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MONETARY POLICY AND REGIONAL INTEREST RATES IN THE UNITED STATES, 1880-2002

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ABSTRACT

The long running debate among economic historians over how long it took regional financial markets in the United States to become fully integrated should be of considerable interest to students of monetary unions. This paper reviews the debate, discusses the implications of various hypotheses for the optimality of the US monetary union, and presents some new findings on the origin and diffusion of monetary shocks. It appears that financial markets were integrated in the late nineteenth and early twentieth centuries in the sense that monetary shocks were routinely transmitted from one part of the United States to another. In particular, shocks to interest rates in the eastern financial centers were routinely transmitted to the periphery. However, it also appears that during this period significant shocks to bank lending rates in the periphery often arose on the periphery itself. This suggests that a nineteenth century monetary authority that relied on operations confined to eastern financial centers would have had a difficult time managing the U.S. monetary union. After World War II the problem of eruptions on the periphery declined.

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Monetary Policy and Regional Interest Rates in the United States, 1880-2002[1]

1. Financial Integration in a Monetary Union

There has been a long-running debate among economic historians over how quickly financial markets in the United States achieved integration after the formation of a currency union in 1788. Some students of American capital markets believe that full integration was not achieved until more than a century later. Today, the inclusion of additional countries in the EMU, the dollarization of countries in Latin America, and the creation of wholly new monetary unions are real possibilities. Therefore, this debate over the speed at which the U.S. capital market integrated is worth reviewing for the light that it sheds on the potential development of the capital market as an efficient transmission system for monetary policy within a monetary union.

This debate can be traced to Lance Davis's (1965) classic paper, although one could also cite the older paper by R.M. Breckenridge (1898), which is still well worth reading. More recent contributions, just to mention a few of our favorites, include Richard Sylla (1967, 1969), John James (November 1976, December 1976), Gene Smiley (1975), Richard Keehn (1980), and (of course!) Howard Bodenhorn and Hugh Rockoff (1992).

The focus of this literature has been on why there were persistent regional differences in interest rates, and on how long these differences took to disappear. One reason for focusing on long-run differences is the concern of economic historians with economic growth. Persistent differences in rates of return were the incentive to move

capital from one region to another, and the movement of capital from the Northeast to the West, Midwest, and South, was a major source of economic growth.

A second reason for focusing on long-run differences in rates is a concern with the efficiency of markets. One might be tempted to assume that financial markets, especially short-term markets, would integrate soon after a monetary union was formed. Labor markets, real capital markets, or final goods markets might show less uniformity of response because of legal or cultural barriers to trade. However, one would think that one could depend on the integration of financial markets to create an effective transmission mechanism for monetary policy. For one thing people who work in financial markets are knowledgeable specialists in arbitrage: we would expect them to respond quickly to small profit opportunities. Moreover, the physical cost of transporting money from one place to another is trivial compared with the costs of moving labor or real capital. We might expect workers to respond slowly to a difference in real wages, and we might expect it to take time to build new factories and move machinery; but we would expect financiers to respond quickly to a difference in interest rates. In other words, the suggestion that persistent regional differences might be an example of market failure undoubtedly motivated much of the research in this area.

This literature, whatever the original motives, provides useful information for students of monetary unions. If changes in interest rates in eastern financial markets were transmitted in a slow and halting way to the periphery, or simply were not transmitted at all, then there was little potential for an effective monetary union, at least one managed through short-term rates.[2] Thus the school of thought that holds that it took the United

States the whole of the nineteenth century to achieve an integrated financial market would make the United States a pessimistic model for monetary unions.

Efficient transmission of shocks from one part of the monetary union to another is merely a necessary condition for an optimal currency area. The key question, as pointed out long ago by Robert Mundell, is whether business cycles (here assumed to be reflected in interest-rate cycles) in different regions were synchronous. Did shocks to interest rates occur nationwide or were some regions subject to important independent shocks? If interest rate shocks are system wide, a monetary union can be managed in a simple way. The monetary authority can offset system wide shocks by taking actions in the central money market. On the other hand, if independent shocks occur frequetly in outlying parts of the monetary union, the problem facing the monetary authority becomes far more complicated. Suppose an undesirable rate increase occurs in the periphery while rates remain at target levels in the core. What is a monetary authority to do? If rates in the core are lowered in order to combat high rates on the periphery, rates in the core will be too low. The first case, of course, corresponds to the case in which the monetary union is an optimal currency area in Mundell's sense; the second case, one in which it was not.

We will begin by exploring the existing literature for the information it contains about the pace of financial integration.

2. The Debate over Financial Market Integration

The analogy that most students of U.S. financial markets have had in mind is with a market for some uniform commodity, for example wheat. In the absence of transportation costs, transactions costs, tariffs, and so on, we would expect the price of a

particular grade of wheat to be the same everywhere. A shock to the system, moreover, would be transmitted quickly to all parts of the market. A bad harvest in the Ukraine would produce a general increase in the price of wheat throughout the world. In the same way, we might expect interest rates to be the same in the absence of transactions costs, usury laws, and so on. If there were barriers to trade, then we would see higher or lower prices persisting in some markets. Technological progress or institutional change that reduced barriers to trade would produce a more uniform price.

Breckenridge (1898) may have been the first to look at U.S. short-term capital markets with this analogy in mind. He looked at rates on commercial paper in different cities of the United States in the 1890s, and found differences in rates that he considered astonishing. While the average rate in Boston for 1893-97 was 3.832 percent, the average rate in Omaha Nebraska was 7.980 percent, Breckenridge (1898, 120). Breckenridge rejected the possibility that differences in the risk of repayment could explain the differences in rates. The commercial paper on which Breckenridge focused most of his attention consisted of short-term, first-class double name paper.[3] He regarded this sort of paper as carrying a very low risk of default in every part of the country.[4] If risk couldn't explain the regional differences what did? Based on comparisons with Canada, and other developed countries, Breckenridge concluded that the fragmented structure of the American banking system set up artificial barriers to the movement of capital. A few large banks with headquarters in Toronto and Montreal and branches throughout the country dominated the Canadian system. The U.S. system, on the other hand, consisted of separate banking systems in each state. Branching within states, moreover, was often prohibited.

The modern literature, as we noted above, begins with Davis (1965). One of Davis's innovations was to make use of the reports of the Comptroller of the Currency on the National Banks. This source provides the income and expenditure data and balance sheets for all of the National Banks of the United States. From it Davis was able to compute proxies for interest rates by state and city that covered the whole of the United States on an annual basis from the time the National Banking system was established in 1863. Like Breckenridge, Davis found substantial interregional differences in rates. Davis's data, moreover, permitted him to observe the long-term trend, which he believed showed the gradual convergence of regional rates. Why did these differences persist for so long? Davis (1965, 358) believed that there was a "disinclination of capital to migrate," that was gradually overcome. In part, this barrier was overcome by the diffusion of an important institution: the commercial paper market.[5] This market consisted of unregulated brokers, located mainly in financial centers, who would buy paper created by local businessmen and then sell it on a national market. Davis believed that rates came down and rate gaps closed as this network of brokers spread and provided competition for local banks.

This hypothesis has been subjected to considerable criticism.[6] One of the first to criticize Davis's interpretation was George Stigler (1967). Stigler argued that it is not possible to make inferences of the sort Davis made about whether differentials between regions are "too" high in the absence of information about transactions costs. Suppose we observe that the price wheat is different in different markets, Stigler asks. Would we conclude that "there was a disinclination of wheat to migrate" or would we ask whether

there were transaction costs that made it uneconomic to buy wheat in the cheap market and sell it in the dear market?

Richard Sylla (1969) in another classic paper argued that Davis was right about persistent differences in interest rates, but wrong about the causes of the differences, and wrong about the reasons for their disappearance. Sylla argued that high rates in rural areas of the United States reflected local bank monopolies. The National Banking Act (1863 and 1864) in combination with a punitive tax on notes issued by state banks gave National Banks the sole right to issue bank notes. The Act also set a high minimum standard for the capital of national banks. Together these factors meant that many small towns, especially in the South and West became one-bank towns. These towns couldn't support a state bank because state banks couldn't issue notes, and they couldn't support more than one national bank because of the high minimum capital requirement. The result was a national bank that could exploit its monopoly position by raising interest rates on loans.

This problem, as stressed by Ransom and Sutch (1977), was especially severe in the South after the Civil War. In the South poverty meant that the minimum capital requirement in the National Banking Act was an important barrier to entry, and illiteracy and innumeracy meant that the limitation on state banks of issue was also important. Over time, according to Sylla, the growth of deposit banking, partly as a result of the growth of numeracy and literacy, made it easier for state banks to compete, thus eroding the monopoly positions of the National Banks. The Gold Standard Act of 1900 reduced the minimum capital requirements of the National Banks. A surge of entry occurred in its

wake, which served both to further undermine the monopoly positions of local banks, and to illustrate it's underlying cause.

John James (1976a, 1976b, 1978) reworked Davis's interest rates and argued based on cross-state regressions that Sylla was right that local bank monopolies explained most of the differentials. Risk, in the form of loan loss rates, an issue raised by one of us (Rockoff 1977), could only explain a relatively small part. James differed from Sylla, however, on why local bank monopolies had been eroded. In James's view, the key development was the passage of "free banking laws" in various states that allowed small state chartered banks to enter local markets and compete with existing banks.

