1.26 (.558)	1.11 (.065)		2.29	.88
	5	-.736 (.452)	1.01 (.053)		1.97	.90

Table 4. Estimates of Equation (14) for Short-Term Rates (Standard Errors in Parentheses)

Region	Size Class	Estimates α	β	Rho	DW	$\bar{R}^2$
Other Northeast	1	.068 (.138)	1.14 (.045)	.485	2.30	.97
	2	.342 (.063)	1.04 (.023)	.377	2.10	.99
	3	.509 (.054)	.983 (.022)	.316	2.01	.99
	4	.409 (.048)	1.05 (.023)	-	1.56	.98
	5	.229 (.078)	1.08 (.037)	.520	1.81	.98
North Central	1	-.213 (.239)	.994 (.053)	.823	1.94	.96
	2	.108 (.117)	.969 (.034)	.752	2.08	.98
	3	.398 (.086)	.901 (.037)	-	1.82	.94
	4	.234 (.053)	.980 (.025)	.249	1.94	.98
	5	.196 (.448)	.980 (.024)	-	1.62	.98
Southeast	1	.380 (.346)	.911 (.076)	.825	1.77	.94
	2	.384 (.328)	.902 (.072)	.847	1.57	.94
	3	.336 (.203)	.880 (.071)	.682	1.74	.92
	4	.143 (.164)	.970 (.066)	.633	1.93	.94
	5	.064 (.123)	1.03 (.058)	.500	2.08	.95
Southwest	1	.473 (.223)	.821 (.066)	.675	1.58	.92
	2	.182 (.151)	.899 (.051)	.595	1.73	.95
	3	.227 (.15)	.908 (.044)	.582	1.63	.96
	4	.333 (.099)	.908 (.044)	.492	2.07	.96
	5	.242 (.077)	.968 (.039)	.249	1.88	.96
West Coast	1	.754 (.152)	.893 (.047)	.622	2.15	.96
	2	.445 (.160)	.948 (.045)	.769	1.79	.97
	3	.406 (.132)	.927 (.047)	.681	2.02	.96
	4	.191 (.084)	1.02 (.036)	.545	2.17	.98
	5	.371 (.157)	.920 (.047)	.806	2.57	.97

Table 5. Estimates of Equation (14) for Long-Term Rates (Standard Errors in Parentheses)

Region	Size Class	Estimates α	β	Rho	DW	$\bar{R}^2$
Other Northeast	1	1.87 (.356)	.539 (.165)	.574	1.80	.50
	2	1.04 (.109)	.666 (.058)		1.83	.77
	3	.609 (.103)	.736 (.056)		1.65	.81
	4	.419 (.144)	.756 (.082)		2.28	.68
	5	.372 (.133)	.818 (.072)		2.03	.76
North Central	1	1.16 (.155)	.506 (.118)		1.76	.33
	2	.893 (.116)	.585 (.062)		1.81	.69
	3	.485 (.109)	.762 (.060)		1.81	.81
	4	.380 (.128)	.829 (.073)		1.77	.77
	5	.281 (.116)	.907 (.064)	-.331	2.15	.77
Southeast	1	.842 (.282)	.744 (.179)	.376	1.99	.39
	2	.586 (.231)	.815 (.124)		2.01	.52
	3	.715 (.334)	.836 (.168)	.364	2.07	.56
	4	.409 (.692)	.955 (.314)	.476	1.66	.43
	5	.822 (.249)	.605 (.133)	-.330	2.08	.30
Southwest	1	1.97 (.567)	.160 (.177)	.714	2.20	.50
	2	.808 (.090)	.733 (.048)		1.85	.85
	3	.488 (.115)	.778 (.063)		1.99	.80
	4	.414 (.108)	.862 (.063)	-.266	2.09	.76
	5	.502 (.130)	.761 (.071)		2.04	.74
West Coast	1	1.68 (.173)	.321 (.132)		1.88	.12
	2	.789 (.098)	.758 (.053)		1.46	.84
	3	.450 (.140)	.767 (.077)		2.34	.72
	4	.369 (.184)	.866 (.104)		2.18	.64
	5	.478 (.129)	.630 (.070)		1.77	.67

Table 6. Intraregional Estimates of Equation (14) for Long-Term Rates, Where Size Class 2 is the Independent Variable (Standard Errors in Parentheses)

