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The Geographic Distribution of the Size and Timing of Monetary Policy Actions

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Abstract

This paper examines the magnitude and timing of the effects of changes in the monetary base on the aggregate and regional changes in bank loans within the United States. We consider both Bureau of Economic Analysis (BEA) regions, and individual states and the District of Columbia for our regional analysis. The empirical analysis provides some insight on the bank-lending channel of monetary policy. We find strong evidence of a 4-quarter lag in the effect of changes in the monetary base on bank loans. That finding proves robust across all regions and nearly all states.

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1. Introduction:

Textbook discussions of monetary policy generally tell the following story. The central bank increases the supply of government money (the monetary base), kicking off a multiple expansion of deposits and the money supply. The increase in the money supply puts downward pressure on the interest rate in the short run (the liquidity effect) and stimulates aggregate demand and economic activity. That story provides the theoretical background for the short-run real effect of monetary policy and for the potential role of monetary policy in affecting the business cycle.

The previous paragraph describes what is called the "money view" of monetary policy transmission. It is not often noted that while the multiple expansion of bank deposits and the money supply occur, a simultaneous multiple expansion of bank credit (securities and loans) also occurs.[1] That is, the process of expanding the money supply and lowering the interest rate goes hand-and-glove with the expansion of bank credit; those adjustments occur simultaneously rather than sequentially. Because empirical evidence does not provide strong and robust evidence on the importance of the money view, other researchers now explore the "credit view" of monetary policy transmission. The credit view proposes additional endogenous channels to supplement the money view.

One strand of the credit-view literature, called the lending channel, argues that injecting reserves into the banking system kicks off a multiple expansion of deposits and credit (e.g., loans) and that the increase in the supply of loans lowers interest rates. The falling interest rates due to the increased supply of loans supplements the money view's story about interest rates. That is, the injection of reserves comes through an open market purchase of government bonds that raises the price of and lowers the interest rate on bonds. More explicitly, the open market

[1] See Brunner and Meltzer (1964, 1966, 1968) and Burger (1971) for a discussion of the bank credit multiplier.

operation typically affects the short end of the term structure of interest rate. The bank loan market reflects the whole spectrum of interest rates from short- to long-term. Assuming that the term premium does not change, then the whole term structure of interest rates falls. In other words, the long and short rates of interest fall by the same amount, more or less. No reason exists for the interest rate on loans to fall by an additional amount because of an increase in the supply of loans. The lending channel, in our estimation, does not differ from the money view.[2] Rather the argument of the lending channel examines more carefully how the money view generates the interest rate effects.

A second strand of the credit view, called the balance sheet channel, argues that injecting reserves into the banking system also kicks off the same multiple expansion of deposits and credit (e.g., loans) and that the increase in the supply of loans lowers interest rates. To this point, the story is the same. Now, the balance sheet channel considers the effects of higher interest rates on the financial conditions of borrowers. That is, lower interest rates improve firms' cash flows, lower firms' debt service, and boost firms' collateral values. As a consequence, the improved financial positions of the firms lower their associated risk premiums and further lower the interest rate. Continuing the discussion in the prior paragraph, a lower risk premium lowers the term premium in the term structure of interest rates, allowing the long rates to fall more than the short rates.

Within a monetary union, such as the U.S., monetary policy cannot and should not attempt to control regional economic performance, such as to stimulate one region while at the

[2] Since the multiple expansion process requires both the asset and liability sides of the balance sheet to adjust, the money view (i.e., increasing deposits) and the lending view (i.e., increasing loans) reflect the same process. That is, it makes little sense to argue sequentially that increasing the monetary base leads to multiple expansion of deposits and the money supply that then lowers the interest rate and raises the quantity of loans. Rather the increase in the quantity of deposits and loans occurs simultaneously.

same time cooling off another region. That does not preclude, however, the possibility that the effect of aggregate monetary policy implies different regional implications. Different regions within a monetary union exhibit different structures and structurally different regional economies respond differently to the impulses of aggregate monetary policy.

Several research papers (Quah 1996; Carlino and Sill 2001; Kouparitsas 2001) consider the similarities and differences between regional business cycles within the U.S. Aggregation across regional cycles produces the aggregate business cycle. Thus, synchronized movements in regional business cycles produce similar movement in the aggregate business cycle, while unsynchronized movements in regional business cycles offset each other to a large extent.

How can one rationalize differences in regional business cycles? Owang and Wall (2003) argue "… states and regions differ … in the characteristics that determine growth rates …. (such as) physical geography and endowments, industry composition, income levels, fiscal policies, regulatory and legal environments, accessibility to foreign markets, etc." That statement provides a "Mulligan stew" of possible explanations, but with little intuition as to how they can lead to regional differences in the business cycle. Rather, they represent regional differences, in and of themselves.

We offer an explanation, focusing on those factors that play an important role in the current discussions about the geographic propagation of monetary policy – large and small firms and large and small banks. Firms need sources of financing; the flow of funds accounts indicate that most firm financing comes through banks loans. Large firms can access national and international markets to service their financing needs. That is, they can issue new stock, bonds, or commercial paper. Large firms can also borrow funds from banks as well. This occurs, however, in national and international lending markets serviced by large banks. Such lending

from large banks to large firms does not possess any regional character, because large firms move nationally and internationally to obtain the best terms that they can. In contrast, small firms generally must seek funds from small banks in regional or local markets. Consequently, the regional transmission of monetary policy can importantly affect the regional business cycle, through small and medium-sized banks and small and medium-sized firms.

The historical development of the banking sector in the U.S. followed a much different path than in most other countries. The founding fathers' concern about preventing concentrations of power generated a diffused banking system with many banks and numerous geographic restrictions of banking activities. It was not until the last quarter of the 20th century that those geographic restrictions began to fall. Although the U.S. banking system now permits full interstate banking, the future of banking in the U.S. probably will continue to exhibit a large number of regional and local banks that serve the needs of small- and medium-sized businesses.

This paper examines the effects of national monetary policy, measured by changes in the monetary base, on national, regional, and state credit availability, measured by bank loans. We start by considering the linkages between the monetary base and bank loans at the national level to provide a benchmark with which to judge our regional and state-level findings. In that sense our work falls into the literature associated with the lending channel, which we view as an elaboration of the money view (see footnote 2).

2. Review of the Relevant Literature

Regional economists have considered the effects of national monetary policy on regional economies, going back to the 1950s. Bias (1992) provides a summary of that work, dividing it into two categories – those efforts that consider the effect of national monetary policy (e.g., the national money supply) on regional financial variables (e.g., the regional money supply) and

those that consider the effect of national monetary policy on regional non-financial variables (e.g., regional personal income or regional employment). The former analysis is a proper subset of the latter analysis. That is, for national monetary policy to affect regional economic (non-financial) variables such as personal income or employment probably requires that national monetary policy first affects regional financial variables such as the regional money supply that then, in turn, affect those regional non-financial variables. Most of the empirical analysis that Bias (1992) cites falls into the category of national monetary policy affecting regional non-financial variables, and not into the category of national monetary policy affecting regional financial variables. Bias's research, however, falls in the former category, as does our analysis. A final category of research, not categorized by Bias, considers the effects of regional financial variables on regional non-financial variables. In sum, national monetary policy affects regional non-financial variables by first influencing regional financial variables and then those regional financial variables, in turn, alter the regional non-financial variables.

First, consider the literature on how national monetary policy affects regional non-financial variables. Most studies adopt a St. Louis reduced-form equation approach where the change (rate of growth) in regional income or employment measures are regressed onto the changes (rates of growth) in high employment federal government spending and revenue and the national money supply (Garrison and Chang 1979, Mathur and Stein 1980, 1983, Garrison and Kort 1983).[3] Those studies generally find regional differences in the effects of national monetary policy on regional non-financial variables.