The Sylla-James bank market structure interpretation was challenged by a number of writers. (1) Richard Keehn performed a cross-bank study for Wisconsin and found no evidence of local bank monopolies that would explain the local pattern of interest rates. Rates in Milwaukee (where there was lot's of competition) were sometimes higher than rates in rural areas. Wisconsin, however, as Keehn pointed out, may not have been typical because it had a long history of relatively free entry and competition. As far as we are aware, no one has tried to replicate Keehn's careful study for other states. This seems to us, however, to be the best way of getting at the one-bank-town argument. (2) The Sylla-James hypothesis was also challenged by Marie Elizabeth Sushka and W. Brian Barrett (1984) who argued that financial market integration had occurred earlier than suggested by the Sylla-James hypothesis, and that increasing financial sophistication on the part of borrowers (reminiscent in some ways of Davis's position) explain the decline in rate differentials. And (3), the Sylla-James hypothesis was attacked by John Binder and David T. Brown (1991) who found little evidence to support either free banking laws or the

Gold Standard Act of 1900 as key developments. Instead they stressed the absence of branch banking and changes in agricultural returns.

A number of writers have pushed in other directions. Kerry Odell (1989) explored the degree of integration on the Pacific Coast. Bodenhorn (1992) and Bodenhorn and Rockoff (1992) explored integration before the Civil War. Gene Smiley (1975) also modified Davis's interest rate estimates, and raised an interesting point about the measurement of interest rate differentials: should we look at absolute differentials or a measure of dispersion such as the coefficient of variation. Since interest rates were generally falling at the end of the nineteenth century (in the United States and the rest of the world) absolute differentials were falling. But dispersion measured, say, by the coefficient of variation was falling less rapidly. Smiley puts full integration, measured by low dispersion of rates, later than Davis.

The implication of the regional differences identified by Davis and documented by subsequent writers for the efficiency of the short-term capital market as a transmission system for monetary policy depends on the reasons for the persistence of interest rate differentials. If Davis was right, then we would expect that monetary impulses that affected rates in eastern financial markets would have minimal effects on other regions. According to Davis it required a specific institutional link -- the commercial paper market -- to connect regional financial markets. It would seem to follow that when that link was lacking the transmission of monetary shocks would fail. On the other hand, if Sylla and James were right that local bank monopolies were raising the price of credit in rural areas, then there would be no presumption that the transmission mechanism would be impaired. A gas station has a local monopoly and as a result is able to set its selling price

higher than the price in competitive markets. We would still expect this station to raise and lower its price in response to changes in the wholesale price of gasoline.

Even in Sylla-James case, one can think of reasons why interest rates in different regions might respond differently to monetary shocks. Conservative bankers in rural areas, protected by local monopolies, might be less inclined to keep abreast of and respond to every short-term fluctuation in the market. But on the whole, one would think that local bank monopolies, although they would imply a less than optimal allocation of banking resources, would not inhibit the transmission of monetary policy impulses.

The possibility that regional differences reflected risks would also be consistent with the efficient transmission of monetary impulses. After all one sees persistent differences in rates of return on assets of varying levels of risk that trade in the same market. But they respond in harmony to monetary shocks. Lea Carty (1996) found a distinct regional premium on railroad bonds: Bonds issued by Southern railroads paid a higher rate. But Carty also noted that rates in the South and other regions fluctuated together in response to common macro-economic shocks.

To sum up, the literature on regional interest rates in the United States suggests that the ability of the short-term capital markets to serve as a conduit for monetary policy may have evolved rather slowly in the United States. Some stories are more encouraging to the advocates of monetary unions than others – for example the work by Sylla and James suggesting that local bank monopolies account for persistent rate differences or the work by Bodenhorn and Rockoff suggesting that a good deal of integration had been achieved before the Civil War – but all suggest that it took time and effort to achieve integration.

This literature, however, has been largely silent on the second issue of crucial importance to students of monetary unions: where did shocks arise? Did interest rates vary throughout the country mostly because large shocks hit eastern financial centers? Or were peripheral regions subject to independent shocks? Our empirical work has been focused on this issue.

3. Data and Definitions

The debate over regional interest rates in the United States, as we noted above, has generated significant amounts of data on bank lending rates by region. Banking across state lines was prohibited in the United States. Each state therefore had its own banking system. Many states, moreover, prohibited branch banking. The result was a myriad of local banks filing reports on their assets and earnings with government regulators. From this massive amount of data local lending rates of commercial banks can be established. If a few large banks with many branches had characterized the United States, as was the case in Canada and other developed countries, local rates might be much harder to establish. They would be recorded in the internal records of the banks, and would not be reported to regulators. As we will see below data for the most recent years may be contaminated by this problem. Luckily (for scholars if not for the country as a whole), the fragmented structure of the American banking system has created a substantial amount of data on regional interest rates.

For regional interest rates we used Bodenhorn's (1995) estimates for the period 1880 to 1960 and estimates based on data on the FDIC website for 1966 to the present. In the first decade after the Civil War, by the way, the Western United States remained on gold while the East remained on the Greenback. The United States returned to the gold

standard in 1879, so Bodenhorn's data starts when the U.S. monetary union is reconstituted after the Civil War. Bodenhorn (1995), following Smiley (1975) and James (December 1976, November 1976), purged Davis's data of various revenues and losses in order to arrive at something closer to contractual loan rates. Essentially, Davis attributed all bank earnings to loans, and divided that figure by total loans to get a proxy for the rate of interest. Smiley and James removed earnings on bonds and other non-loan earnings from the numerator and various non-loan assets from the denominator to produce a number closer to the contractual rate on loans. Bodenhorn (1995) extended these estimates to 1960. We also tried using Davis's original estimates because they are available before 1880 and for a finer division of regions. Some of our preliminary results are reported below. But these results suggested that the impurities may be important when it comes to using the rates in the VARs reported in the penultimate section of the paper.

Our data for the period after 1966 was derived from income and balance sheet data posted on the FDIC website.[7] This data would appear to be exactly what is needed. The variable we used was the ratio of "Total Interest Income on Loans and Leases" to "Net Loans and Leases." The main problem here is that total interest income and loans are reported by bank and attributed to the home office of the bank. Interregional mergers in recent years have undoubtedly undermined the usefulness of the series as measures of regional interest rates. To bridge the gap between Bodenhorn's series and the FDIC loans and discounts series we interpolated using data from the *Annual Report of the Federal Deposit Insurance Corporation*.

Here a different variable, the ratio of "Interest and Discounts on Loans" to "Loans, Discounts, and Overdrafts" was available. This variable produced somewhat lower rates in the Northeast (especially in New York State), and so this variable was used as an interpolator. We simply computed percentage deviations from trend values in the FDIC loans, discounts, and overdrafts series and added them to deviations from the trend between the end of the Bodenhorn series and the beginning of the FDIC loans and discounts series. The standard deviations of the resulting series are relatively low during the period 1961 to 1965. But this is also true of other rates such as the corporate bond rate. So we did not try to adjust the interpolator for a potential difference in its underlying volatility.

Figure 1, plots the bank lending rates in the Northeast and the West and the rate on high grade corporate bonds, a proxy for a rate that could be controlled through open market operations, for the period 1880 to 2002. An inspection of the chart tells the basic story. In the postwar era bank lending rates in the West and in the Northeast and the yield on high grade corporate are moving together. In the late nineteenth century this is far from obvious.

How should we define "monetary policy?" First of all, it should be noted that the term "monetary policy" is anachronistic when applied to the nineteenth century. Before the establishment of the Federal Reserve System in 1913 the stock of money in the United States was determined primarily by (1) the amount of gold in the country, (2) the reserve ratios of banks, and (3) the currency deposit ratio of the public. Domestic mining and the balance of payments in turn determined the amount of gold. The Federal government did influence these variables in various ways, but generally it would be a

mistake to think of the Federal government as an active monetary authority. After the Federal Reserve was established in 1913 it makes sense to speak of monetary policy. What we are in fact doing for part of the period is examining the effects of monetary shocks on regional rates whether those shocks were caused by monetary policy or by the private sector.

We experimented with several measures of monetary policy: (1) interest rates, including both short term rates and the corporate bond rate, which as figure 1 shows seems to be closely related to the bank lending rates, (2) the rate of change (or the change in the rate of change) of high-powered money, and (3) the rate of change (or the change in the rate of change) of the stock of money, generally M2. For the most part, however we report results using short-term interest rates in financial centers as the measure of monetary policy. This choice follows the current fashion of viewing interest rates as the measure of monetary policy. And focussing on interest rates is a good way of focusing on the efficiency of the transmission mechanism: when one end of the line was shaken, by whatever means, what happened at the other end? The monetary aggregates, moreover, seldom showed any clear effects on rates in the simple initial tests we used, partly perhaps because of the complicated structure of the effects of the aggregates on interest rates. Interest rates, of course, are only an intermediate indicator of the affects of monetary policy. Ultimately, we are interested in the affects on employment and prices. But we have not explored the connection between interest rate movements and regional employment or other measures of economic activity.

4. Financial Crises

If monetary impulses were transmitted quickly through financial markets, and if interest rates were good indicators of monetary policy, then we would expect to find periods of extreme distress in financial markets recorded in interest rates from all regions. Financial crises are, to put it somewhat differently, natural experiments in which to test the integration of financial markets. Tables 2 and 3 use this idea by exploring several interest rates during the key periods of financial distress in the nineteenth and early twentieth centuries. Although there were a number of financial crises, the crises of 1873, 1893, 1907 and 1929 would surely be among those at the top of any list. Each was characterized by a stock market crash, a banking crisis, and a sharp downturn in economic activity. Depending on the variables one looks at, one might bring in a few other crises. Looking at the stock of money or deposits in suspended banks, for example, would point to the crisis of 1877-78. And looking at the change in the price level would point to the recessions that followed the Civil War and World War I. But few financial historians would disagree with the conclusion that the four crises examined here were among the most severe. Indeed, we would guess that most American financial historians would rate them as the four most important crises between the Civil War and World War II.

