SUPERLATIVE BANK CREDIT INDEXES AND THE LENDING CHANNEL

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ABSTRACT

Credit aggregates are developed using statistical index number theory. These aggregates take into consideration the profitability associated with providing different levels of credit services. Rather than focusing on the *stock* of credit outstanding, or balance sheet values, it is recognized that it is the *flow* of credit services that is important for economic models, particularly those studying the credit channel.

Some evidence is provided that suggests that our new credit aggregates may be more responsive to monetary policy than are their simple sum counterparts. In addition, the new bank credit indexes may have a better statistical relationship with gross domestic product than their simple sum counterparts. Such stronger relationships result from the fact that the new credit measures are able to pick up portfolio reallocations within loan categories and between loans and securities that would not affect corresponding simple sum aggregates of bank credit.

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Introduction

Recently, there has been renewed interest in the role of bank credit in the transmission mechanism of monetary policy and the macroeconomic role of bank credit more generally. Some observers believed that the conventional money channel seemed too weak to account for the sometimes relatively large effects of monetary policy on observed spending.[1] Bernanke and Blinder (1988) sketched a model of the monetary transmission mechanism that made clear that for a distinct lending channel of monetary policy transmission to exist, two conditions would need to be met. First, loans from financial intermediaries would need to be "special." That is, the expertise acquired by banks in the process of evaluating and screening applicants and in monitoring loan performance enabled them to extend credit to customers who find it difficult or impossible to obtain credit in the open market. Second, as Kashyup and Stein (1994) succinctly put it, "the Fed must be able, by simply conducting open market operations, to shift bank's loan supply schedules." Thus, an assumption of imperfect substitutability of loans for securities in bank portfolios is required to ensure that a decline in reserves leads to a decline in lending by financial institutions. Despite numerous studies examining the relationship between macroeconomic activity and bank credit, there still is a lack of consensus about whether these two conditions have been empirically met.

Other observers have argued that credit market imperfections may play an independent

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[1] See in particular Bernanke and Blinder (1988, 1992), Kashyap and Stein (1992), Gertler and Gilchrist (1992), Bernanke (1993, p. 55), Thornton (1994), Hubbard (1994), and Mishkin (1996).

important role in the transmission of monetary policy. Informational asymmetries may introduce frictions in financial markets that drive a wedge between the price of uncollateralized external funds and the price of internal funds.[2] This wedge, or premium, determines the "value" of a loan extended by a bank to a borrower and influences the costs of borrowing at the margin. In these models, the changes in borrowing costs influence real economic decisions and have a real macroeconomic impact.

Differences in the definition of "credit," or "lending," in studies examining their role in the transmission of monetary policy are striking. While some authors use total loans at banks, thrifts, or both (e.g. Thornton (1994)), others restrict their definition to include specific types of commercial bank lending. Bernanke and Blinder (1988), for example, define credit as the sum of intermediated borrowing by households and businesses. Kashyup, Stein and Wilcox (1991) used short-term business loans in their study. Others, notably Gertler and Hubbard (1988), Gertler and Gilchrist (1991) Kashyup and Stein (1994) and Oliner and Rudebusch (1994), have taken a more disaggregated approach and have either investigated the effects of monetary policy on particular types of firms, or on different sized banks.

The apparent uneasiness of empirical researchers interested in testing the lending channel of monetary policy transmission or alternatively the credit market imperfection hypotheses to include various components of bank portfolios in their definition of "credit," is similar to the lack of comfort associated with using high-level aggregates for "money" when investigating the money channel. Friedman and Schwartz (1970, p. 151-152) described the source of discomfort

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[2] See Gertler and Gilchrist (1992) for a survey of this "excess sensitivity hypothesis."

with high-level money aggregates:

> This [summation] procedure is a very special case of the more general approach. In brief, the general approach consists of regarding each asset as a joint product having different degrees of "moneyness," and defining the quantity of money as a weighted sum of the aggregate value of all assets, the weights for individual assets varying from zero to unity with a weight of unity assigned to that asset or assets regarded as having the largest quantity of "moneyness" per dollar of aggregate value. The procedure we have followed implies that all weights are either zero or unity. The more general approach has been suggested frequently but experimented with only occasionally. We conjecture that this approach deserves and will get much more attention than it has so far received.

In this study, we used the intertemporal bank profit maximization model in Hancock (1985, 1991) to derive implicit prices for credit services, which proxy the value added by banks in the credit intermediation process. These prices and dollar values of balance sheet holdings at U.S. commercial banks were used to construct a new credit service aggregates for the banking sector by employing index number theory.[3] We compare our new credit aggregates with their simple sum counterparts and find that their time-series properties are distinctly different. We also demonstrate that our new credit aggregates have a much higher correlation with monetary policy indexes than their simple sum counterparts. Using a test for the strength of the lending channel developed by Miron, Romer, and Weil (1993) we demonstrate that there was a stronger relationship between our new credit aggregates and gross domestic product than there was between simple sum measures with identical credit components and gross domestic product during the late 1980s and early 1990s. While it is still too soon for us to enter the debate about

[3] Fixler (1988, 1993) has used the profit maximization model of Hancock (1985, 1991) to develop an output price index for commercial banks. This index can be used as a deflator to measure the real credit services provided by banks.

the lending channel controversy, we offer the hypothesis that the credit view's lackluster empirical success may be partly due to measurement error for the credit services provided by the banking sector. We note that our new aggregates may also be useful in the study of the credit market imperfection propagation mechanism since we focus on borrowing costs and the value added from the banking sector.

The paper is organized in the following manner. First, we briefly discuss price measurement for credit services and the appropriateness of using index number theory to construct our new measures of credit services provided by the banking system. Second, we discuss the data and how we constructed our bank credit indexes. Third, we show how our credit indexes compare with their respective simple sum counterparts for the banking system as a whole and for four separate Census regions. Fourth, we compare our measures and simple sum measures of bank credit to a monetary policy index, and fifth we look at the relationship between our new credit measures and gross domestic product.

Issues in Credit Price Measurement and Index Number Theory

Traditionally, macro economists have measured the "credit," or "lending" services provided by banks at any particular point in time by simply adding the dollar values of various types of loans (and possibly securities) that are on banks balance sheets. While such simple sum credit aggregates may be useful from an accounting perspective, they are unlikely to be useful as economic variables measuring credit services.[4] In the context of measuring monetary services, Barnett, Offenbacher and Spindt (1984) noted that,

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[4] Simple sum credit measures, for example, could be useful for monitoring the asset structure of commercial banks.

[b]y equally weighting components, aggregation by summation can badly distort an aggregate. For example, if one wished to obtain an aggregate of transportation vehicles, one would never aggregate by summation over physical units of, say subway trains and roller skates. Instead, one would construct a quantity index (such as the Department of Commerce's many Laspeyres quantity indexes) using weights based on the *values* of the different modes of transportation. ((1984, p.1051)

Alternatively stated, simple sum aggregation either assumes that the components in the aggregate are perfect substitutes or that their prices are identical. Of course, if the price of each component of the credit aggregate were a dollar, then relative prices would never change and simple sum aggregation would be justifiable.