More recent analyses (Carlino and DeFina 1998, 1999; Fratantoni and Schuh 2003; Owyang and Wall 2003) adopt the vector autoregressive (VAR) methodology to allow for

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[3] The regions reflect Bureau of Economic Analysis regions, except for Garrison and Kort (1983) that consider the region as the state level.

spillover effects between regions. Those authors criticize the earlier work as overlooking such regional spillover effects. For example, Carlino and DeFina argue "A shortcoming with existing studies is their attempt to measure monetary policy impacts region by region without accounting for feedback effects among regions (i.e., monetary policy directly affects region ***i***, and through trade with region ***j***, monetary policy indirectly affects region ***j***, and vice versa)." That argument misses, in our view, the special feature of the St. Louis reduced-form equation studies. To wit, such analyses capture the direct and indirect effects of fiscal and monetary policy on the variable of interest – personal income or employment. The St. Louis reduced-form equation analysis does not overlook such indirect effects. The VAR methodology, on the other hand, by allowing for alternative channels of influence automatically reduces the initial effect of national monetary policy on regional non-financial variables, since the methodology holds constant the other channels of influence.[4] The impulse response analysis, since it focuses on the long-run effects, should reintroduce both the direct and indirect effects, generating similar results to the St. Louis reduced-form analyses.

Second, consider the literature examining the effect of national monetary policy on regional financial variables. Although Bias (1992) reports a longer list of studies that consider the effect of national monetary policy on regional financial variables than on regional non-financial variables, many of the cited studies involve no empirical analysis. Moreover, those that do involve empirical analysis generally involve older data that do not incorporate more recent

[4] Sims (1972, 1976) presents the classic example. Sims (1972) shows that money causes income in a bivariate model of real GDP and the money supply. Sims (1976) introduces the interest rate as a third variable and the significance of money in explaining real GDP disappears. In other words, the money supply's effect on real GDP goes through the interest rate. So holding the interest rate constant, isolates the "direct" effect on the money supply on real GDP that does not go through the interest rate.

events in the financial sector.[5] Bias (1992) and those earlier studies find that national monetary policy affects regional financial variables in different regions differently.

Finally, McPherson and Waller (2000) provide one of the few studies of the relationship between regional financial variables and regional non-financial variables. Their study, however, does not determine whether differences exist in the effects of national monetary policy on regional non-financial variables. Rather, they provide evidence that is consistent with a bank credit channel.

Our analysis considers the effect of national monetary policy on regional financial variables. We consider the effects of changes in the monetary base on bank loans at the national, the regional, and the state levels, separately.

3. Methodology and Data

The Federal Reserve (Fed) employs the open-market-operation sword to implement monetary policy actions – no matter whether the Fed employs a Taylor rule, adopts inflation targeting, or uses some other target of monetary policy. Students in money and banking and monetary theory classes struggle through the intricacies of the multiple expansion or contraction of bank reserves and credit, once the monetary authorities carry out an open market operation. Most of U.S. banking history labored under the geographic restrictions on bank operations, restricting banking and branching activities to fall within state-level regulatory silos. That is, once an open market operation occurs from the open market desk at the Federal Reserve Bank of New York, that impulse must transverse throughout the U.S. economy finding its way across state boundaries. In addition, many states further restricted banking and branching activities within a state's

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[5] Samolyk (1991) has the most recent publication date followed by Miller (1978). One important event that appears in the more recent data is the absolute decline in total bank reserves that begins in January 1994 and continues through the present.

boundary (i.e., limited and unit branching states). The Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994 broke the back of such geographic restrictions, although full implementation of the contents of the Act did not occur until 1996. Finally, the United States still experiences the transition toward a nationwide banking system.[6]

We employ data from three different sources. First, we use monthly data reported by the Board of Governors of the Federal Reserve System on aggregate reserves, the monetary base, and total loans and leases of the banking system.[7] That data allow the disaggregation of total loans and leases into holdings by large and small domestic banks and foreign banks, albeit with shorter sample periods. Second, we employ annual data on a state-by-state basis reported at the web site of the Federal Deposit Insurance Corporation. Those state level data, of course, can aggregate into the eight Bureau of Economic Analysis regions. Finally, we collect the quarterly Report on Condition and Income (Call Report) data posted on the Federal Reserve Bank of Chicago web site on a bank-by-bank basis[8]. Those data aggregate into either state-level or the eight BEA regional-level data. In all cases, we explore the size and timing of national monetary policy actions, as measured by the monetary base, on the national, regional, or state financial variables, as measured by bank loans.

Our analysis proceeds as follows. We explore how an injection of the monetary base by open market operation wends its way through the nation, the BEA regions, or the states. For example, how quickly does an open market purchase that alters the monetary base begin to affect

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[6] The ultimate structure in U.S. banking is path dependent. That is, having started with a highly disaggregated banking structure, the final nationwide banking system will still exhibit many more banks than most other countries in the world, where they did not begin with such a disaggregated banking system.

[7] The data come from the historical compilation of releases H3 and H8 from the Board of Governors of the Federal Reserve System.

[8] The address is http://www.chicagofed.org/economicresearchanddata/data/bhcdatabase/bhcdatabase.cfm.

bank loans in New York, California, Texas, or Illinois, given that the impulse originated from the Open Market Operations Desk at the New York Federal Reserve Bank?

Other authors have employed the same data set to examine similar issues. Kashyop and Stein (2000) explore the monetary transmission mechanism, searching for evidence to support the bank-lending channel of monetary policy implementation. They use the quarterly Call Report data, but examine how the effects differ by bank size, rather than geographic location. Ashcraft and Campello (2002) consider the balance sheet channel on monetary policy implementation. Employing quarterly Call Report data, they determine the differential responses of small banks affiliated with the same bank holding company, but located in different geographic regions. Summer (2002) investigates how bank equity interacts with bank lending and real activity. He also uses the Call Report data and performs his vector autoregressive analysis at the national and the eight census regions levels.

Assuming that monetary policy possesses real effects in the short run, differences in the size and timing of monetary policy changes across regions and states can generate unequal outcomes at the regional and state levels to national monetary policy actions. We expect that some regions and states participate much later and/or less vigorously in response to the Federal Reserve's monetary policy actions. Moreover, since Milton Friedman argued that the lags in the effect of monetary policy exhibit long, 3 to 8 quarters, and variable patterns, we anticipate differences in timing patterns between regions and states.

4. Model and Results

We explore how changes in monetary policy, represented by changes in the monetary base, affect the quantity of bank loans across geographic regions and across banks. We assume that the monetary base exogenously affects the quantity of bank loans and employ an estimation

technique that captures both the direct and indirect effects of changes in the monetary base on the quantity of bank loans. The general estimating equation is as follows:

$$\Delta LNS_t = \alpha + \sum_{i=0}^{n} \beta_i \Delta MB_{t-i} + \varepsilon_t \ , \qquad (1)$$

where ΔLNS equals the change in bank loans, ΔMB equals the change in the monetary base, α and β_i*'s* equal the models parameters that are estimated, and ε equals a well-behaved random error. The Appendix provides detail on data sources and definitions.

Equation (1) determines the effects of changes in current and lagged changes in the monetary base on the current change in bank loans. Some may question why no other control variables appear in equation (1), for example, lagged changes in bank loans. By including such control variables, the coefficients of changes in the monetary base exclude any effects those changes in the monetary base produce on the change in bank loans that operate through those control variables. Such effects exhibit an indirect path. By excluding control variables, the coefficients of the change in the monetary base capture both the direct and indirect effects on the change in bank loans.