In Tables 1 and 2 we show the cumulative change in particular interest rates from the level reached in the preceding trough of the business cycle (according to the NBER chronology.)[8] For example, the first entry in the first column of data in Table 1 shows that the commercial paper rate in 1871 was 27 basis points below the level in 1870 (the trough of the business cycle). The third entry shows that at the cyclical peak in 1873 – the

cyclical peaks such as 1873 are in bold – the commercial paper rate was 306 basis points above the level of the previous trough. As you can see, as least as far as Davis's data is concerned, the financial boom and bust cycle, shown so clearly in data columns one and two, was only imperfectly reflected in the regional rates. As might be expected, New York City rates conform fairly closely to the commercial paper and call money rates, but others show a much looser connection. Region III, mainly Southern states, follows its own path as it recovers from the Civil War. One might have expected a closer relationship in 1893, and 1907, but in Davis's data, which reports realized yields, the picture is also mixed in those years.

Bodenhorn's figures are the basis for the pictures of the crises of 1893, 1907, and 1929 shown in Table 2. In all three crises we see the same pattern in money market rates. Commercial paper rates and call money rates rose dramatically during the boom (speculative bubble?) and then fell dramatically afterwards. In 1893 and 1929, although not in 1907, money market rates ended up below the level they had settled into during the previous trough. In 1893 regional rates followed a roughly similar path, although they did not fall so far below the level reached in the previous trough, as did money market rates. During the boom, rates in the Plains and in the West actually rose more than in the money markets. This was, by the way, the period of Populist agitation against the "moneyed interests." It is also, the only case in our data where increases in bank lending rates exceeded the increases in money market rates. This is the only case, to put the matter differently, that literally matches the old adage "When Wall Street Sneezes, Main Street Catches a Cold."[9]

Perhaps the most surprising feature of Table 2 is the behavior of rates during the Great Contraction from 1929 to 1933. Most historians of the integration of U.S. financial markets have argued that the process was completed in the nineteenth century or at the latest early in the twentieth century. But here we see evidence of regions going their own way in the 1930s. Most of the regional rates did rise along with the money market rates in 1928 and 1929. But the impact seems to have been somewhat muted. And while money market rates then plunged well below the 1927 trough during the years 1930-33, the regional rates remained above the 1927 level.

This episode is so striking that it deserves a diagram. Figure 2 plots two money market rates, the commercial paper rate and the call money rate, and the four regional bank-lending rates from 1926 to 1934. It is hard to escape the feeling that the regional rates were divorced during this contraction from the violent fluctuations in the financial centers. It is possible that as the economy declined banks saw the risk attached to their average loan rising, so that risk adjusted rates may have been falling. But whatever the reason, it is clear that the typical bank borrower did not benefit from the rapid decline in rates in the financial centers. There were no major financial disturbances in the early postwar years, so it is not possible to find an example from that period to compare with the disturbances shown in Tables 1 and 2 and Figure 2.

A close look at the financial crises, to sum up, suggests that monetary shocks were communicated to all parts of the United States by financial markets, but that the level and timing of the responses was erratic. Focusing on the financial crises, of course, means ignoring information from less disturbed periods. In the following two sections we

use more general statistics to characterize these response patterns. We begin with some simple correlations.

5. Simple Correlations

Perhaps the simplest way of approaching the question of short-run financial market integration is to ask whether regional interest rates tended to move in the same direction in the short run as interest rates in the financial centers (or other indicators of monetary policy) and whether the frequency with which regional rates moved in the same direction as rates in financial centers increased over time. Presumably, if financial markets were highly integrated interest rates in different regions would move in the same direction at the same time.

This idea is applied in Table 3. Here we examined three periods: 1880-1905 (26 years), 1906-1945 (40 years), and 1946-1960 (15 years). The years from 1880-1905 were a period of relative economic and financial stability. The United States was on the gold standard throughout and generally enjoyed peace and growing prosperity, although as we have seen there were periodic financial crises, particularly in the 1890s. During 1880-1905 many scholars have argued, as we saw above, that US short-term capital markets although not fully integrated were heading toward that ideal. Scholars disagree, however, on when full integration was achieved. The years from 1906 to 1946 were a time of trouble when even highly integrated markets would behave in an anomalous fashion. This period includes two major financial crises, 1907 and 1929-33, and the two world wars. During the Second World War, moreover, market rates were distorted for a considerable time by the Federal Reserve's policy of pegging interest rates. And a number of

institutional changes occurred that tended to further unify national capital markets including the establishment of the Federal Reserve System, and the concentration of the Federal Reserve's authority in the Federal Reserve Board in Washington D.C. (Rockoff 2000). The period after 1946 was, generally, one of economic stability with many of the prerequisites for financial market integration in place.

For each sub-period we calculated the percentage of years in which the rate in a particular region moved in the same direction as the rate in the money markets. Panel A of Table 3 shows the percentage of years in which regional rates moved in the same direction as the commercial paper rate, Panel B shows the percentage of years in which regional rates moved in the same direction as the call money rate, Panel C shows the percentage years in which regional rates moved in the opposite direction (to capture a short-term liquidity effect) from the change in the rate of change (acceleration) of money, and Panel D shows these measures for various assets traded in the financial centers to provide a basis of comparison.

If the markets were perfectly integrated in the short run, and if bank loans in various regions and short-term money market instruments were all of similar risk, we would expect that when rates rose in the money market they would rise in regional markets -- the figures in Table 3 would all be 100s. If the markets were completely separate we would expect that when rates rose in the money markets, they might rise in regional markets or they might, just as likely, fall -- the figures in Table 3 would all be 50s.

It is clear that by this measure the correspondence between movements of interest rates in the interior regions and in the money markets was rather loose during the initial

period. In the Northeast the percentage of same-direction movements was 72 (significantly different from chance at the 10 percent level), but the percentage of same-direction movements was lower in the other regions. In the South it was only 52 percent and in the West 44 percent, obviously no better than chance. Same-direction movements also seem to be a matter of chance during the disturbed years from 1906-1945. One could predict whether interest rates would move in the same direction or the opposite direction from the commercial paper rate by flipping a coin. Only when we get to the postwar era do we see a pattern that resembles what we would expect from a unified market. The pattern for the call money rate shown in Panel B is similar: we must wait until we get to the postwar period to see rates move up and down together.[10]

The positive correlations for the post war period, however, may be partly spurious. There was a sharp and widespread upward trend in interest rates after World War II. This trend may have been the result of rates returning to normalcy from the low levels of the 1930s. And the upward trend also may have been the result of a rising inflation premium. Naturally, if there were a broad upward trend in rates, year-to-year changes would turn out to be highly correlated. But while a return to interest-rate normalcy or an inflation premium in some sense may reflect common monetary factors, they do not represent the short-run monetary impulses that we are trying to uncover.

Panel C. looks at a measure of monetary policy based on the stock of money (M2). Since the stock of money tended to rise from year to year for substantial periods of time, we looked at the change in the growth rate of the stock of money. In the short-run we would expect a decrease in liquidity to raise interest rates. So panel C shows the percentage of years in which this measure of liquidity moves in the opposite direction

from a regional interest rate. While there is generally a tendency for regional rates to move in the opposite direction to the change in the rate of change of money, the relationship is fragile. The problem may be that there are also positive connections between money and interest rates complicating the picture. Changes in the growth rate of money for example might signal expansion or inflation which generally produce higher rates.[11]

Panel D of Table 3 provides some evidence that our measure of integration, rates moving in the same direction, as crude as it is, can pick up signs of integration. Our two money market rates, the call rate and the commercial paper rate generally moved in the same direction during the initial period 1880-1905. During the second period, 1906-1945, however, there is retrogression, perhaps because the call money rate was being affected by disturbances and institutional changes in security markets.

We find similar patterns if we look at securities that we know were trading in the same markets. For High-grade Municipal bonds and High-grade Corporates the percentages of same-direction movements, as shown in Panel D, are 84 percent in the first period, 73 percent in the second period, and 93 percent in the third period, all statistically significant. Interest rates on bonds of different quality ratings are available only for part of the period. Between 1920 and 1945 yields on Aaa (low risk) corporate bonds and Baa (medium risk) corporate bonds moved in the same direction 85 percent of the time, and from 1946 to 1960, 93 percent of the time. These comparisons show that our simple measure of co-movement is capable of picking up short-term integration when it is present. The high correlation of movements in the Aaa and Baa bonds did not mean, to reiterate, that there was no difference in yields. For the period 1920 to 1960 the Aaa rate

averaged 3.76 percent while the Baa rate averaged 5.76 percent, a difference of 1.40 percent. The difference gradually declined in the postwar period. But the decline was not a sign of increasing market integration, but rather increased economic stability, and hence a decrease in the risk attached to the Baa bonds

As the problem with spurious correlation in the period 1946 to 1960 indicated, the simple correlations explored above, although suggestive, may provide a misleading picture of the correlation (or lack thereof) between monetary policy changes in financial markets and outlying regions. Vector Auto Regressions provide a way of characterizing the relationship that can avoid this and similar problems.

6. Vector Autoregressions

Vector autoregressions (VARs) are a useful way of characterizing the data for the purpose of examining how amenable the system was to management by a single monetary authority. With VARs we can divide the changes in rates in each region into an amount that could be predicted on the basis of past values of all the rates in the system, and an error that depends on the shocks hitting the system. If most forecast errors were the result of shocks that arose in the financial core and diffused to the periphery then the task of the monetary authority would be straightforward. If an undesirable shock to national rates occurred then the authority could simply intervene in the core market and offset the shock. On the other hand, if most forecast errors on the periphery were the result of shocks that arose on the periphery itself, then the ability of a monetary authority operating through rate changes in core financial markets would be problematic.