One reason that both money and credit have been summed in the past is that there has been some confusion between the asset stocks denominated in money and the service flows derived from those stocks. As pointed out by Barnett (1981), money is a durable good and the dollar price of a unit of its stock is applicable only for an infinite holding period. During a finite holding period, our concern is with the *flow of services* generated by the stock. Credit can be thought of as simply renting money. And, it is not the stock of balance sheet items on the books of banks but the flow of services associated with those stocks that is consumed over a finite period. It is the measurement of the flow of credit services that is of importance for economic models. The rental price of the flow of credit services is the user cost of the credit asset.

Rental prices, or user costs, for financial services have been derived in the context of intertemporal consumer decision models by Donovan (1978) and Barnett (1980), and in the context of intertemporal bank profit maximization models by Hancock (1985) and Barnett (1994). The latter are appropriate for measuring the rental price for credit services provided by an individual bank. The real user cost for credit service i is the net effective cost of holding one dollar of asset i, or:

$$u_{Ai} = \frac{\rho - h_i}{1 + \rho} \quad (1)$$

where ρ is the discounting rate, or benchmark rate, used by the bank to monitor performance and h_i is the holding period revenue from asset i during the finite period being examined. The holding period revenue is the per-dollar stream that a bank earns. In particular, it includes the interest rate received, a service charge rate (including late loan payments and stand-by charges), an expected capital gains rate (possibly negative if losses are anticipated), and incorporates an expected default rate, and tax shields. In short, the user cost formulation incorporates all of the information typically ascribed as being relevant to the optimal investment of funds by the bank. We note that both Bernanke (1983) and Friedman and Kuttner (1994) have used interest rate differentials, a key component of the user cost, to measure credit market conditions.

Aggregation theory could be used in the context of a profit maximizing banking firm to test for whether weakly separable (factorable) blockings of banking assets are reasonable and to test for their functional form.[5] However, the value of the credit aggregate would depend on unknown parameters. The task of updating the data series would be nontrivial since it would require estimation of the banking technology each time the series was updated.

[5] See Hancock (1987, 1991) for a discussion of tests of separability between monetary and non-monetary assets in production for banks in pre- and post- Monetary Control Act environments. In Hancock (1992), the necessary conditions for exact economic aggregates for bank outputs are discussed.

Alternatively, index number theory can be used to approximate the current point on the aggregator function without knowledge of, or estimates of, the unknown parameters. Statistical index numbers are parameter free and depend only upon data on prices and quantities. Diewert (1976) has identified a class of "superlative" statistical index numbers that both satisfy the mathematical properties deemed desirable from the perspective of index number theorists and provide second order approximations to the values of economic quantity aggregates of aggregation theory. Importantly, the selection between superlative index numbers is of little empirical importance. For example, Barnett (1980a) found that differences in the growth rates of Divisia and Fisher ideal indexes for monetary aggregates was negligible, despite a large divergence between these indexes and simple sum indexes comprised of identical components. Thus, index number theory provides us with a means of inferring the time-series properties of the implied aggregator functions that incorporate each bank's desired substitution among the assets included in the aggregate, which, of course, depended upon their relative prices, without actually having to estimate the aggregator functions. In order to construct commercial bank credit aggregates employing index number formulae, for either the United States or for each census region, information on the rental prices of bank assets included in such aggregates and their corresponding balance sheet holdings were required.

Data Construction

Bank Credit

Data for individual banks came from the quarterly Reports of Condition and Income (Call

Reports) for insured, domestically-chartered, commercial banks.[6] These quarterly reports included both balance sheet information and income statement information. Generally, there was more detailed balance sheet information reported in the Call Report than income statement information. As a consequence, the feasible level of bank asset disaggregation was bounded by the asset categories for which interest and fee income, charge-offs, and recoveries were available. In addition, for the construction of a bank credit index it was desirable to have asset classifications broad enough such that most banks would hold assets in each of the asset categories in consecutive quarters. Our quarterly data began with the December 1984 Call date and ended with the December 1995 Call date. We began our data set at year-end 1984 because there were substantive changes to Call Report asset classifications in 1984:Q1.[7]

Bank credit included bank holdings of securities, loans, and leases but excluded such assets as the book value of buildings, cash, and balances due from other depository institutions. We disaggregated bank credit into bank holdings of "securities" and of "loans and leases." The Call Report included in the securities category the following assets: U.S. Treasury and federal agency securities (including agency-related collateralized mortgage obligations, or CMOs); obligations of corporations, state and local governments, and political subdivisions; domestic and foreign

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[6] The data were consolidated, in that they pertained to both the domestic and foreign offices of domestic banks. Data limitations prevent including agencies and branches of foreign banks in our sample. The data were for individual banks, not for the bank's holding company. Data were adjusted for mergers and acquisitions.

[7] See Kashyup and Stein (1994, pp. 26-28) for a discussion about significant changes in asset classifications used in the Call Report as of 1984:Q1.

debt securities; and equity securities such as mutual funds.[8] Loans and lease financing receivables were disaggregated into four loan categories, namely, individual, real estate, commercial and industrial, and "other." Individual, or consumer, loans included credit card, check credit, installment, and other loans to individuals, households, and families for personal expenditures. Included in the real estate loan category were loans secured by one-to four-family residential properties, loans to finance the purchase of commercial real estate, loans secured by real estate to finance construction and land-development activities, and loans secured by multifamily properties (five or more units). Commercial and industrial loans were loans to businesses, both U.S. and foreign addressees. "Other" loans (the "loans not elsewhere classified" category in the Call Report) included obligations (other than securities) of states and political subdivisions in the United States, loans to foreign governments, loans for the purchase of securities, agricultural loans not secured by farmland, loans to depository institutions, and lease financing receivables.[9] Dollar totals for securities and for each loan category were the average balance sheet holdings for each quarter by bank.[10]

Rental prices per unit of service, or user costs, were calculated for each loan category by bank

[8] CMOs and other real estate-based securities have some of the features of real estate loans. We judged CMOs and other real estate-based securities to be closer substitutes for the other components of the securities category as defined by the Call Report than for real estate loans.

[9] Excluded from the "other" category was unearned income on loans held by the bank.