Others may question why equation (1) uses the monetary base rather than bank reserves. That is, the money view argues that increases in bank loans follow increases in bank reserves. If bank reserves do not rise, then bank loans cannot increase, according to this argument. But, the banking system and the rest of the world (both domestic and foreign residents) both place demands on the monetary base – banks demand reserves while the rest of the world demands currency. The Federal Reserve System supplies the monetary base to the economy; the banks and the rest of the world demand that monetary base. As a consequence, bank reserves reflect endogenous decisions of the banks and the rest of the world. That observation suggests that changes in the monetary base probably more closely represent exogenous policy adjustments

than does the change in bank reserves. Nonetheless, we ran equation (1) where changes in bank reserves replace changes in the monetary base. The results prove significant, but much less frequently and often with "wrong" and counterintuitive (i.e., negative) signs. Examining the time-series plot of total bank reserves reveals a dramatic fact. To wit, total bank reserves decline absolutely since January 1994.[9]

The econometric analysis of equation (1) employs three different frequencies of data – monthly, annual, and quarterly. The first set of regressions use the monthly data reported by the Federal Reserve System and considers the linkages between changes in the monetary base and changes in bank loans for the entire banking system as well as for domestic and foreign banks, separately, and for large and small domestic banks, separately. These regressions provide a benchmark against which to evaluate our regional regression results. Next, we employ annual Federal Deposit Insurance Corporation (FDIC) data on a state-by-state and Bureau of Economic Analysis (BEA) region basis. The Appendix defines which states are in which BEA region. Lastly, we use quarterly "Call Report" data posted at the Federal Reserve Bank of Chicago web site aggregated across individual banks to the state and BEA region levels.

Aggregate Monthly Data: Findings

Table 1 reports the results from estimating equation (1) with nationwide bank loans for all banks, domestic banks, large domestic banks, small domestic banks, and foreign banks. Because of data availability, the regressions for all banks run from January 1959 to March 2003. The regressions

[9] Although this dramatic change in trend somewhat postdates the well-known problems with using M1 and M2 as intermediate targets of monetary policy, the absolute decline in total reserves reflects the structural change in bank balance sheets as non-transactions deposits, which do not carry reserve requirements, rise dramatically relative to transactions deposits, which do have reserve requirements. In sum, the monetary base (i.e., MB or M0) measure of the money stock may now possess the closest link to economic activity. But this issue constitutes a different paper.

for domestic and foreign banks run from January 1973 to March 2003. Finally, the regressions for large and small domestic banks run from January 1988 to March 2003.[10]

The results for the total bank loans show that the coefficients of the contemporaneous and first-, second- and fourth-lagged changes in the monetary base exhibit positive and significant signs; the third-lagged term is not significant. Thus, a one million dollar increase in the monetary base in one month leads to almost a $6 million cumulative increase in bank loans over five months.

Now, consider the regression for small domestic banks. Each of the change in monetary base variables exhibits a significantly positive coefficient, increasing the monetary base leads to increases in small domestic bank loans. From a quantitative point of view, a million dollar increase in the monetary base today leads to a total increase of small domestic bank loans of just over six million dollars after five months, where the cumulative increase is spread nearly evenly across the five months.

The results for large domestic banks differ from small domestic banks in that the contemporaneous change in the monetary base exhibits a significantly negative coefficient. While this result seems counterintuitive, it may only reflect reverse causality. That is, when large banks loans decrease in one month, the Federal Reserve increases the monetary base the next month. Concerning the lagged changes in the monetary base, the large banks only possess significant and positive coefficients on the first and fourth lags. The second and third lags do not have significant coefficients. Moreover, the cumulative effect of the significant positive coefficients imply that a million increase in the monetary base leads to a three million dollar increase in loans after five months, excluding the significant, negative contemporaneous effect.

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[10] We include the contemporaneous and four lags of the change in the monetary base. Stock and Watson (1999) report that including four lags provides a good lag structure for most time-series analysis.

Finally, consider the response of foreign bank loans to changes in the monetary base. The significantly negative coefficient on the contemporaneous change in the monetary base also appears in the regression for foreign banks as it does for large domestic banks. Also, the coefficients of the lagged changes in the monetary base prove significantly positive, except for the third lag, which is insignificant. Moreover, the cumulative effect of the significant coefficients implies that a million dollar increase in the monetary base leads to just over a million dollar increase in foreign bank loans, ignoring the significant, negative contemporaneous coefficient. These findings suggest that foreign banks more closely match the large domestic bank results.

The size of the effects of changes in the monetary base on changes in loans across the various bank classifications hints at another observation. To wit, the responsiveness of loans to the monetary base increased in the late 1980s relative to earlier periods. That is, the sum of the coefficients across the small and large domestic bank regressions equals the coefficients in the domestic bank regressions, using the same sample periods. Since we use different sample periods, those coefficients do not conform to this equality. In fact, the sum of the coefficients in the small and large domestic bank regressions typically exceed the coefficients in the domestic bank regression, implying that loans responded more to changes in the monetary base after 1988. The magnitudes of the effects in the domestic and foreign bank regressions do generally match the magnitudes of the coefficients in the total bank regression, indicating that no increase in responsiveness of loans to the monetary base occurs after 1973.

In sum, changes in the monetary base produce reasonably quick changes in bank loans. Such changes in the monetary base have the largest and most persistent effect on small domestic banks and the smallest effect on foreign banks. Some evidence exists that is consistent with the

Federal Reserve responding to the loan experience of large domestic, and possibly foreign, banks.

Regional Annual Data: Results

Table 2 reports the results of estimating equation (1) on a state-by-state basis using the annual data from the FDIC. The results for the USA constrain the coefficients across all states to equal each other, forming a pooled regression where the states are the individual units. In that regression, the coefficients of the contemporaneous and first-lagged change in the monetary base show positive signs, although only the coefficient on the first-lagged change in the monetary base is significant. Thus, a one million dollar increase in the monetary base in one year leads to a $70,000 increase in loans in each state and a total increase in loans across all states of $3.57 million in the following year.[11]

The qualitative results provide a mixed picture. For the coefficients of the contemporaneous change in the monetary base, 25 of the individual state coefficients exceed zero while 26 fall below zero. Moreover, 12 of these coefficients prove significant with 9 positive and 3 negative. For the first-lagged change in the monetary base, 38 of the individual state coefficients exceed zero while 13 fall below zero. In this case, 21 coefficients prove significant with 18 positive and 3 negative. Those findings prove consistent with the pooled results, where both the coefficients of the contemporaneous and lagged changes in the monetary base exceed zero, but only the coefficient of the lagged change in the monetary base is significantly positive.

[11] Although the coefficient of the contemporaneous change in the monetary base is not significant, that coefficient implies that a one-million dollar increase in the monetary base in a year leads to a $14,000 increase in loans and a total increase in loans across all states of $714,000 in the same year. This gives a cumulative effect of $4.284 million from the contemporaneous and first-lagged coefficients.

Table 3 reports the results of estimating equation (1) using the annual FDIC data on a region-by-region basis. We perform these regional regressions in two different ways. The regressions, identified as using pooled regional data, pool the state level bank loan data in each region and impose the constraint that the coefficients equal each other across the states within the region under consideration. Thus, the USA regression matches nearly identically the USA regression in Table 2. The regressions identified as the aggregate regional data sum the state level bank loan data into regional bank loan aggregates. In that sense, the aggregate regional data regressions conform in spirit to the state-by-state regressions in Table 2. Finally, the USA regression using the aggregate regional data imposes the constraint that the coefficients equal each other across regions in a pooled regression based on the aggregate regional data.

The new USA regression that pools the data across regions yields findings similar to the USA regression that pools the data across states. That is, the coefficients of the contemporaneous and first-lagged change in the monetary base are both positive, although only the coefficient of the lagged change in the monetary base is significant. Here, a one million dollar increase in the monetary base leads to a $443,000 increase in loans in each region and a total increase of loans of $3.54 million the next year.[12]

The qualitative results show a more consistent pattern. The outcomes for the pooled regional and the aggregate regional data match each other. That is, for the coefficients of the contemporaneous change in the monetary base, 3 of the individual region coefficients exceed zero while 5 fall below zero. Moreover, 3 of these 8 coefficients prove significant with 2 positive and 1 negative. For the first-lagged change in the monetary base, 7 of the individual region

[12] Once again, although the coefficient of the contemporaneous change in the monetary base is not significant, that coefficient implies that a one-million dollar increase in the monetary base in a year leads to a $91,000 increase in loans and a total increase in loans across all states of $728,000 in the same year. This gives a cumulative effect of $4.268 million from the contemporaneous and first-lagged coefficients.

coefficients exceed zero while 1 falls below zero. In this case, 4 coefficients prove significant with all positive. Focusing on the coefficient of the first-lagged change in the monetary base, the Great Lakes, Mideast, and Southeast regions exhibit larger positive effects than the USA findings. Based on the state-by-state findings, Ohio and Illinois probably contribute to the magnitude of the coefficient of the first-lagged change in the monetary base of the Great Lakes region, while New York plays a similar role in the Mideast region and North Carolina and Georgia play that role in the Southeast region.