Our strategy was to set up a vector auto regression that included each of the regional rates explored above and a national rate, the latter being a potential or actual instrument of monetary policy. We then asked two questions of the resulting VARs. Were the markets integrated in all periods in the sense that shocks to the national rates were diffused to all regions? And were the national markets dominant in all periods in the sense that the movement of rates in the periphery mostly reflected movements in the core?

Our data, as noted above, extends from 1880 to 2002. We first divided this period into three segments: 1880-1913, 1914-1943, and 1955-2002. This division, we believe, would appear natural to most financial historians. The first segment extends from the start of our data in 1880 (the first year after the post-Civil-War reunification of the monetary union) to 1913 when the Federal Reserve was established. The second segment includes the disturbed middle decades of the twentieth century: the two world wars and the Great Depression. The last segment begins in 1955, when our data on the Federal Funds rate begins and represents the modern period in Federal Reserve history. One could, of course, break the initial period into different and additional segments. It would be interesting, for example, to break the initial segment near 1900 into two smaller segments because some financial historians have argued that full integration was achieved at about that time. Unfortunately, however, this additional break would leave us with relatively small samples given the model we wish to estimate.

In what follows we identify orthogonalized structural shocks in the VAR/VEC by assuming that the contemporaneous relationship matrix of the VAR is lower triangular. Given this identification we ordered the variables in the following way: (1) the national

rate – the commercial paper rate or the Federal Funds rate, (2) the Northeast rate, (3) the Plains rate, (4) the Southern rate, and (5) the Western rate. This ordering was dictated partly by the main question: what could a monetary authority do? The monetary policy variable therefore comes first, and then the Northeast region. The Northeast contained the eastern financial centers: New York (by far the most important), Boston, and Philadelphia. The order to be chosen for the peripheral regions is less clear-cut. The order we usually worked with was, after the Northeast, the Plains states, the South, and the West. To some extent reflects a nineteenth century view of things. Today we would be more likely to put the West second and, perhaps, the Plains states last.

All the variables were tested for the presence of a unit root and it was found that all were I(1) in the sense that the hypothesis of a unit root could not be rejected.[12] Since all the variables were I(1) we needed to estimate the VAR in differences. This brings into play the issue of cointegration. If there is cointegration present the appropriate model to estimate is the Vector Error Correction model which is just the DVAR (VAR in differences) with error correction terms added to each equation. We used the method of Johansen (1988, 1992) to test for co-integration, but we used the sample size corrected critical values suggested by Cheung and Lai (1993).

Our results were mixed. (1) In 1880-1913 we found evidence at the 5% level of one cointegrating relationship between all the variables in the system. (2) In 1914-1943 we did not find evidence of any cointegrating relationships. If one looks at a graph of the data for this period, for example Figure 2, it is obvious why this is the case. The commercial paper rate behaves quite differently from the regional rates. (3) In 1955-2002 we find evidence at the 5% level of one cointegrating vector for both sets of variable

whether we combine the regional rates with the commercial paper rate or the Federal Funds rate. This result is strong if we allow for a break in drift in the variables in 1981.

Given these results we did the following: (1) For period 1880-1913 we estimated a VEC model with one lag, (2) for the period 1914-1943 we estimated a straight DVAR with one lag, and (3) for the period 1955-2002 we estimated two VEC models, one with the commercial paper rate as the "national'' rate and a second with the Federal funds rate as the "national" rate. Our VARs are reported in Tables 5-7.

In each case we computed orthogonalized interest rate impulse response functions using a Cholesky decomposition. Given our ordering of the variables, the Cholesky decomposition means that we can interpret the shocks in the following way. The national shock is the shock that hits the commercial paper rate (or the Federal Funds rate). The Northeast shock is the component of the northeast residual that is orthogonal to the national shock. The Plains shock is the component of the plains shock orthogonal to both the national shock and the Northeast shock. The South shock is the component of the South shock that is orthogonal to the National, Northeast, and Plains shocks. The West shock is the shock that hits the West that is orthogonal to all the other shocks.

These impulse response functions were then used to construct variance decompositions. The variance decompositions show the contribution each structural shock makes to the non-forecasteable components of each variable (i.e. the random component of each variable once we account for the trend, level, and the relationship to past levels of the series). We can display these decompositions on a simple graph. The vertical axis measures the proportion (as a percent) of the variance of the forecast errors explained by the variance of the independent shocks to a particular interest series, and the

horizontal axis shows time in years. Variance decompositions are more useful for our purposes because they reflect both the size and frequency of the shocks as well as their impact as described by the VAR equations. The usual impulse-response charts does not show the size or the frequency of the shocks, but merely what the effect of a standardized shock would be. Since there are 5 variables in our system (the national rate and the four regional rates) there are 25 variance decompositions for each period.

We will focus first on the Northeast (the core) and the West (the periphery). Figure 3 shows the effect of a shock to the National rate on bank lending rates in the Northeast. As might be expected, in the most recent period shocks to the national rate, whether measured by the commercial paper rate or the Federal Funds rate, appears to explain most (about 70 percent) of the variance of the forecast errors in the Northeastern bank lending rate. Perhaps it is more surprising, however, that this also appears to have been true in the earliest period that we examine, 1880-1913. Only during the years of war and depression do we find a lower figure. If we move to the periphery (Figure 4) we find a very different story. As before, shocks to the National rate account for most of the variance of the forecast errors in the Western rate in the post World War II era. But if we go back to the period 1880-1913, or 1914-1943 we find that shocks to the National rate explain very little.

The other side of the coin is the role of shocks within the region itself. Figure 5 shows the impact on the Northeast of shocks arising within the Northeast itself. In both the postwar and pre-1914 eras, shocks that we assign to the Northeast account for only about 20 percent of the variance of the forecast errors. Only during the war and interwar years do the independent regional shocks appear important. But when we turn to the West

(Figure 6) we find something very different. Here we find that regional shocks were important – accounting for about 50 percent of the forecast errors in the West – during both 1880-1913 and 1914-1943. Only when we get to the modern era do we find that shocks arising independently in the West played a minor role.

If we look at the other peripheral regions, the Plains and the South, we see essentially the same pattern. Figure 7 shows the variance decomposition of the effects of shocks to the National rate on the Plains. Again, shocks to the National rate explain most (90 percent) of the forecast errors in the bank lending rate on the Plains during the postwar era, but a substantially smaller percentage during the two earlier periods. And Figure 8 shows the variance decomposition of the effects of shocks to the National rate on the South. And again, we find shocks to the National rate explaining 90 percent of the variance of the forecast errors in the Southern rate during the postwar era, but perhaps only 20 percent during 1914 to 1943, and only 10 percent during 1880-1913.[13]

The simplest interpretation of these dramatic results, and the one that we favor, is simply that the regions have become more homogeneous over time. When Orange County California actually grew oranges the economy and hence bank lending rates behaved very differently from rates in other regions. Only a monetary policy tailored for California would have been able to offset local shocks. Now that the economy of Orange County is much like the economy in the rest of the country the relevant interest rate shocks are those hitting the national economy, and an interest rate policy tailored to California is no longer necessary. One could, it is true, come up with some alternative interpretations. It could be true that the adoption of the Federal Funds rate as the preferred instrument for conducting monetary policy has increased the significance for

the economy as a whole of shocks to this rate. But this explanation does not explain so well why the commercial paper rate was dominant in the East in the late nineteenth century.

7. Conclusion

The U.S. monetary union was established at the end of the eighteenth century when the U.S. Constitution was adopted. But financial market integration did not occur overnight. Indeed, there is a long-running debate among financial historians over how quickly financial markets were integrated. The pessimists such as Davis maintain that it took nearly a century. The optimists, such as Bodenhorn and Rockoff, maintain that a high degree of integration was achieved in the antebellum period.

But even if the optimists are right there was a second problem that made centralized monetary control problematic. In the nineteenth century, perhaps until World War II, the peripheral regions of the United States did not simply import interest rate shocks from other regions. They generated their own. In the first segment we examined, 1880-1913, for example, most of the variance in the forecast errors we observe in the West were generated by innovations occurring in the West. This lack of synchronicity set a difficult problem for a potential monetary authority.

It was true, to put it somewhat differently, that "When Wall Street Sneezed, Main Street Caught a Cold" If that is all there was to it, the money doctor's task would be simple. Giving Wall Street a dose medicine whenever it sneezed would take care of Main Street as well. The problem was that Main Street often caught colds when Wall Street didn't. Giving everyone the same medicine at the same time wouldn't work.

Was this problem peculiar to the American monetary union or is it to be expected in all such unions? Clearly, the unique institutional history of American banking has much to do with the resulting weakness of the banking system as a monetary transmission mechanism. Each state had its own independent banking system. As Breckenridge (1898), Davis (1965), and others have noted this system created artificial barriers to the movement of short-term funds. The Civil War, moreover, reversed much of the integration that had occurred in the first half of the nineteenth century by destroying the banking system of the South. And the National Banking Act adopted during the war put important constraints on the ability of the South to rebuild its banking system. As Bodenhorn and Rockoff (1992) and Bodenhorn (1992) have shown, there were important signs that capital markets were approaching full integration before the Civil War. This process will not of course be followed in detail in other monetary unions. Nevertheless, the possibility that political forces will prevent the unification of financial markets as existing monetary unions are extended or new ones created cannot be ruled out.

