

Does Monetary Policy Have Differential Regional Effects?

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In simple textbook descriptions, monetary policy actions have a uniform national effect. In reality, the nation is made up of diverse regions that are linked but that respond differently to changing economic circumstances. For example, the large declines in crude oil prices in the mid-1980s affected energy-producing regions very differently from energy-consuming regions. Indeed, the notions of a “rolling

recovery” and of a “bi-coastal recession” have already entered the business vocabulary and suggest that the timing and perhaps the magnitude of ups and downs in economic activity vary across regions. The idea that monetary policy can have varied effects across regions is a short and logical next step. In fact, almost 40 years ago, Walter Isard, founder of the Regional Science Association, stated that “since each of [the nation’s] regions has different resource potentials and confronts different obstacles to growth, it follows that monetary policies alone generate both retarding factors for some regions and problem intensifying factors for other regions.”

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Despite long-standing interest and concern about the issue, there is, at present, little empirical evidence on whether and to what extent monetary policy actions have differential effects on regional economic activity. Monetary policymakers have access to a lot of information about regional economic conditions. They acquire this information through periodic reports from regional Federal Reserve Banks (Beige Book reports) and through the regional business data gathered by the presidents of the 12 Federal Reserve Banks, who attend meetings of the Federal Open Market Committee (FOMC). Additional information on differences in the impact of monetary policy across regions may aid policymakers in their consideration of regional developments in the formulation of national monetary policy.

WHY MIGHT MONETARY POLICY AFFECT REGIONS DIFFERENTLY?

Economic theory suggests at least three reasons why monetary policy might have differ-

ential effects across regions: regional differences in the mix of interest-sensitive industries, in the ability of banks to alter their balance sheets, and in the mix of large and small borrowers.

Regional Differences in the Mix of Interest-Sensitive Industries. Different industries respond quite differently to changes in interest rates. These different responses may interact with the different mix of industries across regions, and this interaction may result in differential regional effects of monetary policy. For example, changes in interest rates are likely to have profound effects on people's ability to buy houses and on businesses' willingness to acquire new structures. Construction accounted for almost 8 percent of real gross state product (GSP) in the Rocky Mountain region in 1980, but a little more than 4 percent of New England's real GSP (Table 1). In addition, manufacturing, another interest-sensitive sector, accounted for just over 30 percent of GSP in the Great Lakes region in 1980, but less than 12

TABLE 1

Percent of Gross Regional Product Accounted for by Major Industry (1980)

Region	Agri	Mining	Const	Mfg	Trans. & Pub. Util.	Trade	FIRE	Service	Govt	Pop (% of US)
New England	0.96	0.13	4.02	27.1	8.20	16.3	15.1	17.0	11.2	5.4
Mideast	0.82	0.52	4.12	21.6	10.30	16.3	16.1	17.2	13.0	17.8
Great Lakes	2.36	1.04	4.37	30.2	9.40	15.9	14.0	13.1	9.7	17.2
Plains	6.50	1.99	4.85	20.0	10.50	17.4	15.4	12.9	10.6	7.2
Southeast	2.52	5.90	5.80	20.6	9.60	16.1	13.3	12.5	13.7	23.7
Southwest	2.03	17.50	6.60	15.5	9.20	14.9	12.8	11.3	10.2	10.2
Rocky Mountain	3.93	10.60	7.60	11.6	10.50	15.1	15.4	12.6	12.7	3.0
Far West	2.97	1.70	5.50	18.1	8.10	16.8	18.0	16.5	12.3	14.9
United States	2.45	4.20	4.79	21.9	9.02	16.2	15.5	14.04	11.7	-

See Appendix A for breakdown of regions.

Source: Compiled from Bureau of Economic Analysis data

percent of the Rocky Mountain region's real GSP. Compounding these differences are interregional trade relationships, which can transmit localized responses differently across regions.

Regional Differences in the Ability of Banks to Alter Their Balance Sheets. Fed policy actions can have varied effects on different banks' ability to make loans. During periods of tight monetary policy when bank reserves are restricted, some banks can find alternative sources of funding for loans more cheaply and more easily than others, for example, by issuing large denomination CDs. Such banks' lending will be less sensitive to monetary policy changes. Anil Kashyap and Jeremy Stein propose that bank size largely explains differences in financing abilities: large banks have more funding options than small banks. Thus, regions in which a disproportion-

ately large share of bank loans are made by small banks might respond more to monetary policy actions than regions in which a large share of loans are made by the nation's large banks.

One way that Kashyap and Stein define small banks is those with total assets at or below the 90th percentile. Alternatively, John Boyd and Mark Gertler classify a bank as small if its assets are less than \$300 million. Since the asset size of the 90th percentile was just under \$300 million in 1994, Kashyap and Stein's definition is equivalent to Boyd and Gertler's classification. The regional distribution of loans made by banks with total assets at or below the 90th percentile in 1994 is given in Table 2. Whether we look at all small banks or only small banks that are *not* members of a bank holding company, the regional distribution of loans made by small banks is highly unequal,

TABLE 2

Share of Total Loans Made by a Region's Small Banks

December 31, 1994

	All Small Banks		Small Banks Not in Holding Co.	
	No. ^a	Loans (%)	No. ^b	Loans (%)
New England	129	8.5	119	7.7
Mideast	448	4.4	374	3.4
Great Lakes	1743	21.4	1147	11.8
Plains	2221	44.3	1732	25.3
Southeast	2211	21.7	1593	14.1
Southwest	1356	26.2	1102	20.0
Rocky Mountain	472	33.9	298	18.7
Far West	457	8.4	417	7.6

^aThe number of banks in each region that are at or below the 90th percentile in terms of total assets (compared with all banks in the nation). See Appendix A for breakdown of regions.