What do the findings in Tables 2 and 3 tell us? The regression pooled across all states supports the statement that changes in the monetary base affect bank loans with a one-year lag. Disaggregating to the regional and then the state levels weaken such a conclusion. That is, the observed patterns both qualitatively and quantitatively reveal more deviations from the regression findings from pooling across all states.[13]

Regional Quarterly Data: Results

Table 4 reports the results of estimating equation (1) on a state-by-state basis using the quarterly call report data. Once again, the results for the USA constrain the coefficients across all states to equal each other, forming a pooled regression where the states are the individual units. In that regression, the coefficients of the contemporaneous and one-, three-, and four-lagged changes in the monetary base show positive signs; the coefficient on the second-lagged change in the monetary base is not significant. Thus, a one million dollar increase in the monetary base in one quarter leads to a $450,000 increase in loans in each state and a total increase in loans across all states of almost $23 million over the five quarters.

[13] The regional results for the Far West prove most unexpected. Both coefficients of the changes in the monetary base are negative with the coefficient of the contemporaneous change in the monetary base significantly negative.

The qualitative results exhibit an extremely strong and consistent pattern across states. That is, for the coefficients of the fourth-lagged change in the monetary base, all 51 of the individual state and District of Columbia coefficients exceed zero. Moreover, 49 of these coefficients prove significant. Weaker findings emerge for the contemporaneous, and first- and second-lagged changes in the monetary base, where 48 (3 significant), 47 (6 significant), and 31 (0 significant) coefficients fall below zero, respectively, while 3 (0 significant), 4 (0 significant) and 10 (0 significant) exceed zero. For the third-lagged change in the monetary base, 47 coefficients exceed zero, while 4 coefficients fall below zero. In this last case, 2 coefficients prove significant – all positive.

Table 5 reports the results of estimating equation (1) using the quarterly call report data on bank loans on a region-by-region basis. As before, we perform these regional regressions in two different ways. The regressions identified as using pooled regional data pool the state level bank loan data in each region and impose the constraint that the coefficients equal each other across the states within the region under consideration. Thus, the USA regression is identical to the USA regression in Table 4. The regressions identified as the aggregate regional data sum the state level bank loan data into regional bank loan aggregates. In that sense, the aggregate regional data regressions conform in spirit to the state-by-state regressions in Table 4. Finally, the USA regression using the aggregate regional data imposes the constraint that the coefficients equal each other across regions in a pooled regression based on the aggregate regional data.

The new USA regression that pools the data across regions yields findings similar to the USA regression that pools the data across states. That is, the coefficients of the contemporaneous and first-lagged changes in the monetary base are both significantly negative, while the coefficients of the third- and fourth-lagged changes are both significantly positive. Here, a one

million dollar increase in the monetary base leads to just over $2.7 million increase in bank loans in each region and a total increase of bank loans of just under $22 million after five quarters.

The qualitative results show similar, but not identical, outcomes for the pooled regional and the aggregate regional data. That is, for the coefficients of the fourth-lagged change in the monetary base, all 8 individual regional coefficients significantly exceed zero. For the contemporaneous, first-, and second-lagged changes in the monetary base, all coefficients exhibit a negative sign; none are significant in the aggregate regional regressions, while 5 of the coefficients in the pooled regional regressions prove significant – one for the contemporaneous term and 4 for the first-lagged term. For the third-lagged change in the monetary base, the coefficients exhibit positive signs in all cases. No coefficient proves significant in the aggregate regional regressions, while one proves significant in the pooled regional regressions.

What do the findings in Tables 4 and 5 tell us? At both the state and regional levels, a robust pattern emerges where changes in the monetary base significantly and positively affect bank loans with a four-quarter lag. That is, all of the action appears in the four-quarter lag and not at shorter frequencies.

Next, we rank the regional results based on the magnitude of the coefficient of the fourth-lagged change in the monetary base. The regressions for the aggregate regional data produce the following ranking from largest to smallest: Southeast, Mideast, Great Lakes, Far West, Plains, New England, Southwest, and Rocky Mountain.[14] Once again, the Southeast, Mideast, and Great Lakes regions exhibit a magnitude on the coefficient of the fourth-lagged change in the monetary base that exceeds that coefficient in the USA regression that estimates a pooled regression across

[14] The pooled regional regressions produce a ranking that moves the Southeast from first to third place and the Southwest from eighth to sixth in the rankings, where all other regions including the USA maintain their relative positions in the ranking.

the regions. Further, certain states within each region exhibit the largest effects. For the USA as a whole, the largest effects occur, in order, in New York, North Carolina, Ohio, Illinois, California, and Minnesota. Within each region, the states with the largest effects are as follows: Southeast (North Carolina), Mideast (New York), Great Lakes (Ohio), Far West (California), Plains (Minnesota), New England (Rhode Island), Southwest (Texas), and Rocky Mountain (Utah).[15]

5. Conclusion

This paper examines the magnitude and timing of the effects of changes in the monetary base on the aggregate and regional changes in bank loans within the United States. We consider both Bureau of Economic Analysis (BEA) regions and individual states and the District of Columbia for our regional analysis. The empirical analysis provides some insight on the bank-lending channel of monetary policy.

We employ data from three different sources. First, we use monthly data reported by the Board of Governors of the Federal Reserve System on the monetary base and total loans and leases of the banking system. That data allow the disaggregation of total loans and leases into holdings by large and small domestic banks and foreign banks. Second, we employ annual data on a state-by-state basis reported at the web site of the Federal Deposit Insurance Corporation. Those state level data, of course, can aggregate into the eight Bureau of Economic Analysis regions. Finally, we collect the quarterly Report on Condition and Income (Call Report) data posted on the Federal Reserve Bank of Chicago web site on a bank-by-bank basis. Those data aggregate into either state-level or the eight BEA regional-level data. In all cases, we explore the

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[15] The finding that Rhode Island possesses the biggest effect in the New England region and that North Carolina possesses the biggest effect in the Southeast region may reflect the consolidation of banking activities that occurred in response to the Interstate Banking and Branching Efficiency Act of 1994, which permitted banks to report their financials on an aggregated basis in one state. Thus, the consolidation of balance sheet accounts by Fleet Bank in Rhode Island and Nations Bank (now Bank of America) in North Carolina may contribute to the size and significance of those regional coefficients.

size and timing of national monetary policy actions, as measured by the monetary base, on the national, regional, or state financial variables, as measured by bank loans.

Our findings include the following. For the monthly data, changes in the monetary base produce reasonably quick changes in bank loans. Such changes in the monetary base have the largest and most persistent effect on small domestic banks and the smallest effect on foreign banks. The timing of the aggregate monthly data stands in contrast to the timing effects for our other data sets at longer frequencies – that is, the quarterly and annual data. Moreover, the monthly results also hint at the possibility that the responsiveness of bank loans to the monetary base increased after 1988. For the annual FDIC data, the regression pooled across all states supports the conclusion that changes in the monetary base affect bank loans with a one-year lag. Disaggregating to regional and then state levels weakens such a conclusion. That is, the observed patterns both qualitatively and quantitatively reveal more deviations from the regression findings from pooling across all states. For the quarterly call report data, both the state and regional regressions identify a robust pattern, where changes in the monetary base significantly and positively affect bank loans with a four-quarter lag. That is, all of the action appears in the four-quarter lag with little activity appearing at any shorter intervals.