Today the Federal Reserve relies on operations conducted in central financial markets. This should not blind us to the possibility of other institutional arrangements. The system of Federal Reserve District banks was designed to deal with the unique problems of individual districts. It made sense to have an institutional structure that could respond to idiosyncratic shocks in rural areas. Bank reserve ratio changes, a largely forgotten tool of monetary policy, also could have been used as a tool for addressing problems in particular markets.

The United States is often held up as an example of a successful monetary union. But the history of how it got to be a successful monetary union is not as well known as it

should be. The literature on regional differences in interest rates reviewed and extended here suggests that the journey from monetary union to optimal currency area was long and hard.

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Table 1. Money Market Rates And Regional Interest Rates In Three Periods Of Financial Distress, 1873, 1893, and 1907.

	Change from the level in the preceding cyclical trough (basis points)								
Panic	Money Market Rates		Bank Lending Rates by Region						
	Commercial Paper	Call money	NYC	I	II	III	IV	V	VI
1871	-27	-27	-16	-59	27	-313	21	NA	NA
1872	138	240	11	-67	-5	-403	28	NA	27
1873	**306**	**874**	**31**	**-43**	**6**	**-422**	**87**	**NA**	**119**
1874	-127	-218	-13	-106	-6	-441	28	NA	-112
1875	-181	-254	-63	-178	-38	-536	48	NA	-40
1892	-128	-57	-92	-103	-18	-46	-33	-198	59
1893	**140**	**110**	**-54**	**-47**	**0**	**22**	**-71**	**-143**	**-15**
1894	-235	-237	-157	-121	-52	-145	-247	-261	-128
1905	20	221	-165	-64	-21	73	-33	183	21
1906	148	462	-22	8	26	-54	1	11	-25
1907	**214**	**481**	**29**	**54**	**60**	**-43**	**-2**	**96**	**184**
1908	17	18	-56	11	-64	-45	-39	-25	2

Sources: Commercial Paper and Call Money: Friedman and Schwartz (1982, 122) Regional Rates: Davis (1965). These are Davis's "weighted returns of Reserve City Banks." The regions are defined in Table 4.

Table 2. Money Market Rates And Regional Interest Rates In Three Periods Of Financial Distress, 1893, 1907, and 1929.

	Change from the level in the preceding cyclical trough (basis points)					
Crisis	Money Market Rates		Bank Lending Rates			
	Commercial Paper	Call money	Northeast	South	Plains	West
1892	-128	-57	-78	-65	-55	-60
1893	**140**	**110**	**35**	**82**	**197**	**158**
1894	-235	-237	-82	-30	-9	-40
1905	20	221	-69	-12	-20	-62
1906	148	462	-32	-24	-40	-158
1907	**214**	**481**	**161**	**116**	**151**	**65**
1908	17	18	39	29	21	-130
1928	82	195	-24	2	-55	159
1929	**176**	**361**	**82**	**34**	**39**	**24**
1930	-47	-109	44	61	78	135
1931	-139	-229	21	34	37	119
1932	-130	-201	61	36	64	129
1933	-235	-290	46	7	51	137

Sources: Commercial Paper and Call Money: Friedman and Schwartz (1982, 122) Regional Rates: Bodenhorn (1995, 450-51.) The regions are defined in Table 4.

Table 3. The Frequency of Co-movements in Money Market and Regional Rates, 1880-1960.

Region	Period		
	1880-1905	1906-1945	1946-1960
A. Commercial Paper Rate			
Northeast	72%*	63%	87%**
South	52	55	93**
Plains	60	60	93*
West	44	43	73*
Money	56	63	60
B. Call Money Rate			
Northeast	64	50	87**
South	52	40	93**
Plains	44	40	93**
West	52	38	73*
Money	40	43	60
C. Changes in the Rate of Change of Money			
Northeast	68	75*	67
South	72*	63	67
Plains	88**	75*	67
West	64	55	60
Call Money	40	43	60

D. Rates within the Financial Centers			
Commercial Paper and Call Money	76**	65	87**
Municipal Bonds and High-Grade Corporate Bonds	84**	73*	93**
Aaa Corporate Bonds and Baa Corporate Bonds	NA	85**[a]	93**
Commercial Paper and Monetary Acceleration	60	63	60
Call Money and Monetary Acceleration	36	43	60

Notes: The Table shows the percentage of years in each period in which interest rates in a given region moved in the same direction as the commercial paper rate (panel A) or the call money rate (panel B), or in the opposite direction to the change in the rate of change of the stock of money, "acceleration" of money (panel C), or that rates in financial markets moved in the same direction (Panel D). One * means that the observation is significantly greater than 50 percent (chance) at the 10 percent level; two *s, that it is significantly greater at the 5 percent level.

[a] 1920-1945

Table 4. The Regions Defined by Davis and Bodenhorn.

Northeast (Bodenhorn)	Region (Davis)	South (Bodenhorn)	Region (Davis)	Plains (Bodenhorn)	Region (Davis)	West (Bodenhorn)	Region (Davis)
Maine	I	Virginia	III	Minnesota	IV	Arizona	VI
New Hampshire	I	West Virginia	III	Iowa	IV	Idaho	VI
Vermont	I	North Carolina	III	Missouri	IV	Utah	VI
Massachusetts	I	South Carolina	III	Oklahoma	V	Nevada	VI
Rhode Island	I	Georgia	III	Texas	III	California	VI
Connecticut	I	Florida	III	Kansas	V	Oregon	VI
New York	II	Alabama	III	Nebraska	V	Washington	VI
New Jersey	II	Mississippi	III	North Dakota	V		
Delaware	II	Louisiana	III	New Mexico	V		
Pennsylvania	II	Tennessee	III	Montana	V		
Maryland	II	Kentucky	III	Wyoming	V		
Ohio	IV	Arkansas	III	Colorado	V		
Indiana	IV						
Illinois	IV						
Michigan	IV						
Wisconsin	IV						

Note: Region II includes the District of Columbia. Region NYC is New York City
Sources: Davis (1965), Bodenhorn (1995).

Table 5: Estimation Results for VEC:1880-1913

Cointegrating Eq:	CointEq1
r_{t-1}^{comm}	1.000000
r_{t-1}^{NE}	1.317486
	(1.04420)
r_{t-1}^{Plains}	-4.546399
	(0.77771)
r_{t-1}^{South}	8.641425
	(1.52986)
r_{t-1}^{West}	-1.614998
	(0.53596)
Constant	-26.05903

VEC	Δr_t^{comm}	Δr_t^{NE}	Δr_t^{Plains}	Δr_t^{South}	Δr_t^{West}
CointEq1	-0.035273	-0.056758	0.085985	-0.053066	0.063256
	(0.09413)	(0.05326)	(0.08367)	(0.04887)	(0.12773)
Δr_{t-1}^{comm}	0.098841	0.424982	0.301113	0.111647	0.163839
	(0.21874)	(0.12376)	(0.19443)	(0.11357)	(0.29681)
Δr_{t-1}^{NE}	-0.504462	-0.519332	-0.257823	0.209513	-0.277549
	(0.43147)	(0.24411)	(0.38351)	(0.22401)	(0.58546)
Δr_{t-1}^{Plains}	-0.811847	-0.447980	-0.569012	-0.361865	-0.156484
	(0.40996)	(0.23194)	(0.36439)	(0.21284)	(0.55628)
Δr_{t-1}^{South}	0.441062	0.368508	-0.293224	-0.285047	-0.133221
	(0.60648)	(0.34312)	(0.53907)	(0.31487)	(0.82294)
Δr_{t-1}^{West}	-0.076332	-0.123857	0.107312	-0.002879	-0.347544
	(0.19838)	(0.11224)	(0.17633)	(0.10300)	(0.26919)
Constant	-0.025112	-0.023869	-0.041686	-0.088148	-0.163564
	(0.18027)	(0.10199)	(0.16023)	(0.09359)	(0.24461)
R-squared	0.479663	0.471995	0.352430	0.450357	0.263675
Adj. R-squared	0.354782	0.345274	0.197013	0.318442	0.086957

Table 6: Estimation Results for VAR: 1914-1943

VAR	Δr_t^{comm}	Δr_t^{NE}	Δr_t^{Plains}	Δr_t^{South}	Δr_t^{West}
Δr_{t-1}^{comm}	0.050360	0.333030	0.522799	0.210862	0.278810
	(0.17724)	(0.12355)	(0.12562)	(0.11295)	(0.13995)
Δr_{t-1}^{NE}	0.182246	-0.238599	0.027166	0.439248	-0.010536
	(0.51221)	(0.35707)	(0.36304)	(0.32642)	(0.40446)
Δr_{t-1}^{Plains}	-1.004283	-0.255433	-0.630108	-0.283657	0.353484
	(0.36880)	(0.25710)	(0.26140)	(0.23503)	(0.29122)
Δr_{t-1}^{South}	0.218811	0.254455	0.542377	-0.184302	0.019099
	(0.50244)	(0.35026)	(0.35612)	(0.32019)	(0.39674)
Δr_{t-1}^{West}	0.288042	0.179917	0.043915	0.043938	-0.703479
	(0.24619)	(0.17162)	(0.17450)	(0.15689)	(0.19440)
Constant	-0.235349	-0.145262	-0.160758	-0.146429	-0.114000
	(0.15628)	(0.10895)	(0.11077)	(0.09960)	(0.12341)
R-squared	0.341695	0.277109	0.536982	0.247354	0.505585
Adj. R-squared	0.204548	0.126506	0.440520	0.090552	0.402582

Table 7a: Estimation Results for VEC:1955-2002 (using the commercial paper rate)