[10] For banks missing the previous Call, such as de novo banks, the average balance sheet holdings were calculated assuming balance sheet values of zero for the missing quarter. If a bank had no real estate loans on its previous Call, then the average balance would be half its end-of-quarter balance sheet value.

using data provided in the Call Report.[11] Calculated holding revenues per dollar included interest revenue and service charge income earned less a provision for expected loan losses.[12] We note that using individual revenue data allowed us to distinguish differences in the amount of credit services provided within a given category of bank credit between banks. For example, consider two banks each with one million dollars of real estate loans on their balance sheet. Bank A makes a single loan, keeps it on the books and collects the interest income. Bank B, on the other hand, makes a one million dollar loan, sells it, and makes another several times during the quarter. Bank B's income is largely derived from fees since it continually sells its loans. Bank B's balance sheet real estate holdings represent the loans it has warehoused. Even though both banks have the same volume of real estate loans on the balance sheet at any point in time, they are not providing the same volume of credit services. The rental price captures this difference because each bank's holding revenues are different despite identical balance sheet holdings of real estate loans. Similarly, banks that provide more value added when they provide credit services will be able to earn more revenue per dollar so that adjustments in the allocation of

[11] The Call Report income data are year-cumulative. When a bank acquires another bank using the "pooling of interests" accounting method, it includes the income of the predecessor on subsequent Call Reports. However, when a bank acquires another bank using the "purchase" accounting method, it does not include the predecessors income on subsequent Call Reports. For mergers where the purchase method was used, an estimate of the predecessors income from the previous call to the merger date should be added to the successor's income data in order to obtain reliable holding revenues per dollar held on the balance sheet. If the predecessor and successor banks were in the same bank holding company, we assumed that the pooling of interest accounting method was used, otherwise we assumed that the purchase accounting method was used.

[12] The average balance sheet value for the quarter was used in the denominator to compute the rates earned per dollar.

credit across banks may also influence the bank credit aggregate. Adjustments were made to account for capital gains and losses on securities holdings on a realized basis. Expected loan losses per dollar were proxied by each bank's net charge-offs (charge-offs less recoveries) over four quarters.[13]

To derive the rental prices for bank assets also required us to choose a benchmark rate of interest for banks. According to standard portfolio theory, the benchmark rate should be the same across all accounts so that an individual bank can optimally allocate funds to their uses. In this paper we report credit aggregates using the one year constant maturity US Treasury note rate as the benchmark rate because it represented a risk-free alternative investment for bank shareholders.[14] We tried other benchmark rates, such as the five year constant maturity US Treasury note rate, but the behavior of the credit aggregates was virtually the same. Thus our credit aggregates are robust to the choice of the benchmark rate.[15] This result is consistent with previous work that measured bank output quantity and price indexes for U.S. commercial banks by Fixler and Zieschang (1992). They found that Tornquist and Fisher ideal output and price indexes were not sensitive to the choice of the benchmark rate.

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[13] The four quarters of data on charge-offs rates included the current and preceding three quarters. Charge-offs have some seasonality, typically rising in the fourth quarter of each year. The four-quarter moving average always incorporates the December Call charge-off data into the proxy for the default rate which depends on past experience.

[14] Fixler and Zieschang (1992) have shown that user cost based bank output price indexes are not sensitive to the selection of the benchmark rate of interest.

[15] See Barnett (1980) for a discussion of the importance of the choice for a benchmark rate in the context of money aggregation. He found that his results were also robust to the choice of benchmark rate.

Generally, loans and securities had negative user costs implying these credit services are outputs of the banks providing them.[16] On occasion, however, some banks had a positive user cost for one or more of their services suggesting that these credit services were intermediate inputs used by the bank in period *t*. We followed the convention of Debreu (1959, p.38) and measured all prices positively, outputs positively, and intermediate inputs negatively. The price for each credit service at each bank was the absolute value of its user cost and the corresponding balance sheet value was multiplied by one or negative one depending upon whether its user cost was negative or positive respectively. Quarterly means for the rental prices of the main components of bank credit -- real estate loans, consumer loans, commercial and industrial loans, and securities -- are presented in Table 1 in cents per dollar. Not surprisingly, the rental prices for bank loans that have often been categorized as particularly "special" in the banking and macroeconomic literature -- commercial and industrial loans and consumer loans -- typically had relatively high rental prices. Not surprisingly, securities had the lowest rental price. So, even if a bank had equal holdings of each of the components, the "special" services would be weighted more in our bank credit service aggregate than are securities holdings since their revenue shares would be relatively larger.

Computation of Index Numbers

Once the data on each bank's prices and quantities for credit services had been constructed, there were two methods that could be used to compute macroeconomic indexes of credit services provided by banks. A two stage procedure could be used where indexes for the credit services

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[16] See Hancock (1985, 1991) for the justification used for classifying outputs and inputs.

provided at each bank would be calculated in the first step and in the second step an appropriately weighted average of individual bank indexes would be calculated. Alternatively, the index could be computed in a one step procedure by using the relevant price and quantity data for *all* banks in the index number formula. Diewert (1980, Theorem 161, p.498) has demonstrated that these two aggregation methods create index measures that coincide to the second order. We chose the one stage procedure for computational convenience.

Two Fisher ideal indexes were constructed, a bank loan index and a bank credit index.[17] A Fisher ideal index number is a *superlative* index number; that is, it is an exact index number that has a flexible functional form for the underlying production function. Diewert (1980, p.496) has shown that all superlative index numbers approximate each other to the second order if changes in prices and quantities between the two periods are small. In addition, he demonstrated that all superlative index numbers should generate virtually the same aggregate series, so that the choice of a specific superlative index number becomes empirically irrelevant. The additional advantage of the Fisher ideal indexes is that they can handle both outputs and inputs and classification switching across periods.[18] The Fisher ideal bank loan index we constructed aggregated the credit services of real estate loans, consumer loans, commercial and industrial loans, and "other' loans defined above. The Fisher ideal index of bank credit extended the coverage of the loan index to include securities.

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[17] See Diewert (1992) for justifications for the usage of the Fisher ideal index number formula. He shows that the Fisher ideal quantity index is the unique function that satisfies 20 desirable mathematical properties for index numbers.

[18] See Diewert and Smith (1994) for an application of the Fisher indexing procedure over "netputs."

Another complication that arises in the construction of macroeconomic credit indexes merits some discussion. Some banks did not have holdings of some of the loan categories in consecutive quarters. In addition, banks that failed did not have data in consecutive quarters. This problem is formally analogous to the "new service problem," that is, when a new service appears in one period but not in the prior period. Hicks (1940, p.114) suggested that in periods when data is unavailable, the quantity could be set to zero and a reservation price could be estimated that would rationalize a zero demand or supply of the service. This same methodology could be used here. However, a practical problem to the Hicksian solution is that it is difficult to estimate such reservation prices. Consequently, we followed a procedure recommended by Diewert (1980, p. 500): we calculated the Fisher ideal price index -- which has the same functional form as the Fisher ideal quantity index except that the role of prices and quantities is reversed -- for each of our credit service aggregates except that we used price and quantity information on only those services that were provided in adjoining periods. The Fisher ideal price index is the geometric mean of the Laspeyres and Paasche indexes, or

$$FI=\left(\left[\sum_{ij}\frac{p_{ij}^{2}}{p_{ij}^{1}}*S_{ij}^{1}\right]*\left[\sum_{ij}\frac{p_{ij}^{1}}{p_{ij}^{2}}*S_{ij}^{2}\right]^{-1}\right)^{1/2} \qquad (2)$$

where $p_{ij}^{\,t}$ is the price of the ith credit service at bank j in period t and $S_{ij}^{\,t}$ is the revenue share of credit service i at bank j in period t. Once these "restricted" price indexes were constructed, the corresponding quantity indexes were defined to be the revenue value ratios for goods in the aggregate under consideration divided by the corresponding restricted price indexes.[19] The resultant quantity indices were then chained to construct the implicit Fisher ideal quantity index for bank credit and for bank loans.