Unresolved Issues

Several additional issues remain unresolved. This section briefly enumerates the additional analysis that we are performing. First, footnote 15 noted that consolidation of financial statements after the passage of the Interstate Banking and Branching Efficiency Act of 1994 may have polluted our findings. We have rerun our regression analysis terminating the sample with 1994 data. The results generally match the findings with the longer sample, although the significance of the results falls. That is, the signs and magnitudes of the coefficients do not

change too much, but more coefficients prove insignificant. Viewed differently, the inclusion of the post-1994 data strengthens the findings.

Second, our strongest, most-persistent result emerges for the quarterly data, where the fourth-lagged effect proves strongly significant across all regions and nearly all states. We considered extending the lags to five, six, and then eight lags. Once again, our findings prove extremely robust, but troubling. To wit, the coefficients on the lagged terms turn significantly negative at lag five. Overall, lags five and six appear significantly negative, while the second and third lags now more frequently prove significantly positive. At the moment, those findings remain a mystery.

Third, while the magnitudes of the effects seem reasonably consistent within a given sample when we disaggregate the regression analysis, the cross-sample magnitudes give us pause. For example, we do not have a reasonable explanation as to why the magnitudes of the regressions on the annual data give smaller effects than the regressions on the quarterly data. Clearly, the regressions are not nested. That is, if we regressed the quarterly change in loans onto the contemporaneous change and fourth lagged change in the monetary base, then we could aggregate across four consecutive quarters to generate something like our annual regressions. We would generate the annual change in loans regressed onto the contemporaneous annual change and the first lagged annual change in the monetary base. If we merely aggregated the quarterly regressions by adding up four consecutive quarterly regressions, we get the annual change in loans regressed on five annual changes in the monetary base, where each of the annual changes in the monetary base begins at a different quarter. And the larger magnitude occurs for the quarterly regression and not for the annual regressions, which seems intuitively backwards.

Finally, our regression analysis does not enter the debate over how to identify the bank lending versus balance sheet channels of the credit view of monetary policy transmission. That is, we do not attempt to identify whether the change in loans reflects shifts in the demand or supply of loans. We note in passing that the extent to which credit rationing due to adverse selection problems exists in the market for bank lending, changes in loans will reflect shifts in the supply of bank loans, supporting the lending channel.

Appendix:

Data Sources:

Data from the Board of Governors of the Federal Reserve System:

http://www.federalreserve.gov/releases/

H3: Aggregate Reserves of Depository Institutions and the Monetary Base, Historical Data

Table 1: Aggregate Reserves of Depository Institutions Adjusted for Changes in Reserve Requirements

Total Reserves, Seasonally Adjusted (monthly), 1959:1 to 2003:3

Monetary Base, Seasonally Adjusted (monthly), 1959:1 to 2003:3

H8: Assets and Liabilities of Commercial Banks in the United States, Historical Data

Loans and leases in bank credit

All Commercial Banks, Seasonally Adjusted (monthly), 1959:1 to 2003:3

Domestically Chartered Commercial Banks, Seasonally Adjusted (monthly), 1973:1 to 2003:3

Large Domestically Chartered Commercial Banks, Seasonally Adjusted (monthly), 1988:1 to 2003:3

Small Domestically Chartered Commercial Banks, Seasonally Adjusted (monthly), 1988:1 to 2003:3

Foreign-Related Institutions, Seasonally Adjusted (monthly), 1973:1 to 2003:3

Data from the Federal Deposit Insurance Corporation:

http://www2.fdic.gov/hsob/index.asp

Commercial Bank Reports

Total Loans and Leases, All States and the District of Columbia, 1966 to 2001

Data from the Report on Condition and Income (Call Report):

http://www.chicagofed.org/economicresearchanddata/data/bhcdatabase/index.cfm

Total Loans, Net of Allowance and Reserve, RCFD2125, (quarterly), 1976:I to 2002:III

Regional Identification:

Bureau of Economic Analysis (BEA) Regions:

New England Region
- Connecticut
- Maine
- Massachusetts
- New Hampshire
- Rhode Island
- Vermont

Mideast Region
- Delaware
- District of Columbia
- Maryland
- New Jersey
- New York
- Pennsylvania

Great Lakes Region
- Illinois
- Indiana
- Michigan
- Ohio
- Wisconsin

Plains Region
- Iowa
- Kansas
- Minnesota
- Missouri
- Nebraska
- North Dakota
- South Dakota

Southeast Region
- Alabama
- Arkansas
- Florida
- Georgia
- Kentucky
- Louisiana
- Mississippi
- North Carolina
- South Carolina
- Tennessee
- Virginia
- West Virginia

Southwest Region
- Arizona
- New Mexico
- Oklahoma
- Texas

Rocky Mountain Region
- Colorado
- Idaho
- Montana
- Utah
- Wyoming

Far West Region
- Alaska
- California
- Hawaii
- Nevada
- Oregon
- Washington

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Table 1: Monetary Base and Loans: National, Monthly Data

	Constant	ΔMB	ΔMB(-1)	ΔMB(-2)	ΔMB(-3)	ΔMB(-4)
Loans: Total (1959:1 to 2003:3)						
ΔLNS	24.90*	-0.83*	2.51*	1.45*	-0.16	2.84*
	(5.02)	(-2.45)	(6.96)	(3.67)	(-0.34)	(5.72)
Loans: Domestic Banks (1973:1 to 2003:3)						
ΔLNS	27.66*	-0.05	2.15*	1.11**	-0.39	2.09*
	(3.43)	(-0.12)	(5.36)	(2.52)	(-0.77)	(3.76)
Loans: Large Domestic Banks (1988:1 to 2003:3)						
ΔLNS	23.81	-0.97**	1.19*	0.39	-0.88	1.80*
	(1.01)	(-2.37)	(2.73)	(0.80)	(-1.63)	(2.80)
Loans: Small Domestic Banks (1988:1 to 2003:3)						
ΔLNS	-72.54*	1.28*	1.35*	1.21*	0.96*	1.25*
	(-7.04)	(7.20)	(7.11)	(5.76)	(4.08)	(4.46)
Loans: Foreign Banks (1973:1 to 2003:3)						
ΔLNS	9.56*	-0.88*	0.26*	0.24**	0.17	0.58*
	(5.32)	(-10.47)	(2.91)	(2.42)	(1.52)	(4.66)

Note: We employed STATA8 to generate the regression results. The symbols are defined as follows: ΔLNS equals the change in loans and ΔMB(-i) equals the i-th lag of the change in the monetary base. Numbers in parentheses under coefficient estimates are t-values.

* means significantly different from zero at the 1-percent level.
** means significantly different from zero at the 5-percent level.