Region	Size Class	Estimates				
		α	β	Rho	DW	$\overline{R}^2$
New York	1	.158 (.178)	.577 (.102)		1.72	.46
	3	.092 (.107)	.917 (.057)		1.61	.87
	4	.004 (.128)	.899 (.069)		2.05	.81
	5	-.263 (.159)	1.03 (.085)		1.92	.79
Other Northeast	1	.320 (.349)	1.01 (.151)	.387	2.16	.68
	3	-.316 (.136)	.984 (.062)		1.50	.87
	4	-.437 (.301)	.924 (.132)	.316	2.01	.69
	5	-.647 (.421)	.993 (.177)	.462	1.89	.66
North Central	1	.184 (.182)	.884 (.094)		1.75	.69
	3	-.061 (.215)	.269 (.090)	.565	2.19	.84
	4	-.386 (.255)	1.06 (.132)		1.74	.62
	5	-1.08 (.296)	1.43 (.154)		1.51	.69
Southeast	1	.419 (.225)	.661 (.102)		1.61	.51
	3	.439 (.238)	.816 (.108)		1.84	.59
	4	.223 (.647)	.824 (.193)	.545	1.71	.53
	5	.650 (.367)	.540 (.169)	-.255	1.92	.17
Southwest	1	.318 (.453)	.996 (.176)	.628	2.27	.75
	3	-.257 (.145)	.988 (.069)		1.85	.84
	4	-.377 (.215)	1.03 (.103)		1.51	.72
	5	-.581 (.322)	1.08 (.142)	.440	1.97	.74
West Coast	1	.915 (.209)	.602 (.098)		2.21	.48
	3	-.270 (.167)	.958 (.079)		2.10	.79
	4	-.565 (.230)	1.10 (.108)		2.18	.73
	5	-.514 (.183)	.937 (.086)		1.90	.75

Table 7. Instrumental Variable Estimates of Equation (14) for Long-Term Rates (Standard Errors in Parentheses)

Region	Size Class	Estimates α	β	d*	DW	$\bar{R}^2$
Other Northeast	1	-1.77 (.542)	3.39 (.333)	.77	1.82	.72
	2	.537 (.104)	.998 (.041)	1.78	1.85	.94
	3	.220 (.131)	.995 (.052)	1.67	1.61	.91
	4	.332 (.174)	.893 (.073)	2.01	2.01	.79
	5	.519 (.141)	.826 (.059)	2.11	1.99	.83
Southwest	1	-2.30 (.776)	3.63 (.502)	1.07	1.91	.57
	2	.437 (.132)	.988 (.052)	1.89	1.93	.90
	3	.362 (.095)	.924 (.038)	2.43	1.70	.94
	4	.314 (.180)	.966 (.075)	2.01	2.00	.81
	5	.728 (.156)	.756 (.065)	2.17	2.01	.78

*d = 2(rho-1)

FOOTNOTES

1. The great majority of banks (smaller banks) do not normally lend to businesses located outside their "normal trading area," possibly believing that a loan application from outside this area manifests moral hazard: the applicant must be too risky for the banks whose trading areas include him.

2. See Rhoades (1977) for a tabulation. Not all of the studies deal with commercial lending.

3. See Osborne and Wendel (1982) for an elaboration of this point. I do not mean to suggest that the status of a hypothesis can be settled by the proportion of tests that it fails to pass. It is just that this proportion helps to determine the "stylized facts."

For reports and appraisals of the earlier empirical studies, see Flechsig (1965), Phillips (1967), and Taylor (1968). Flechsig and Taylor found no evidence of a concentration effect but did report a significant regional effect, which is just as unfavorable to the Integration Hypothesis.

4. Loan size, on the other hand, had a significant negative effect on interest rates in both of the years studied by Meyer. On the face of it, this effect must be attributed to the greater risks or higher operating costs associated with small loans, for the only other thing that could cause rates to be higher on such loans is a weakness in competition, which

was purportedly represented by the concentration variable and which, as we have seen, exercised no stable effect. But this attribution would be hasty in view of the doubtful correspondence between concentration and a weakness of competition; it would however, agree with the findings of Benston (1964).

5. Bankers often refer to their normal trading areas as their local markets, and this seems to have led the concentration researchers to identify a trading area with the concept of a market as used in economic theory. See Osborne and Wendel (1982) for a discussion of market identification.

6. Keleher provides a useful survey of this theory. Kenen (1976) figures prominently in the survey and should be consulted as a general reference.

7. Essentially all of the sample banks had at least $40 million of commercial loans outstanding in 1967. See the Federal Reserve Bulletins for May 1967 and June 1971 for a description of the survey.

8. Rates reported to the Fed on a discount basis were recomputed to give the effective rate. This is the only control beyond size and maturity.

9. See Koutsoyiannis (1973, pp. 73-74).

10. Davis (1965) also found the Southeast to be different. Perhaps it really will rise again.

11. This model is not usually dignified with a name, far less the name here attached to it. See Garbade (1982, Ch. 19) for a discussion of this model in connection with option pricing.

12. As in the Rate Model, the autocorrelation of the residuals may spring from autocorrelation of the independent variable and the correlation between this variable and the error term.

13. The short-term regressions are not examined in this or the two tests to follow because of their good fits.

14. Only these two regions were examined. Since the results contained no surprises, further work along these lines did not seem worth the trouble.

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