Cointegrating Eq:	CointEq1
r_{t-1}^{comm}	1.000000
r_{t-1}^{NE}	7.541244
	(1.14369)
r_{t-1}^{Plains}	23.06107
	(4.02675)
r_{t-1}^{South}	-28.47610
	(4.40977)
r_{t-1}^{West}	-3.785045
	(1.30640)
Constant	10.73664

VEC	Δr_t^{comm}	Δr_t^{NE}	Δr_t^{Plains}	Δr_t^{South}	Δr_t^{West}
CointEq1	0.020828	-0.132273	-0.067825	-0.020118	-0.076725
	(0.10335)	(0.06479)	(0.04639)	(0.04226)	(0.06009)
Δr_{t-1}^{comm}	0.727232	0.399205	0.436929	0.399077	0.389193
	(0.20474)	(0.12836)	(0.09190)	(0.08372)	(0.11904)
Δr_{t-1}^{NE}	0.153596	0.407044	0.391188	0.171615	0.344568
	(0.68746)	(0.43099)	(0.30856)	(0.28111)	(0.39969)
Δr_{t-1}^{Plains}	1.415023	1.367305	0.987615	0.647794	0.908078
	(1.62010)	(1.01570)	(0.72717)	(0.66247)	(0.94193)
Δr_{t-1}^{South}	-2.983008	-1.426121	-1.243240	-0.866988	-0.874312
	(1.60914)	(1.00883)	(0.72225)	(0.65799)	(0.93556)
Δr_{t-1}^{West}	-0.453151	-0.487856	-0.431340	-0.258032	-0.618130
	(0.74998)	(0.47019)	(0.33662)	(0.30667)	(0.43604)
Constant	0.707789	-0.344920	-0.058878	0.142585	-0.114023
	(0.57633)	(0.36132)	(0.25868)	(0.23566)	(0.33508)
D_{1981}	-1.337117	0.842034	0.234775	-0.229040	0.319101
	(1.12782)	(0.70707)	(0.50622)	(0.46117)	(0.65572)
R-squared	0.415578	0.325975	0.520143	0.559034	0.358437
Adj. R-squared	0.313304	0.208021	0.436169	0.481864	0.246164

Table 7b: Estimation Results for VEC:1955-2002 (using the Federal Funds rate)

Cointegrating Eq:	CointEq1
$r_{t-1}^{FedFunds}$	1.000000
r_{t-1}^{NE}	10.23021
	(1.69495)
r_{t-1}^{Plains}	31.98862
	(5.91049)
r_{t-1}^{South}	-38.48361
	(6.46709)
r_{t-1}^{West}	-5.689151
	(1.93968)
Constant	14.14103

VEC	$\Delta r_t^{FedFunds}$	Δr_t^{NE}	Δr_t^{Plains}	Δr_t^{South}	Δr_t^{West}
CointEq1	-0.043009	-0.106500	-0.063118	-0.026376	-0.069791
	(0.09443)	(0.04929)	(0.03532)	(0.03288)	(0.04556)
$\Delta r_{t-1}^{FedFunds}$	0.661498	0.327215	0.373366	0.332031	0.316519
	(0.22216)	(0.11595)	(0.08308)	(0.07735)	(0.10719)
Δr_{t-1}^{NE}	0.519498	0.476912	0.446614	0.222952	0.448527
	(0.87070)	(0.45444)	(0.32561)	(0.30316)	(0.42010)
Δr_{t-1}^{Plains}	2.399895	1.410201	1.051350	0.718209	0.986936
	(2.01826)	(1.05338)	(0.75477)	(0.70271)	(0.97378)
Δr_{t-1}^{South}	-3.629202	-1.314612	-1.159096	-0.784378	-0.785322
	(1.98773)	(1.03745)	(0.74335)	(0.69208)	(0.95905)
Δr_{t-1}^{West}	-1.082418	-0.662664	-0.578558	-0.388030	-0.818393
	(0.96416)	(0.50322)	(0.36057)	(0.33570)	(0.46519)
Constant	0.349886	-0.444830	-0.170794	0.059687	-0.200296
	(0.76491)	(0.39923)	(0.28605)	(0.26632)	(0.36906)
D_{1981}	-0.632014	0.988506	0.422644	-0.080521	0.482587
	(1.44551)	(0.75445)	(0.54058)	(0.50329)	(0.69743)
R-squared	0.354613	0.315409	0.509928	0.531116	0.350190
Adj. R-squared	0.235726	0.189300	0.419652	0.444743	0.230488

Figure 1. Interest Rates 1880-2002

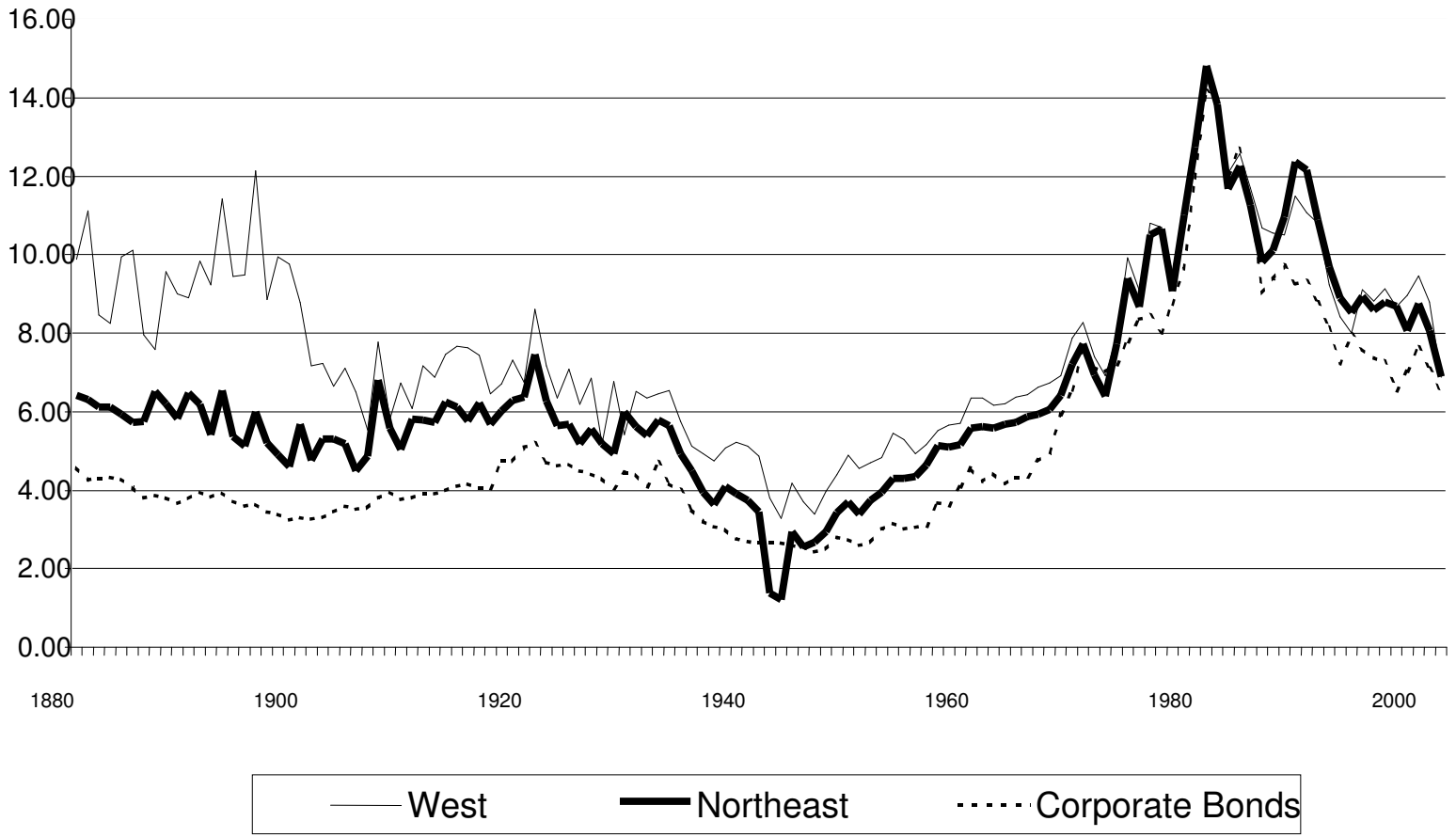

Figure 2. Interest Rates, 1926-1934

Figure 3. Variance Decomposition of Effect on Northeast Rate of a Shock to the National Rate