Time Series Properties of Simple Sum Measures and Indexes of Bank Credit

In Figure 1 we have plotted quarterly data for two nominal simple sum measures of money (M1 and M2) and simple sum bank loans and bank credit as defined above for the 1985:Q4-1995:Q4 period. All series were normalized to equal one in 1985:Q4. The growth of M1 throughout 1990 and 1991, and the decline in the growth rates of bank credit and bank loans in mid-1991 have been reported in the popular press.

Figure 2 plots aggregates based on index number theory for the same components of money and credit as were displayed in Figure 1. Again the indexes are all normalized to equal one in 1985:Q4. Divisia aggregates for the money measures and Fisher ideal quantity indexes for the credit measures are displayed. Noticeably, Divisia M1 grows at a slower pace than its simple sum counterpart during the 1991-1993 period. Even more noticeable is that the behavior of the bank asset aggregates is strikingly different than their simple sum counterparts. During 1988 and 1994 there is a sharp drop in the bank credit index and the growth in the bank loan index was also negative. The simple sum counterpart of neither index had a perceptible decline in nominal

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[19] The restricted price index procedure described here is the one used in the econometric package SHAZAM described in White (1978). The described procedure has also been used by Diewert and Smith (1994) to construct Fisher ideal indexes used in measuring total factor productivity growth for a distribution firm. Diewert (1980, p.500) has shown that the restricted price index procedure will be theoretically correct if the implied reservation price is such that the relative price change in the services not transacted in both periods is equal to the general change in prices for the aggregate.

growth during these periods.

One of the advantages of using bank credit index number theory is that the sample banks over which the index is computed can be defined as desired. For instance, if there is an interest in regional bank credit measures, then the bank sample can be stratified by Census region. In Figure 3, both simple sum indexes and Fisher ideal credit indexes by census region are displayed. There were noticeable declines in the simple sum measures of bank loans first in the Northeast census region (in early 1989) and then in the West census region in early 1991. Even more striking, however, are the differences between the patterns of simple sum measures and their respective index number measures for each of the credit series. The Northeast bank loan index, for example, exhibits greater fluctuation in lending services than would be suggested by the simple sum index with negative growth in the index during 1990, positive and negative growth in 1991, and negative growth throughout most of 1994. In the South and the Midwest bank samples the simple sum measures of bank credit were fairly smooth, but the credit indexes fell sharply beginning in first quarter 1988 reaching a trough in the last quarter of 1988 and first quarter of 1989 respectively to reflect that banks in these regions reallocated their portfolios into securities during the late 1980s. The bank loan indexes in the South and Midwest also exhibited modest declines and then an increase during this period, despite relatively constant growth in the simple sum index of bank loans. A similar pattern is observed for the 1994:Q2-1994:Q4 period: Credit index growth falls sharply while simple sum credit measures have relatively constant growth for the South and Midwest banks. Interestingly, there is a notable dip in the bank credit index 1994:Q1-1994:Q4 in the West despite a continued climb for the simple sum credit measure. Generally, the greater volatility in and higher overall growth of the indexes for credit services by region is readily apparent. In addition, the bank credit and bank loan indexes are noticeably positively correlated with each other.

The Relationship Between Credit Measures and a Monetary Policy Index

Recall that one of the conditions for the lending channel to operate was that the Federal Reserve by conducting open market operation must be able to affect bank's loan supply schedules. That is, an assumption of imperfect substitutability of loans for securities in bank portfolios is required to ensure that a decline in reserves leads to a decline in lending by financial institutions. Thus, we would need to observe a decline in our index measures for bank credit related to the "tightening" of monetary policy.

Unfortunately, analysts disagree on how to measure the stance of monetary policy. While some observers measure monetary policy using the federal funds rate (e.g. Bernanke and Blinder (1988)), others argue that there is no monetary information in this rate that is not contained in other short-term rates (e.g. Garfinkle and Thornton (1994)). Some observers still prefer to measure monetary policy using the growth of simple sum M2 (e.g. Friedman (1992)). In addition, there are many monetary policy indexes that are available that emphasize different criteria for indicating when a policy occurs. For example, the Romer and Romer index focusses solely on the date of an "anti-inflationary shock." Boschen and Mills (1995) and Sellon (1994) have surveyed the literature on narrative indicators of monetary policy. Boschen and Mills (1995) concluded that the different monetary policy indexes constructed by informed observers were in large part remarkably in agreement given the differences in the motivation for the indices.[20] The consistency in the monetary policy indices suggested

> that different ways of categorizing policy such as the impact on money market variables, the emphasis on inflation versus real growth, or more generally "tight" or "loose" policy, all reflect the same basic policy stance. (Boschen and Mills (1995, p.42)).

Given this apparent consistency between monetary policy indicators, we chose to compare our bank credit service measures with the Boschen and Mills (1995) index of monetary policy.

Data for the Boschen and Mills index is plotted in Figure 4 using the right-hand Y axis.[21] The range of the index is -2 through +2, with a value of -2 indicating a strong policy emphasis on inflation reduction and a value of 2 indicating a strong emphasis on promoting real growth. Detrended real simple sum bank credit is plotted in Figure 4 using the left-hand Y axis. The simple sum bank credit series was deflated using the GDP deflator and then detrended using the natural real GDP data series available in Gordon (1992, P.A6).[22] The resultant series were normalized to equal one in 1985:Q4. While there appears to be a real reduction in bank credit in midyear 1987, in the early part of 1989, and in the early part of 1994, coincident with periods identified by Boschen and Mills (1995) as those with an anti-inflationary stance, the period

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[20] The Federal Reserve currently includes a bank-credit target, along with targets for the monetary aggregates, in its semi-annual reports to Congress (See, for example, Friedman (1983, p.122.). The stance of policy with respect to the money and credit targets has largely been in concurrence over our sample period.

[21] Monthly data was averaged for months in each quarter to construct a quarterly data series for the Boschen and Mills (1995) index. We thank John Boschen who provided us with an update of the Boschen Mills index subsequent to its publication.