Table 2: Monetary Base and Loans: State, Annual Data, 1966 to 2001

	Constant	ΔMB	ΔMB (-1)
USA			
ΔLNS	758	0.01	0.07*
	(1.68)	(0.86)	(3.95)
Alabama			
ΔLNS	-2227	0.27*	0.09
	(-1.41)	(4.57)	(1.52)
Alaska			
ΔLNS	51	0.002	0.0004
	(0.61)	(0.54)	(0.12)
Arizona			
ΔLNS	-109	-0.06**	0.13*
	(-0.16)	(-2.41)	(4.95)
Arkansas			
ΔLNS	285	0.01	-0.0009
	(1.37)	(1.71)	(-0.11)
California			
ΔLNS	2,830*	-1.01*	-0.30
	(3.79)	(-3.68)	(-1.02)
Colorado			
ΔLNS	26	0.01	0.04**
	(0.05)	(0.66)	(1.97)
Connecticut			
ΔLNS	637	-0.03	-0.01
	(0.75)	(-1.04)	(-0.20)
Delaware			
ΔLNS	2,722**	-0.09	0.12**
	(1.97)	(-1.82)	(2.24)
District of Columbia			
ΔLNS	449	-0.02	-0.01
	(1.47)	(-1.69)	(0.84)
Florida			
ΔLNS	3,640	0.02	-0.19
	(1.35)	(0.23)	(-1.78)
Georgia			
ΔLNS	-2,141	-0.21	0.59*
	(-0.61)	(-1.64)	(4.31)
Hawaii			
ΔLNS	345	-0.01	0.02
	(1.51)	(-1.56)	(1.94)
Idaho			
ΔLNS	-13	-0.002	0.005
	(-0.04)	(-0.15)	(0.39)
Missouri			
ΔLNS	1,009	0.07	-0.06
	(0.95)	(1.75)	(-1.56)
Montana			
ΔLNS	140	0.008**	-0.002
	(1.44)	(2.22)	(-0.67)
Nebraska			
ΔLNS	168	0.01	0.02*
	(1.31)	(1.93)	(3.15)
Nevada			
ΔLNS	-488	-0.02	0.10*
	(-0.79)	(-0.81)	(4.11)
New Hampshire			
ΔLNS	-337	0.03**	0.02
	(-1.14)	(2.58)	(1.80)
New Jersey			
ΔLNS	1,236	-0.02	-0.01
	(0.65)	(-0.28)	(-0.19)
New Mexico			
ΔLNS	128	0.003	0.002
	(0.75)	(0.56)	(0.36)
New York			
ΔLNS	1,050	-0.17	0.66**
	(1.37)	(-0.62)	(2.20)
North Carolina			
ΔLNS	-2,470**	1.36*	1.11**
	(-2.10)	(3.16)	(2.42)
North Dakota			
ΔLNS	-143	-0.01	0.04*
	(-1.07)	(-1.62)	(7.48)
Ohio			
ΔLNS	-1,885	0.47*	0.22
	(-0.47)	(3.19)	(1.41)
Oklahoma			
ΔLNS	139	0.01	0.02
	(0.41)	(1.07)	(1.81)
Oregon			
ΔLNS	-223	-0.05	0.09*
	(-0.28)	(-1.71)	(2.93)
Pennsylvania			
ΔLNS	6,503	-0.15	-0.07
	(1.79)	(-1.15)	(-0.50)

Table 2: Monetary Base and Loans: State, Annual Data, 1966 to 2001 (continued)

	Constant	ΔMB	ΔMB (-1)			Constant	ΔMB	ΔMB (-1)
Illinois					**Rhode Island**			
ΔLNS	606	0.31*	0.05		**ΔLNS**	-1,814	-0.01	0.38*
	(0.30)	(4.12)	(0.66)			(-0.56)	(-0.04)	(2.97)
Indiana					**South Carolina**			
ΔLNS	1,647	-0.03	0.07		**ΔLNS**	179	0.01	0.01
	(1.25)	(-0.62)	(1.27)			(0.39)	(0.63)	(0.52)
Iowa					**South Dakota**			
ΔLNS	531*	0.01	0.002		**ΔLNS**	144	0.06**	0.003
	(2.81)	(1.53)	(0.29)			(0.19)	(2.13)	(0.11)
Kansas					**Tennessee**			
ΔLNS	287	-0.002	0.02*		**ΔLNS**	1,514	0.04	-0.02
	(1.50)	(-0.36)	(3.19)			(1.49)	(1.06)	(-0.45)
Kentucky					**Texas**			
ΔLNS	774*	0.01	0.004		**ΔLNS**	3,619	-0.10	0.01
	(2.90)	(1.23)	(0.34)			(1.18)	(-0.92)	(0.07)
Louisiana					**Utah**			
ΔLNS	421	-0.02	0.04**		**ΔLNS**	-1,060	-0.01	0.18*
	(0.87)	(-1.28)	(2.34)			(-1.23)	(-0.38)	(5.29)
Maine					**Vermont**			
ΔLNS	125	-0.009	0.01		**ΔLNS**	130**	-0.001	0.003
	(0.71)	(-1.45)	(1.51)			(2.15)	(-0.65)	(1.09)
Maryland					**Virginia**			
ΔLNS	-339	0.03	0.04		**ΔLNS**	1,727	0.09**	-0.13*
	(-0.17)	(0.42)	(0.55)			(1.87)	(2.54)	(-3.59)
Massachusetts					**Washington**			
ΔLNS	3,205	0.16	-0.33*		**ΔLNS**	523	-0.04	0.03
	(1.21)	(1.65)	(-3.22)			(0.35)	(-0.72)	(0.60)
Michigan					**West Virginia**			
ΔLNS	755	0.06**	0.09*		**ΔLNS**	518**	0.01	-0.03*
	(1.11)	(2.35)	(3.22)			(2.40)	(1.23)	(-2.97)
Minnesota					**Wisconsin**			
ΔLNS	-555	-0.22	0.40*		**ΔLNS**	1,262*	-0.01	0.04**
	(-0.15)	(-1.64)	(2.83)			(2.81)	(-0.88)	(2.00)
Mississippi					**Wyoming**			
ΔLNS	193	0.001	0.03		**ΔLNS**	20	-0.02*	0.01*
	(0.53)	(0.05)	(1.84)			(1.63)	(-3.92)	(2.93)

Note: See Table 1.

* means significantly different from zero at the 1-percent level.
** means significantly different from zero at the 5-percent level.

Table 3: Monetary Base and Loans: Regional, Annual Data, 1966 to 2001

Pooled Regional Data					Aggregate Regional Data			
	Constant	ΔMB	ΔMB(-1)			Constant	ΔMB	ΔMB(-1)
USA					**USA**			
ΔLNS	758	0.01	0.07*		**ΔLNS**	4,832	0.09	0.44*
	(1.68)	(0.86)	(3.95)			(1.71)	(0.87)	(4.01)
Far West					**Far West**			
ΔLNS	4,757*	-0.19*	-0.01		**ΔLNS**	2,850*	-1.13*	-0.06
	(3.20)	(-3.45)	(-0.16)			(4.02)	(-4.34)	(-0.20)
Great Lakes					**Great Lakes**			
ΔLNS	477	0.16*	0.09**		**ΔLNS**	2,386	0.79*	0.46
	(0.43)	(3.92)	(2.14)			(0.33)	(2.99)	(1.63)
Mideast					**Mideast**			
ΔLNS	3,510**	-0.07	0.12		**ΔLNS**	2,110((	-0.43	0.72**
	(2.07)	(-1.15)	(1.83)			(2.55)	(-1.41)	(2.25)
New England					**New England**			
ΔLNS	324	0.02	0.01		**ΔLNS**	1,946	0.14	0.07
	(0.40)	(0.79)	(0.39)			(0.77)	(1.52)	(0.74)
Plains					**Plains**			
ΔLNS	206	-0.01	0.06**		**ΔLNS**	1,441	-0.08	0.42*
	(0.34)	(-0.52)	(2.57)			(0.48)	(-0.73)	(3.60)
Rocky Mountain					**Rocky Mountain**			
ΔLNS	-141	-0.002	0.05*		**ΔLNS**	-704	-0.01	0.23*
	(-0.55)	(-0.25)	(4.66)			(-0.69)	(-0.31)	(5.82)
Southeast					**Southeast**			
ΔLNS	-1,649	0.13*	0.13**		**ΔLNS**	-1,980	1.59*	1.52*
	(-1.27)	(2.77)	(2.49)			(-1.89)	(4.12)	(3.71)
Southwest					**Southwest**			
ΔLNS	944	-0.04	0.04		**ΔLNS**	3,777	-0.15	0.17
	(1.20)	(-1.28)	(1.38)			(1.09)	(-1.16)	(1.25)

Note: See Table 1. The appendix lists the states in each region.

* means significantly different from zero at the 1-percent level.
** means significantly different from zero at the 5-percent level.