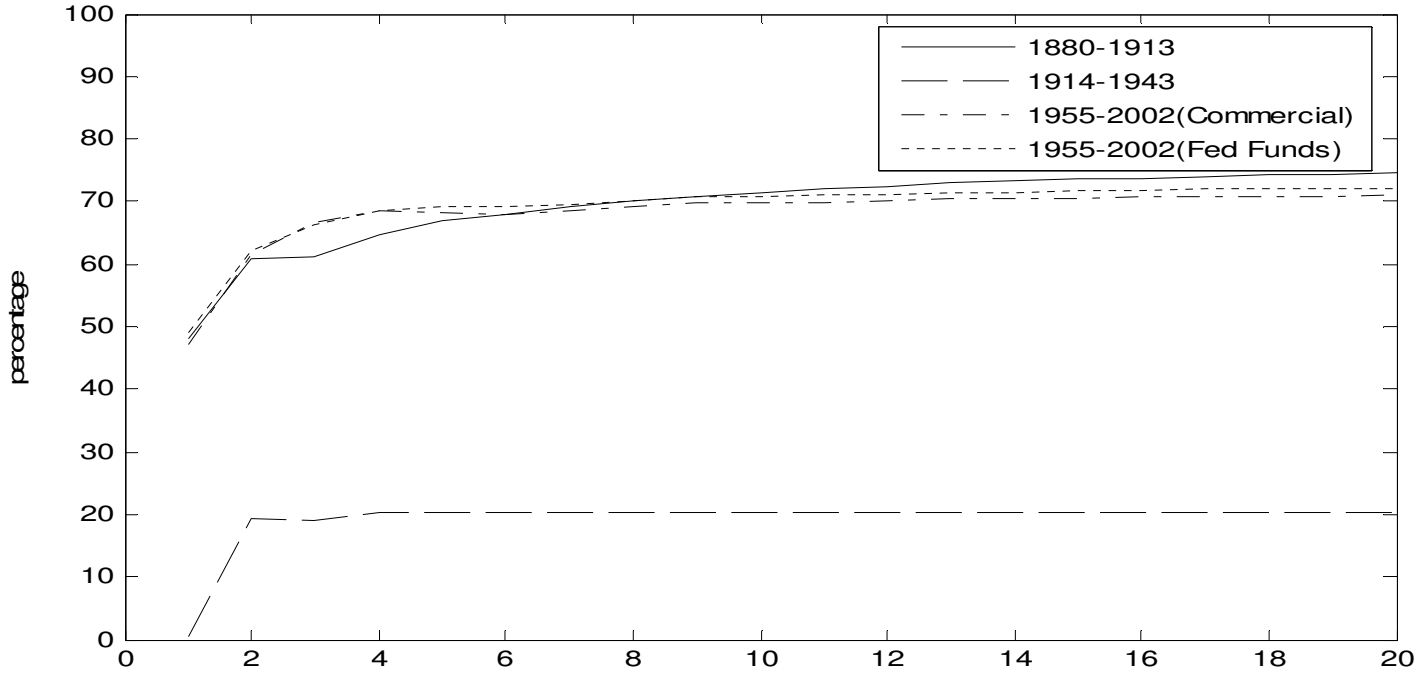

Figure 4: Variance Decomposition of the Effect on the West Rate of a Shock to the National Rate

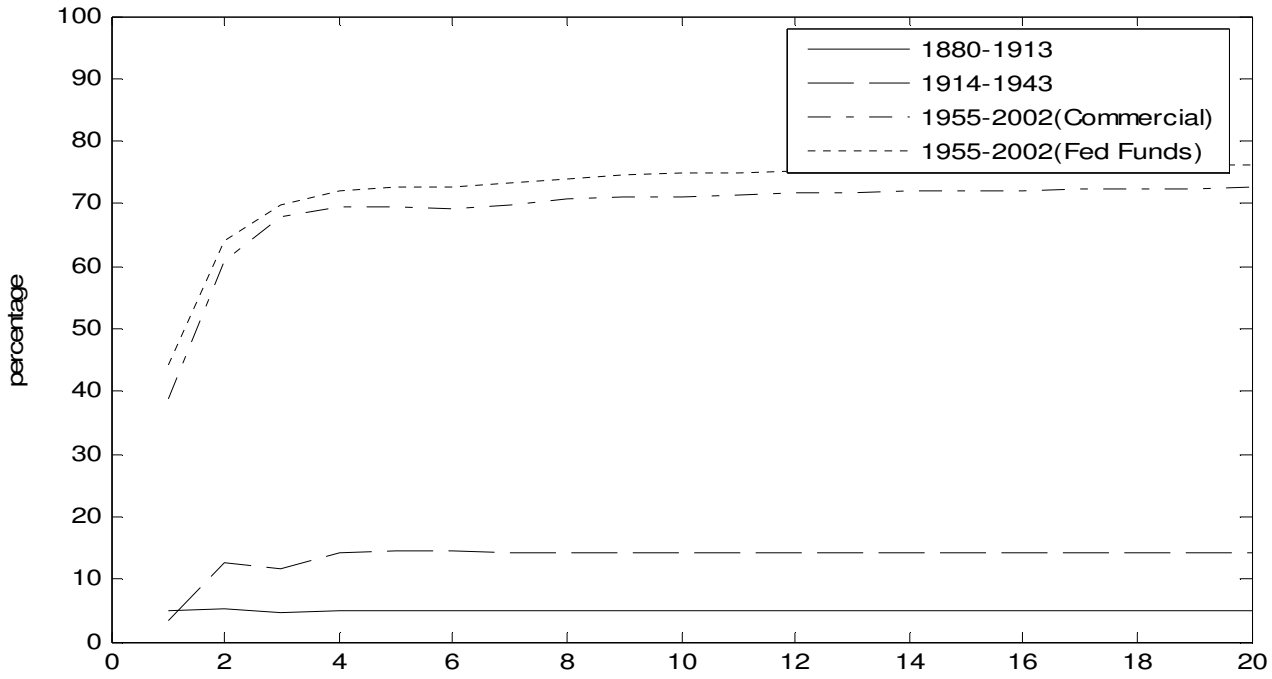

Figure 5: Variance Decomposition of Effect on Northeast Rate of a Shock to Northeast Rate

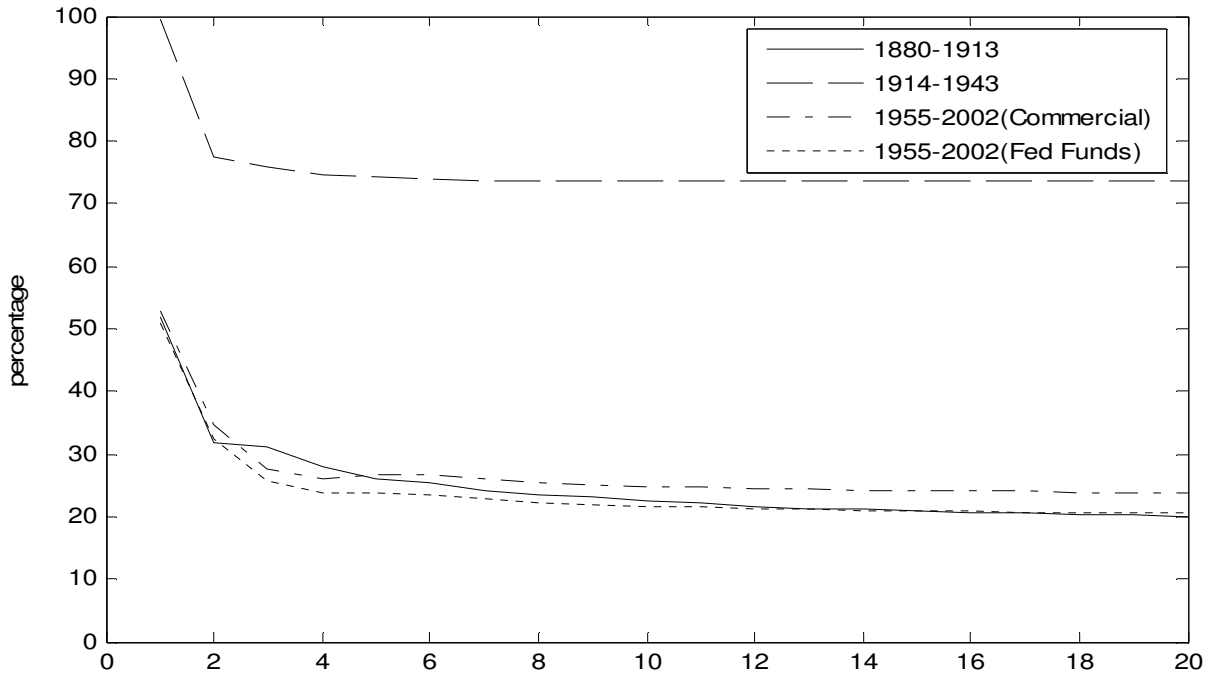

Figure 6: Variance Decomposition of Effect on West Rate of a Shock to West Rate

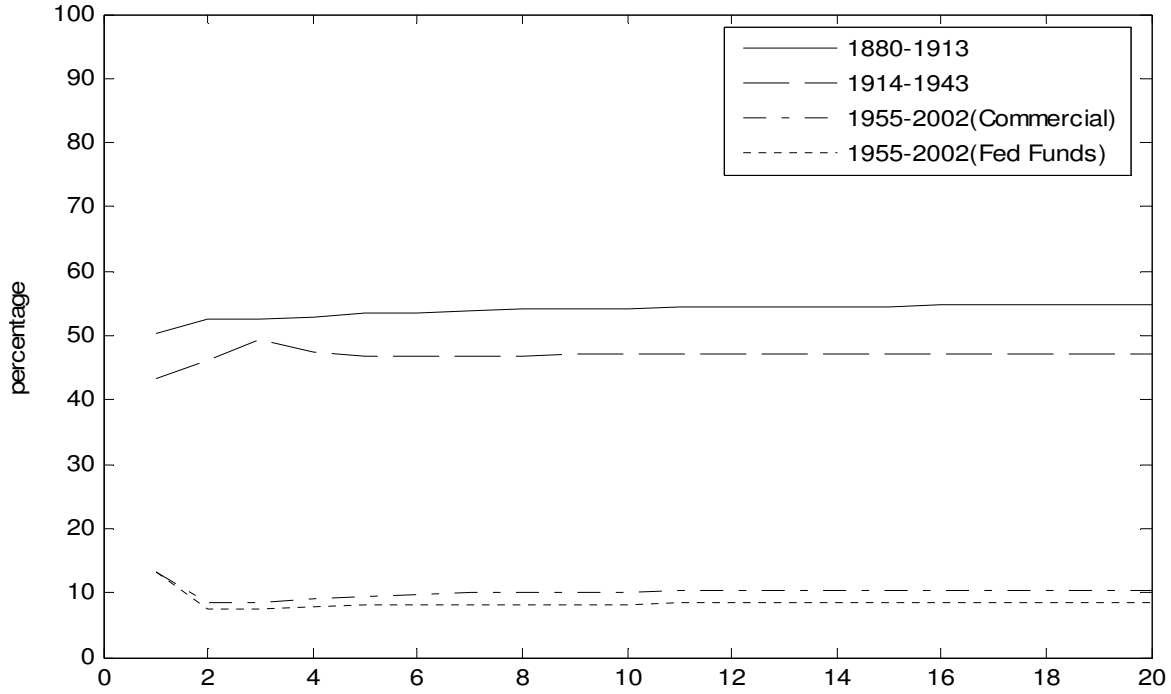

Figure 7: Variance Decomposition of Effect on Plains Rate of a Shock to National Rate