[22] Data on the real natural rate of GDP were not available in Gordon (1993) after date 1992:Q2. We forecasted this variable through the end of our sample period using a 2.5 percent annual growth rate.

identified as one with expansionary monetary policy during the early 1990s did not appear to have a coincident effect on real simple sum bank credit. And, these results are robust to whether or not securities are included in the simple sum credit measure.

In Figure 5, we also plot the Boschen and Mills (1995) index of monetary policy on the right-hand axis, but using the left-hand axis we plot the real detrended Fisher ideal bank credit index. Like the simple sum aggregate, the Fisher ideal bank credit was deflated by the GDP deflator and then detrended using the natural real GDP data series from Gordon (1992). The resultant series was normalized to equal one in 1985:Q4. There appears to be an impressive positive relationship between the Boschen and Mills index of monetary policy and our new bank credit aggregate based on index number theory. During periods identified as those with an anti-inflationary stance, the real detrended bank credit index declines and begins to recover. During periods identified as expansionary, there is consistent strong growth in the real detrended bank credit aggregate. Again, these results are robust to whether we choose to plot a credit aggregate that includes securities.

While the evidence presented in Figures 4 and 5 is merely suggestive, it appears that the Fisher bank credit index may be picking up banks' portfolio reallocation responses to changing stances in monetary policy.[23] Furthermore, by allowing for imperfect substitutability between bank assets, the Fisher ideal indexes of bank loans and bank lending appear to be superior to their simple sum counterparts for studying the effects of a lending channel for the transmission of monetary policy.

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[23] In future research we will control for other variables that may influence bank credit supply.

The Relationship Between Credit Measures and GDP

Miron, Romer and Weil (1993) modified the Bernanke and Blinder (1988) model of the monetary transmission mechanism to consider the relative importance of different financing channels. They argued that a differential in the correlation between output and lending after monetary contractions and in other times provides information about the importance of the lending channel. They reasoned that lending has a substantial endogenous component--investment and loans tend to rise when the economy is doing well and fall when the economy is sluggish--that creates a positive correlation between output and lending. If lending has an independent component which declines in monetary contractions and actually causes output to fall, then the correlation between lending and output should be even higher than usual after monetary contractions, since both the usual endogenous response and the independent lending channel will be operating.

Since the relationship between lending and output is presumably more complicated than a simple contemporaneous correlation, Miron, Romer, and Weil (1993) used a two stage procedure to test their hypothesis. First, they detrended and seasonally adjusted data for both lending (measured by bank loans) and industrial production by taking residuals from regressions of the percentage changes of each variable on quarterly dummy variables and a linear time trend. Second, detrended and seasonally adjusted industrial production -- the residuals from the industrial production regression -- were regressed on the contemporaneous value of the lending variable and three lags of the residuals from the lending equation, or

$$RGDP_t = \alpha + \beta_0 BCI_t + \beta_1 RBCI_{t-1} + \beta_2 RBCI_{t-2} + \beta_3 RBCI_{t-3} + \epsilon \qquad (3)$$

where the prefix of an *R* indicates that the residual from the first stage regression was used and the subscripts refer to the period of the observation. Miron, Romer and Weil (1993) reasoned that the R^2 of the second stage regressions are a measure of the explanatory power of lagged and contemporaneous lending for movements in real GDP. These second-stage regressions were performed on 12 quarter samples after monetary contractions, and on samples excluding these observations.

We followed the Miron, Romer, and Weil (1993) two stage procedure using four measures for the lending variable, namely, the new Fisher ideal bank credit index, simple sum bank credit, the new Fisher ideal bank loan index, and simple sum bank loans. In the first stage of the procedure, to detrend and seasonally adjust our data, we used data from the 1984:Q1 - 1993:Q4 period. In the second stage of the procedure, we used the December 1988 date selected by Romer and Romer (1989, 1992) to mark the beginning of an anti-inflationary monetary contraction. R^2's from the second-stage regressions are reported in Table 2.

The differences in R^2's for our two sample periods for either simple sum bank loans (0.1385) or for simple sum bank credit (0.104) are similar in magnitude to Miron, Romer, and Weil's reported difference in R^2's (0.08) using bank loan data from the 1971:Q1-1991:Q2 period. Generally, the R^2's from regressions using Fisher ideal indexes for financial variables are higher than those using simple sums. Strikingly, the difference in the R^2's from regressions inside and outside the contractionary episode for the Fisher bank loan index is (0.4063) suggesting a greater importance of the lending channel than would be suggested using the simple sum bank loans measure (the difference equalled 0.1385). While the differences in R^2's inside and outside contractionary episodes for the bank credit equations are not large (0.1272 versus 0.104), there is a substantial difference in the explanatory power of the Fisher ideal bank credit indexes over the simple sum index. The R^2 inside the contractionary period when the Fisher ideal bank credit index is used (0.81) is 63 percent higher than when the simple sum measure is used (0.4945). In the pre-contractionary period, a similar difference occurred -- an R^2 of 0.6834 is 75% higher than an R^2 of 0.3905. These results should not be surprising since the Fisher bank credit index would adjust as the mix between loans and securities changed, even if there was no change in the dollars outstanding. Regardless, our empirical results suggest that index numbers for lending and bank credit could be useful in empirical work investigating the lending channel.

Conclusion

The use of economic revenue shares to weight the credit services provided by different credit products is an important departure from the common simple sum measures of bank credit or bank lending. In particular, the simple sum aggregates rely on an implicit assumption of perfect substitutability between credit services -- an assumption that appears to be not borne out in our data. Further, estimated models of banks using microeconomic data have suggested that banks do not view different types of credit as perfectly substitutable.[24] Our credit aggregates use index number theory, which is based on aggregation theory, and take into consideration the profitability associated with providing different levels of credit services. Rather than focussing on the *stock* of credit outstanding, or balance sheet values, we have recognized that it is the *flow* of credit services that is important for economic models, particularly of those studying the credit channel. We have explicitly built into our model the notion that the provision of credit is merely the rental

[24] Berger, Hancock, and Humphrey (1993, pp. 342-343), for example, have found that it is generally more efficient for banks to provide both business and consumer loans.

of the durable good called money.

We have provided some evidence that suggests that our new credit aggregates may be more responsive to changes in monetary policy than are their simple sum counterparts. In addition, our Fisher ideal indexes of bank credit may have a better statistical relationship with GDP than their simple sum counterparts. This would not be particularly surprising, since our credit measures pick up portfolio reallocations within the loan category, and for the higher order aggregate they pick up the reallocation between loans and securities. In addition, the new credit aggregates take into account changes in the size of the banking system as do their simple sum counterparts. All three of these features have been considered important factors in the debate about the credit channel and the role of bank credit more generally. Clearly, further research is required to determine the value of the new credit aggregates in empirical applications. However, our early findings indicate that one reason that the credit view may have been empirically unsuccessful thus far, is because there may have been measurement error in the critical variables measuring bank credit and/or bank lending.