Table 4: Monetary Base and Loans: State, Quarterly Data, 1976:I to 2002:III

	Constant	ΔMB	ΔMB(-1)	ΔMB(-2)	ΔMB(-3)	ΔMB(-4)
USA						
ΔLNS	-2,129*	-0.12*	-0.15*	-0.04	0.13*	0.57*
	(-5.31)	(-3.64)	(-4.36)	(-1.01)	(3.64)	(16.36)
Alabama						
ΔLNS	-4,416**	-0.05	-0.17	-0.05	0.20	0.89*
	(-2.04)	(-0.26)	(-0.93)	(-0.25)	(1.10)	(4.72)
Alaska						
ΔLNS	-87	-0.005	-0.005	-0.001	0.004	0.02*
	(-1.51)	(-1.01)	(-1.10)	(-0.17)	(0.89)	(4.34)
Arizona						
ΔLNS	-1,277	-0.08	-0.10	-0.02	0.10	0.34*
	(-1.72)	(-1.33)	(-1.60)	(-0.28)	(1.57)	(5.29)
Arkansas						
ΔLNS	-395	-0.03	-0.04	-0.001	0.02	0.12*
	(-1.36)	(-1.10)	(-1.74)	(-0.03)	(0.90)	(4.68)
California						
ΔLNS	770	-0.58	-0.66	-0.34	-0.01	1.36*
	(0.16)	(-1.42)	(-1.62)	(-0.82)	(-0.02)	(3.25)
Colorado						
ΔLNS	-851	-0.05	-0.05	-0.01	0.04	0.21*
	(-1.82)	(-1.18)	(-1.15)	(-0.14)	(1.07)	(5.15)
Connecticut						
ΔLNS	-498	-0.05	-0.05	-0.03	0.03	0.17*
	(-0.85)	(-1.08)	(-0.91)	(-0.55)	(0.64)	(3.31)
Delaware						
ΔLNS	-2,652	-0.02	-0.05	-0.14	0.10	0.75*
	(-1.34)	(-0.14)	(-0.30)	(-0.83)	(0.59)	(4.35)
District of Columbia						
ΔLNS	93	-0.01	-0.01	-0.005	-0.004	0.002
	(1.22)	(-0.98)	(-1.19)	(-0.71)	(-0.65)	(0.23)
Florida						
ΔLNS	370	0.04	-0.30*	-0.12	0.03	0.269**
	(0.31)	(0.39)	(-2.91)	(-1.20)	(0.29)	(2.58)
Georgia						
ΔLNS	-5,066**	-0.53*	0.16	0.17	0.23	0.92*
	(-2.18)	(-2.66)	(0.81)	(0.87)	(1.16)	(4.53)
Hawaii						
ΔLNS	-376	-0.03	-0.03	-0.01	0.02	0.12*
	(-1.29)	(-1.13)	(-1.33)	(-0.57)	(0.95)	(4.77)
Idaho						
ΔLNS	-130	-0.002	0.001	0.004	0.01	0.01
	(-1.18)	(-0.28)	(0.11)	(0.39)	(0.66)	(1.32)

Table 4: Monetary Base and Loans: State, Quarterly Data, 1976:I to 2002:III (continued)

	Constant	ΔMB	ΔMB(-1)	ΔMB(-2)	ΔMB(-3)	ΔMB(-4)
Illinois						
ΔLNS	-7,164 (-1.90)	-0.37 (-1.14)	-0.08 (-0.25)	-0.08 (-0.25)	0.28 (0.86)	1.53* (4.64)
Indiana						
ΔLNS	-1,487 (-1.53)	-0.08 (-0.97)	-0.25* (-2.95)	-0.07 (-0.89)	0.18** (2.18)	0.49* (5.77)
Iowa						
ΔLNS	-718 (-1.52)	-0.04 (-1.11)	-0.04 (-0.96)	-0.03 (-0.65)	0.04 (0.88)	0.20* (4.82)
Kansas						
ΔLNS	-651 (-1.60)	-0.05 (-1.31)	-0.05 (-1.38)	-0.01 (-0.18)	0.04 (1.08)	0.18* (5.01)
Kentucky						
ΔLNS	-801 (-1.32)	-0.06 (-1.17)	-0.07 (-1.36)	-0.03 (-0.52)	0.05 (0.89)	0.26* (4.84)
Louisiana						
ΔLNS	-873 (-1.49)	-0.05 (-1.10)	-0.06 (-1.19)	-0.02 (-0.49)	0.05 (0.91)	0.25* (4.87)
Maine						
ΔLNS	-205 (-1.15)	-0.02 (-1.45)	-0.02 (-1.20)	-0.001 (-0.04)	0.02 (1.39)	0.05* (3.50)
Maryland						
ΔLNS	-1,086 (-1.37)	-0.07 (-0.97)	-0.06 (-0.88)	0.01 (0.16)	0.07 (1.03)	0.24* (3.47)
Massachusetts						
ΔLNS	233 (0.14)	0.14 (0.94)	-0.57* (-3.97)	-0.20 (-1.35)	0.06 (0.42)	0.50* (3.38)
Michigan						
ΔLNS	-3,003 (-1.66)	-0.19 (-1.23)	-0.18 (-1.18)	-0.03 (-0.22)	0.16 (1.05)	0.79* (4.97)
Minnesota						
ΔLNS	-3,910 (-1.71)	-0.13 (-0.69)	-0.38 (-1.93)	-0.04 (-0.19)	0.27 (1.36)	1.02* (5.08)
Mississippi						
ΔLNS	-579 (-1.55)	-0.04 (-1.15)	-0.05 (-1.52)	-0.02 (-0.66)	0.04 (1.39)	0.17* (5.13)
Missouri						
ΔLNS	-1,077 (-1.24)	-0.04 (-0.59)	-0.03 (-0.42)	0.05 (0.73)	-0.06 (-0.76)	0.26* (3.44)
Montana						
ΔLNS	-182 (-1.55)	-0.01 (-1.45)	-0.01 (-1.45)	0.00002 (0.00)	0.01 (1.18)	0.05* (4.77)

Table 4: Monetary Base and Loans: State, Quarterly Data, 1976:I to 2002:III (continued)

	Constant	ΔMB	ΔMB(-1)	ΔMB(-2)	ΔMB(-3)	ΔMB(-4)
Nebraska						
ΔLNS	-573 (-1.66)	-0.03 (-1.01)	-0.04 (-1.47)	-0.01 (-0.24)	0.03 (1.08)	0.15* (5.01)
Nevada						
ΔLNS	-1,121** (-2.07)	-0.03 (-0.64)	-0.08 (-1.66)	-0.002 (-0.05)	0.08 (1.75)	0.24* (5.08)
New Hampshire						
ΔLNS	-640 (-1.74)	-0.01 (-0.46)	-0.02 (-0.75)	-0.03 (-1.01)	0.04 (1.33)	0.15* (4.52)
New Jersey						
ΔLNS	-1,633 (-1.32)	-0.09 (-0.81)	-0.06 (-0.58)	0.07 (0.63)	-0.05 (-0.44)	0.41* (3.75)
New Mexico						
ΔLNS	-234 (-1.61)	-0.01 (-0.93)	-0.02 (-1.26)	-0.001 (-0.06)	0.01 (1.09)	0.06* (4.39)
New York						
ΔLNS	-1,800 (-1.57)	-1.25 (-1.27)	-1.54 (-1.57)	-0.32 (-0.33)	1.18 (1.19)	5.07* (5.03)
North Carolina						
ΔLNS	-2,320** (-2.04)	-0.70 (-0.72)	-0.89 (-0.91)	0.19 (0.19)	1.25 (1.27)	4.60* (4.62)
North Dakota						
ΔLNS	-372 (-1.86)	-0.03 (-1.68)	-0.04** (-2.07)	-0.02 (-1.26)	0.06* (3.22)	0.10* (5.72)
Ohio						
ΔLNS	-8,250 (-1.84)	-0.41 (-1.08)	-0.55 (-1.44)	-0.16 (-0.42)	0.62 (1.60)	2.07* (5.28)
Oklahoma						
ΔLNS	-761 (-1.71)	-0.04 (-1.05)	-0.05 (-1.35)	-0.02 (-0.42)	0.04 (1.14)	0.20* (5.12)
Oregon						
ΔLNS	-679 (-1.11)	-0.09 (-1.69)	0.03 (0.50)	0.02 (0.39)	0.06 (1.09)	0.11** (1.99)
Pennsylvania						
ΔLNS	-2,364 (-0.90)	-0.20 (-0.91)	-0.28 (-1.24)	-0.19 (-0.85)	0.17 (0.74)	0.90* (3.93)
Rhode Island						
ΔLNS	-4,825** (-2.18)	-0.37 (-1.94)	0.13 (0.70)	-0.03 (-0.14)	0.29 (1.52)	0.89* (4.60)