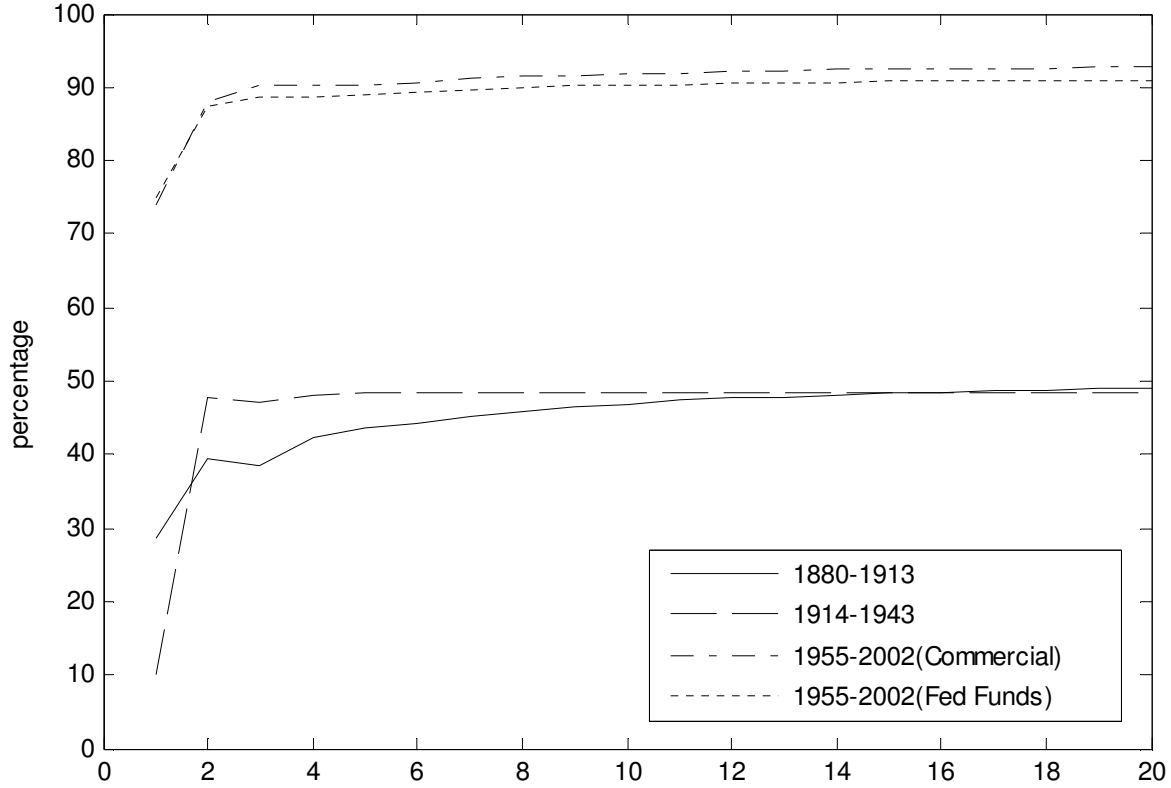

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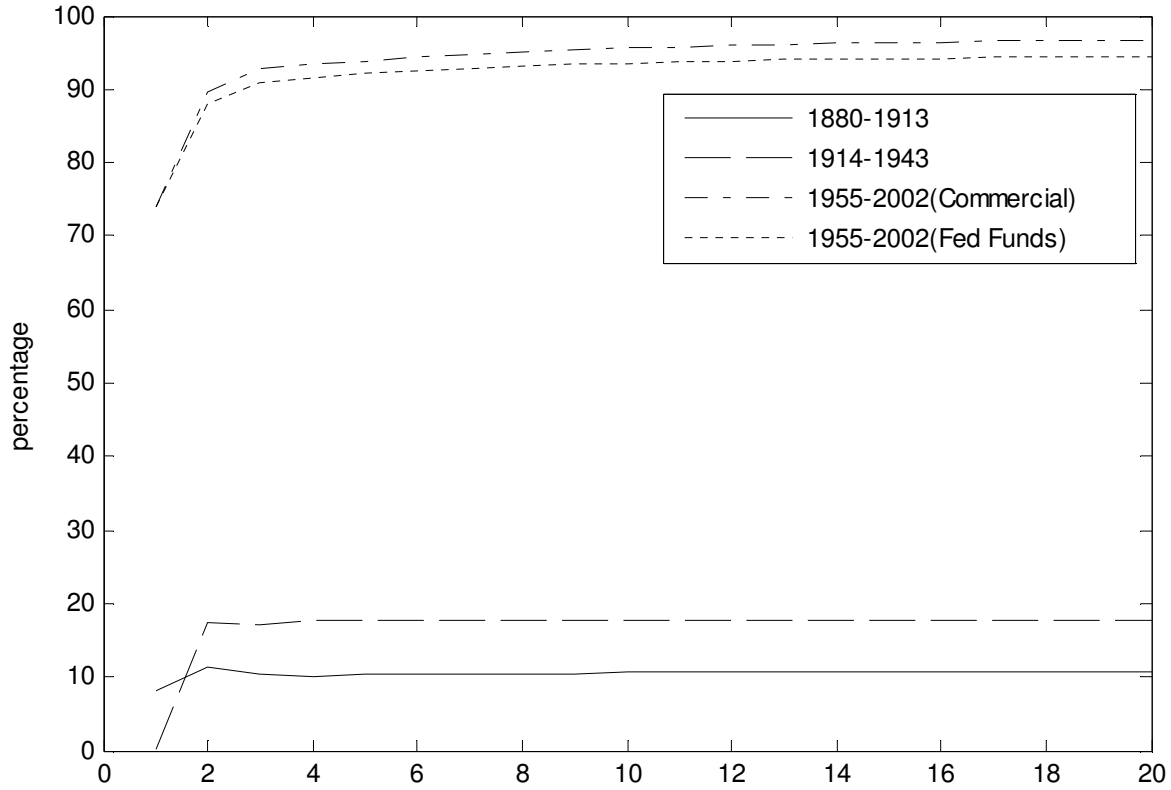
Figure 8: Variance Decomposition of Effect on South Rate of a Shock to National Rate



Endnotes

1. We thank Michael Bordo, Joseph Hughes, Eugene White and the other participants in a seminar at Rutgers University; Marc Flandreau, Rolf Luders, and other participants at a seminar at the Institut d'Études Politiques de Paris; and John James for helpful comments on an earlier draft. John.C.Driscoll of the Federal Reserve Board was kind enough to share his data on regional interest rates with us. Deepa Bhat provided thoughtful research assistance.

2. We focus on short-term interest rates because it has become fashionable in recent years to think of these rates as the main instruments and indicators of monetary policy. We have done some experimentation with other measures of monetary policy, including long-term rates, money, and high-powered money. We do not believe that the use of alternative measures would substantially change our conclusions, but we have not carried out all of our work with alternative measures.

3. Breckenridge also looked at regional differences in mortgage rates. Barry Eichengreen (1984, 1987) and Kenneth Snowden (1987) explored these differences more recently. Here, however, we have focused on the short-term rate differentials because these are more directly relevant to discussions of the effectiveness of monetary policy, at least as policy is currently discussed.

4. Double-name paper was less risky than single name paper for the obvious reason that there were two people to sue if the debt was not repaid rather than one, and for the less obvious reason that it probably represented a "real bill." The purchaser of a real good (a carload of wheat) created a note, which was then endorsed by the seller, before being discounted by a lender. The original creator of the note then could probably repay it by reselling the wheat.

5. The phrase was taken over from Breckinridge (1898, 129).

6. Sylla (1977) provides a good summary of the literature from the first decade after Davis's seminal paper.

7. John C. Driscoll of the Federal Reserve Board kindly shared the regional data that he used in his paper (2003) on bank lending rates. We derived our own series in order to be sure that they were as close as possible to being extensions of the earlier data. As it turned out, our final estimates were extremely close to Driscoll's.

8. The chronology can be found at www.nber.org.

9. We are stretching a point. Usually this adage seems to refer to a connection between stock market crashes and real economic activity.

10. The results are similar if we look at changes over a 5-year interval.

11. We also experimented with measures such as the simple rate of growth of money and the deviation from a five-year trend. But the results were similar. Experiments with high-powered

money also failed to uncover a measure of liquidity that was strongly correlated (in the simple sense used in this section) with regional interest rates.

12. On economic grounds it seems unlikely that there would be a unit root in the interest rate series, especially in earlier years. Real rates would be anchored by the productivity of capital and time preference, and the inflation premium would be held in check by the gold standard. Perhaps in the postwar era when the inflation premium becomes an issue a unit root in nominal rates would be more likely.

13. All the variance decompositions and the underlying data are available from the authors on request.