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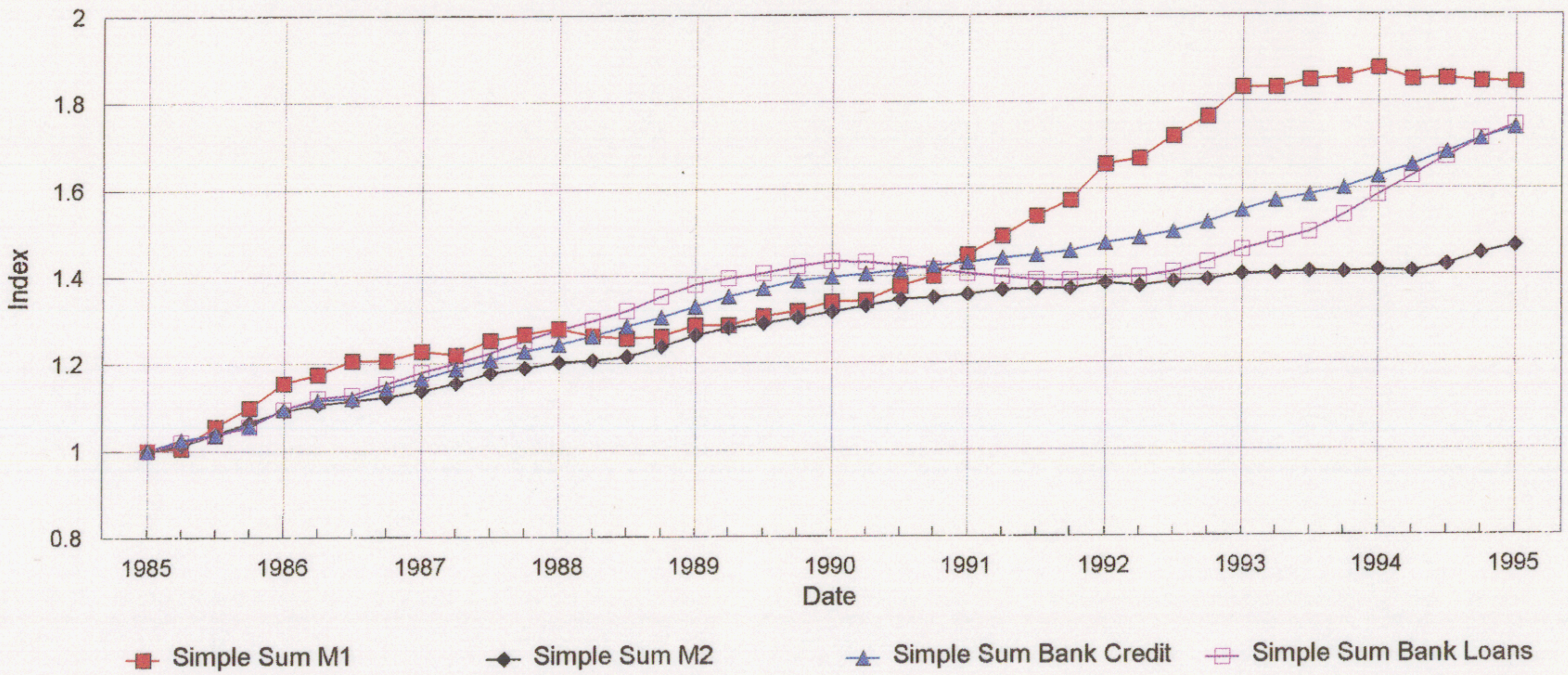
Figure 1

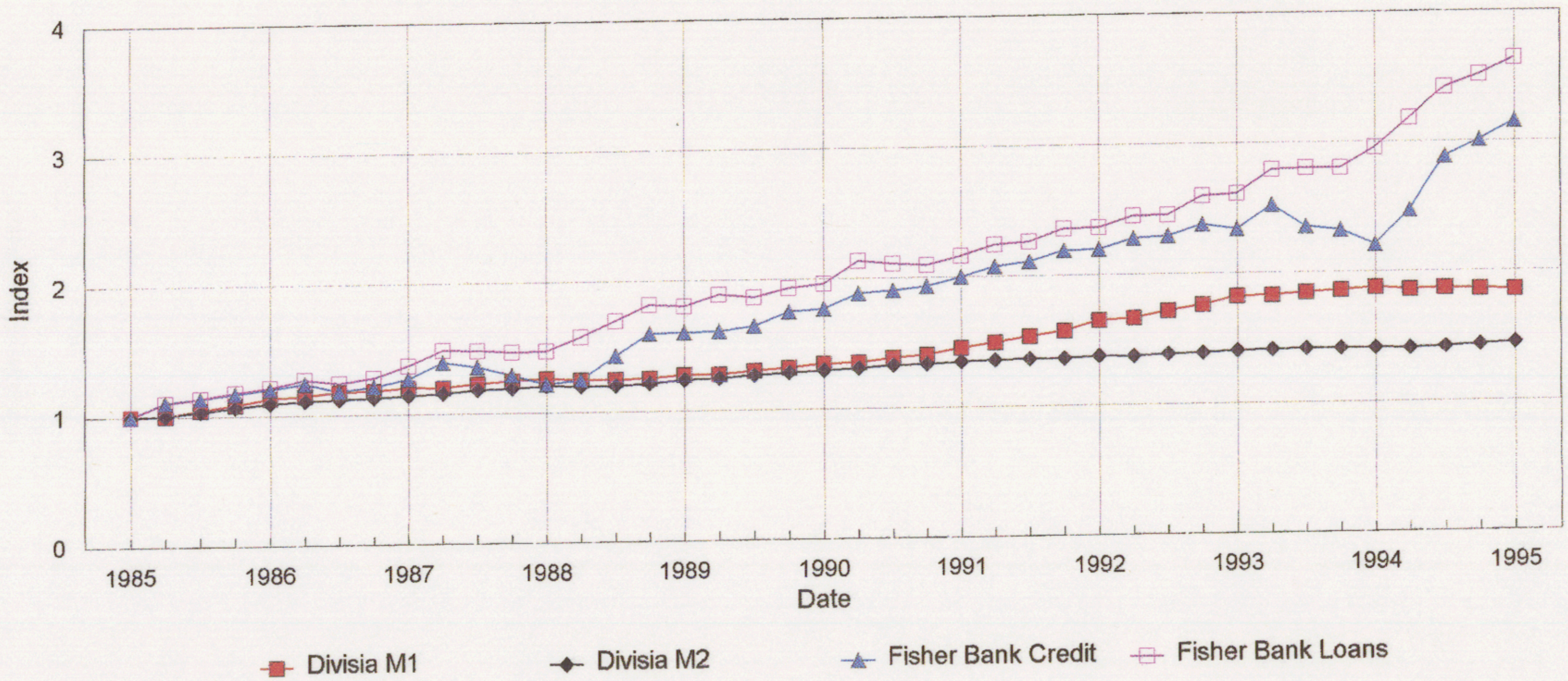
Simple Sum Measures of Money and Bank Credit



Note: All series were normalized to equal one in 1985:Q4.
Years are indicated on fourth quarter observation.