Table 4: Monetary Base and Loans: State, Quarterly Data, 1976:I to 2002:III (continued)

	Constant	ΔMB	ΔMB(-1)	ΔMB(-2)	ΔMB(-3)	ΔMB(-4)
South Carolina						
ΔLNS	-3,961 (-1.23)	-0.03 (-1.03)	-0.03 (-1.05)	-0.01 (-0.31)	0.02 (0.66)	0.12* (4.24)
South Dakota						
ΔLNS	-916 (-1.82)	-0.05 (-1.18)	-0.07 (-1.56)	0.01 (0.13)	0.07 (1.61)	0.22* (4.92)
Tennessee						
ΔLNS	-884 (-0.86)	-0.17** (-2.00)	-0.17 (-1.92)	-0.02 (-0.19)	0.10 (1.15)	0.42* (4.71)
Texas						
ΔLNS	-2,450 (-1.26)	-0.17 (-1.00)	-0.17 (-1.03)	-0.02 (-0.11)	0.05 (0.30)	0.73* (4.25)
Utah						
ΔLNS	-1,949** (-2.01)	-0.07 (-0.81)	-0.08 (-0.99)	-0.08 (-0.93)	0.12 (1.43)	0.48* (5.64)
Vermont						
ΔLNS	-139 (-1.27)	-0.01 (-1.31)	-0.01 (-1.24)	-0.004 (-0.44)	0.01 (0.90)	0.04* (4.59)
Virginia						
ΔLNS	-468 (-0.54)	0.09 (1.25)	-0.29* (-3.85)	-0.10 (-1.33)	0.05 (0.64)	0.32* (4.23)
Washington						
ΔLNS	-1,008 (-1.30)	-0.08 (-1.25)	-0.10 (-1.54)	-0.02 (-0.36)	0.08 (1.12)	0.32* (4.64)
West Virginia						
ΔLNS	-287 (-1.29)	-0.02 (-1.03)	-0.02 (-0.84)	0.001 (0.05)	0.04 (1.89)	0.05** (2.46)
Wisconsin						
ΔLNS	-1,370 (-1.37)	-0.14 (-1.65)	-0.10 (-1.22)	-0.02 (-0.27)	0.10 (1.12)	0.42* (4.81)
Wyoming						
ΔLNS	-33 (-0.38)	-0.03* (-3.81)	-0.02** (-2.13)	-0.003 (-0.35)	0.01 (1.20)	0.04* (5.75)

Note: See Table 1.

* means significantly different from zero at the 1-percent level.
** means significantly different from zero at the 5-percent level.

Table 5: Monetary Base and Loans: Regional, Quarterly Data, 1976:I to 2002:III

Pooled Regional Data						
	Constant	**ΔMB**	**ΔMB(-1)**	**ΔMB(-2)**	**ΔMB(-3)**	**ΔMB(-4)**
USA						
ΔLNS	-2,129*	-0.12*	-0.15*	-0.04	0.13*	0.57*
	(-5.31)	(-3.64)	(-4.36)	(-1.01)	(3.64)	(16.36)
Far West						
ΔLNS	-417	-0.14	-0.14**	-0.06	0.04	0.36*
	(-0.50)	(-1.90)	(-1.99)	(-0.83)	(0.54)	(4.94)
Great Lakes						
ΔLNS	-4,255*	-0.24**	-0.23**	-0.07	0.27**	1.06*
	(-3.34)	(-2.19)	(-2.14)	(-0.68)	(2.44)	(9.51)
Mideast						
ΔLNS	-4,276**	-0.27	-0.33	-0.10	0.24	1.23*
	(-2.01)	(-1.50)	(-1.84)	(-0.53)	(1.33)	(6.59)
New England						
ΔLNS	-1,012**	-0.06	-0.10**	-0.05	0.08	0.30*
	(-1.99)	(-1.27)	(-2.08)	(-1.10)	(1.73)	(6.76)
Plains						
ΔLNS	-1,174*	-0.05	-0.09**	-0.01	0.06	0.30*
	(-3.03)	(-1.63)	(-2.76)	(-0.17)	(1.89)	(8.96)
Rocky Mountain						
ΔLNS	-629*	-0.03	-0.03	-0.02	0.04	0.16*
	(-2.72)	(-1.62)	(-1.60)	(-0.83)	(1.90)	(7.85)
Southeast						
ΔLNS	-3,084*	-0.13	-0.16	-0.001	0.17	0.70*
	(-2.92)	(-1.43)	(-1.77)	(-0.01)	(1.90)	(7.55)
Southwest						
ΔLNS	-1,181**	-0.08	-0.08	-0.01	0.05	0.33*
	(-2.18)	(-1.63)	(-1.83)	(-0.29)	(1.12)	(6.97)
Aggregate Regional Data						
	Constant	**ΔMB**	**ΔMB(-1)**	**ΔMB(-2)**	**ΔMB(-3)**	**ΔMB(-4)**
USA						
ΔLNS	-1,350*	-0.79**	-0.94*	-0.21	0.81**	3.64*
	(-3.51)	(-2.42)	(-2.88)	(-0.64)	(2.42)	(10.79)
Far West						
ΔLNS	-2,502	-0.81	-0.85	-0.36	0.23	2.17*
	(-0.41)	(-1.55)	(-1.62)	(-0.68)	(0.44)	(4.01)
Great Lakes						
ΔLNS	-2,130	-1.19	-1.16	-0.37	1.34	5.30*
	(-1.78)	(-1.17)	(-1.14)	(-0.36)	(1.30)	(5.08)
Mideast						
ΔLNS	-2,570	-1.63	-2.00	-0.58	1.47	7.37*
	(-1.49)	(-1.11)	(-1.36)	(-0.39)	(0.99)	(4.90)

Table 5: Monetary Base and Loans: Regional, Quarterly Data, 1976:I to 2002:III (continued)

Aggregate Regional Data						
	Constant	**ΔMB**	**ΔMB(-1)**	**ΔMB(-2)**	**ΔMB(-3)**	**ΔMB(-4)**
New England						
ΔLNS	-6,074 (-1.41)	-0.33 (-0.90)	-0.54 (-1.47)	-0.29 (-0.78)	0.46 (1.22)	1.81* (4.78)
Plains						
ΔLNS	-8,216 (-1.68)	-0.38 (-0.91)	-0.64 (-1.54)	-0.04 (-0.09)	0.44 (1.05)	2.13* (4.98)
Rocky Mountain						
ΔLNS	-3,145 (-1.92)	-0.16 (-1.14)	-0.16 (-1.13)	-0.08 (-0.58)	0.19 (1.35)	0.80* (5.54)
Southeast						
ΔLNS	-3,700 (-1.87)	-1.54 (-0.92)	-1.91 (-1.13)	-0.01 (-0.00)	2.08 (1.22)	8.39* (4.85)
Southwest						
ΔLNS	-4,723 (-1.48)	-0.30 (-1.11)	-0.34 (-1.25)	-0.05 (-0.20)	0.21 (0.76)	1.32* (4.75)

Note: See Table 1. The appendix lists the states in each region.

* means significantly different from zero at the 1-percent level.
** means significantly different from zero at the 5-percent level.