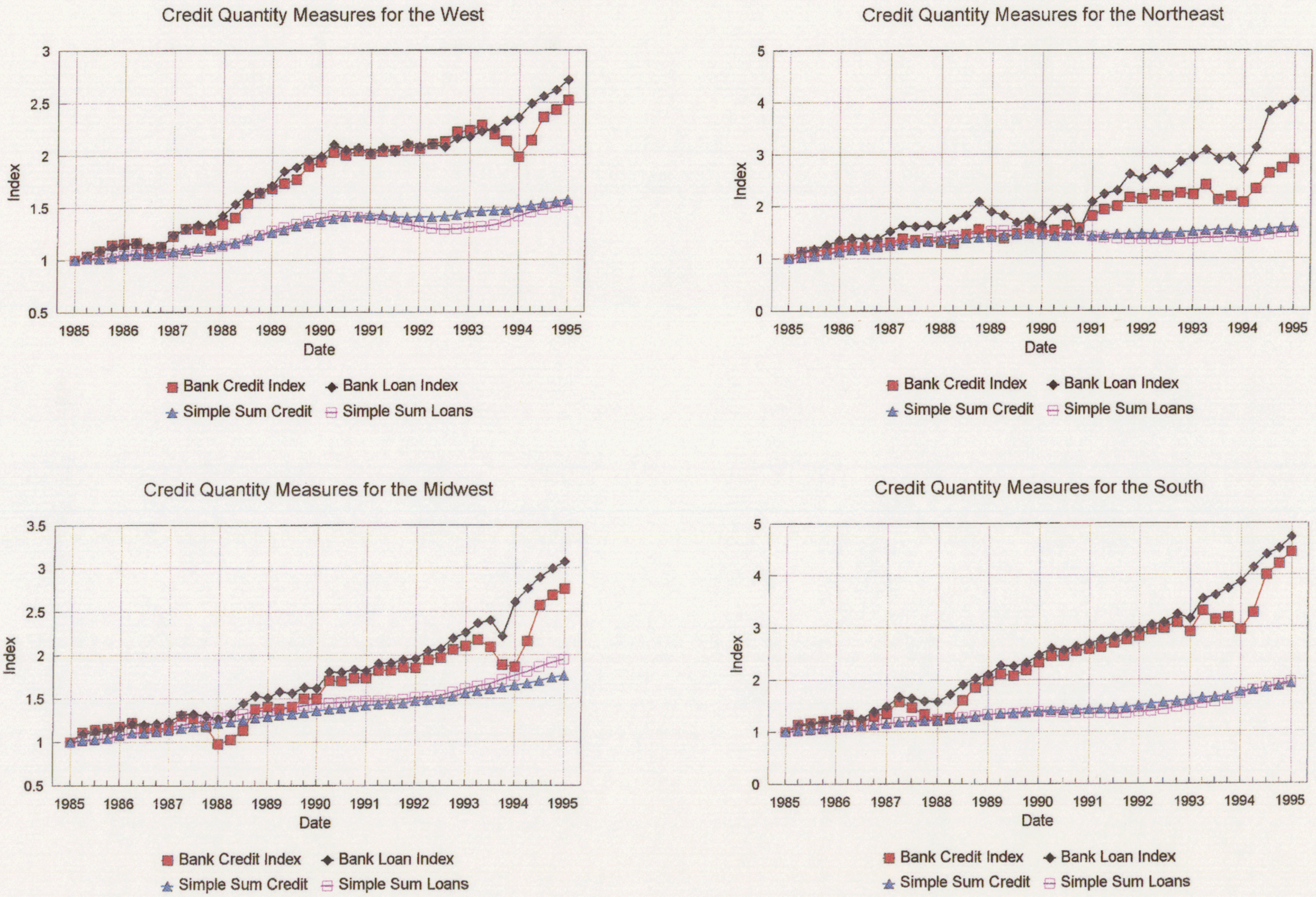
Figure 2

Index Numbers for Money and Bank Credit



Note: All series were normalized to equal one in 1985:Q4.
Years are indicated on fourth quarter observation.

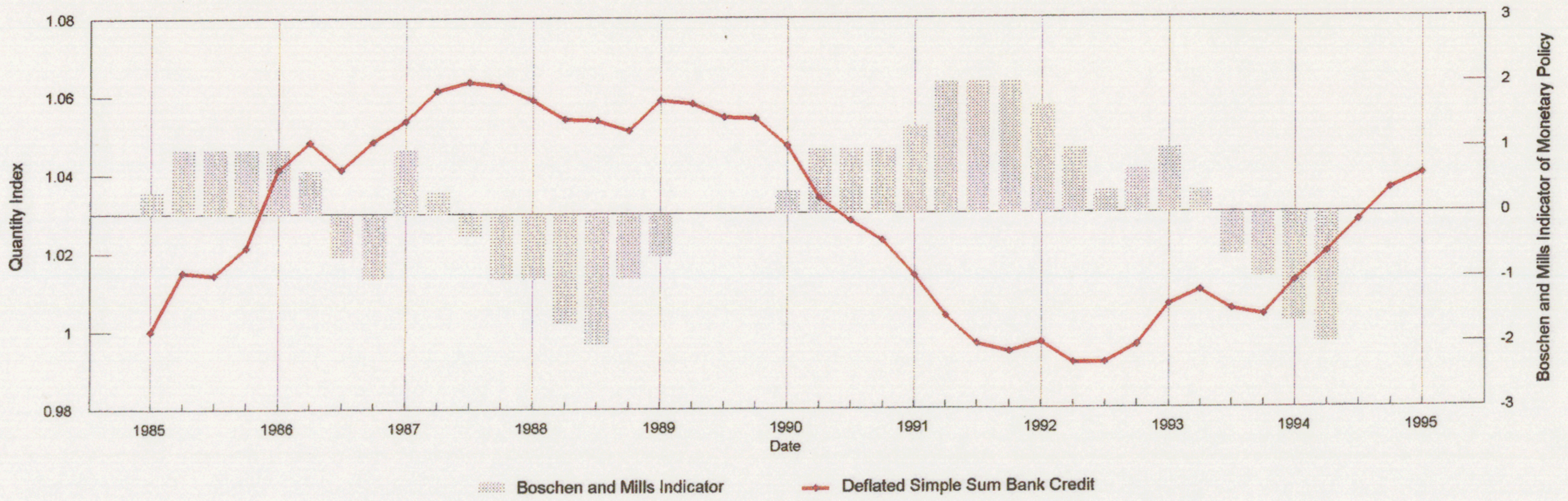
Figure 3
A Comparison of Simple Sum and Index Measures for Bank Credit and Bank Loans By Region



Note: Years are indicated on fourth quarter observation.

Figure 4

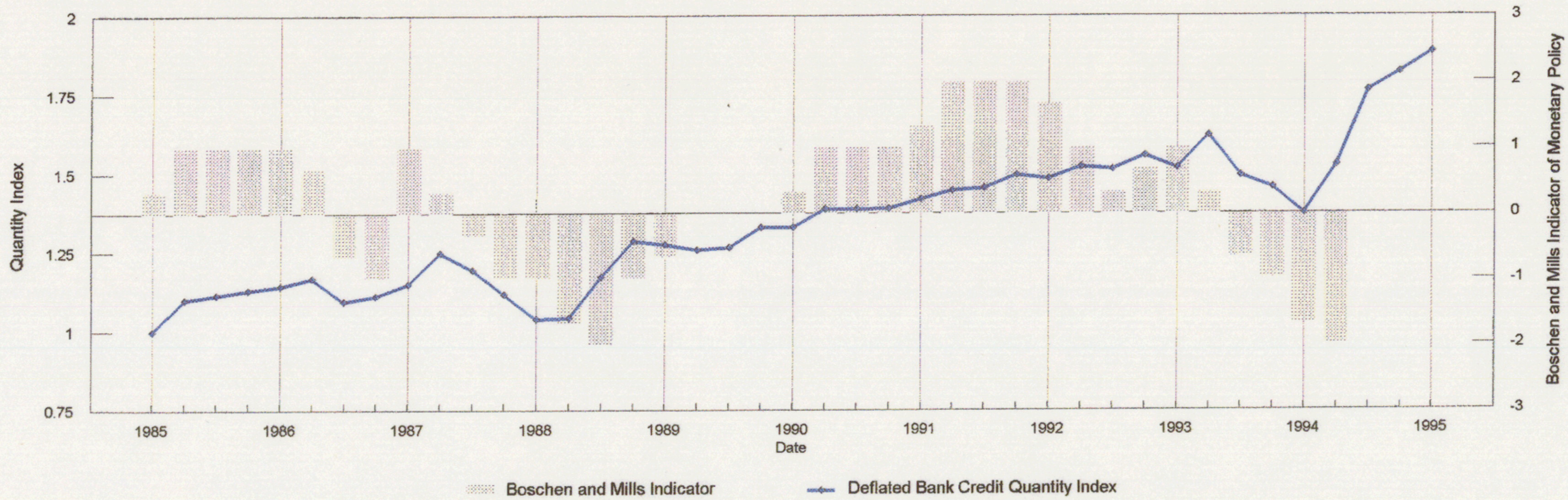
The Relationship Between the Boschen and Mills Indicator of Monetary Policy and the Detrended Simple Sum Bank Credit



Data were detrended using the Natural GDP data series in Gordon (1992, p.A6). All series were normalized to equal one in 1985:Q4. Negative values of the Boschen and Mills Indicator of monetary policy indicates tightening. Years are indicated on fourth quarter observation.

Figure 5

The Relationship Between the Boschen and Mills Indicator of Monetary Policy and the Detrended Fisher Bank Credit Index



Data were detrended using the Natural GDP data series in Gordon (1992, p.A6). All series were normalized to equal one in 1985:Q4.
Negative values of the Boschen and Mills Indicator of monetary policy indicates tightening. Years are indicated on fourth quarter observation.

Table 1

Unweighted Mean User Cost Based Prices for Components of Bank Credit

(in cents per dollar)

Year:Quarter	*Real Estate Loans*	*Consumer Loans*	*Commercial & Industrial Loans*	*Securities*
1985:Q4	4.74	4.85	8.87	1.70
1986:Q1	4.51	4.63	9.05	2.10
1986:Q2	5.25	5.34	9.35	2.52
1986:Q3	5.73	5.77	9.34	2.77
1986:Q4	5.55	5.73	8.68	2.62
1987:Q1	4.81	5.11	8.20	2.14
1987:Q2	3.99	4.18	8.00	0.94
1987:Q3	3.66	4.03	8.57	0.70
1987:Q4	3.71	4.10	9.18	0.71
1988:Q1	3.86	4.34	9.90	1.13
1988:Q2	3.40	3.89	9.91	0.53
1988:Q3	3.02	3.46	10.27	0.06
1988:Q4	2.59	3.17	9.96	0.26*
1989:Q1	1.81	2.28	10.18	0.81*
1989:Q2	2.53	3.16	11.30	0.16*
1989:Q3	3.69	4.28	12.21	0.85
1989:Q4	3.96	4.69	12.27	1.15
1990:Q1	3.34	4.07	11.97	0.40
1990:Q2	3.30	4.13	12.08	0.23
1990:Q3	3.97	4.91	12.94	0.93
1990:Q4	4.71	5.68	13.46	1.49
1991:Q1	5.28	6.48	13.80	2.09
1991:Q2	5.52	6.83	14.07	2.02
1991:Q3	5.94	7.63	14.40	2.49
1991:Q4	6.95	8.72	15.08	3.66
1992:Q1	7.14	8.91	14.65	3.64
1992:Q2	7.06	8.88	14.64	3.39
1992:Q3	7.99	10.10	15.38	4.53
1992:Q4	7.59	9.71	15.05	3.51
1993:Q1	7.40	9.52	15.09	3.51
1993:Q2	7.45	9.48	15.41	3.29
1993:Q3	7.27	9.39	15.71	3.06
1993:Q4	7.07	9.20	15.58	2.49
1994:Q1	6.14	8.20	14.98	1.84
1994:Q2	4.53	6.61	14.13	0.16
1994:Q3	4.17	6.23	14.58	0.17
1994:Q4	2.94	5.01	13.44	1.51
1995:Q1	3.00	4.78	13.84	1.17
1995:Q2	4.48	6.36	15.57	0.27
1995:Q3	5.13	7.21	15.95	0.66
1995:Q4	5.53	7.46	16.04	1.21

Note: An * indicates that the credit service was an intermediary input during the quarter.

Table 2

R^2s From Regressions of Gross Domestic Product on Bank Lending

Bank Lending Variable	*Time Periods*		*Difference*
	0-12 Quarters after a Monetary Contraction 1989:Q1-1991:Q4	Other Times 1985:Q4-1988:Q4	
Bank Credit Index	0.8106	0.6834	0.1272
Simple Sum Bank Credit	0.4945	0.3905	0.1040
Bank Loan Index	0.5324	0.1261	0.4063
Simple Sum Bank Loans	0.4184	0.2799	0.1385