^bThe number of banks in each region that are at or below the 90th percentile in terms of total assets (compared with all banks in the nation) and are not members of a multi-bank holding company.

Source: Compiled from Call Reports

suggesting that monetary policy could have differential regional effects.¹

The effect of the differences in regions' reliance on small banks will be diluted if bank-dependent borrowers can obtain credit from sources outside their own regions. However, there is evidence that banking markets tend to be segmented along regional lines. Craig Moore and Joanne Hill note that since banks can identify and monitor local investment projects more efficiently than banks and investors in other regions, it will be less costly for households and small firms to borrow from local banks.²

Regional Differences in the Mix of Large and Small Borrowers. Regional differences in the proportion of large and small borrowers and the sources of credit available to each also could lead to different regional responses to monetary policy. According to the credit view of monetary policy, Fed actions affect economic activity by altering banks' ability to provide loans.³ To the extent that some bor-

rowers are constrained to obtain credit from banks, monetary policy changes will substantially affect their ability to spend. Large borrowers usually have greater access to alternative, nonbank sources of funds, such as the issuance of corporate stocks and bonds or commercial paper. By contrast, small borrowers, such as individuals and small businesses, typically have banks as their sole sources of credit. Consequently, activity in a region that has a high concentration of small borrowers could be especially sensitive to changes in Fed policy.

The percentage of small firms (defined as regional firms with fewer than 500 employees) varies widely across regions (Table 3). It ranges from a low of 66 to 67 percent in the New England, Mideast, and Great Lakes regions to a high of about 82 percent in the Rocky Mountain region.⁴

¹As a member of a bank holding company, a small bank can issue large denomination (uninsured) CDs at more favorable rates because it can rely on the financial strength of the larger bank holding company. Note also that although the data indicate the location of the lending bank, they do not specify the locations of the borrowers. One reason for focusing on the lending patterns of small banks is that they tend to specialize in loans to local customers. Large banks tend to make loans outside their local market.

²Katherine Samolyk found that, during the 1983-90 period, conditions of the local banking sector explained more of real personal income growth in states where bank loan quality was poor than in those states where banking conditions were relatively healthy.

³The "credit view" of monetary policy is discussed in Ben Bernanke's articles. As pointed out by Mark Gertler and Simon Gilchrist (1994) and Stephen Oliner and Glenn Rudebusch (1995), the credit view assumes that banks do not fully insulate their loans from changes in reserves following monetary policy actions, and that borrowers cannot fully insulate spending from changes in the supply of bank credit.

⁴In a controversial paper, Anil Kashyap, Jeremy Stein, and David Wilcox find evidence for an aggregate bank lending channel for monetary policy. Daniel Thornton finds a positive but small relationship between monetary policy actions and bank lending prior to the early 1980s. After the early 1980s, Thornton found no evidence of such a relationship. He concludes that financial innovation and changes in reserve requirements under the Monetary Control Act of 1980 have essentially eliminated any relationship between monetary policy changes and bank lending. (The study by Kashyap, Stein, and Wilcox and the one by Thornton do not differentiate the effects of monetary policy on small vs. large firms.) Using manufacturing data, Oliner and Rudebusch found no evidence of a substitution away from bank loans for either small or large manufacturing firms following a monetary contraction. Rather, the main effect of a tightening of monetary policy is to redirect *all* types of credit (e.g., commercial paper, loans from finance and insurance companies, and trade credit) from small manufacturing firms to large manufacturing firms. Oliner and Rudebusch refer to the redistribution of all types of finance as a *broad credit channel* for monetary policy as opposed to a narrower bank lending channel. Similarly, Gertler and Gilchrist found that small manufacturing firms contract substantially more than large manufacturing firms following a tightening of monetary policy.

TABLE 3

**Share of
Total Regional Employment
Accounted for by a
Region's Small Firms***

New England	66.2%
Mideast	67.0%
Great Lakes	66.5%
Plains	77.1%
Southeast	73.3%
Southwest	76.9%
Rocky Mountain	82.4%
Far West	77.9%

*Percent of total regional employment accounted for by firms with fewer than 500 employees in 1981. See Appendix A for breakdown of regions.

Source: Compiled from data on county business patterns

**DOES MONETARY POLICY
AFFECT REGIONS DIFFERENTLY?**

While Fed policy actions can conceivably affect regional economies differently, little is known about the actual impact of Fed policy in different areas of the country. Some attention has been paid to the effects of monetary policy on region-specific banking flows as opposed to economic activity. Studies by Randall Miller and Peter Bias have found that Federal Reserve policy actions do affect regional banking flows differently. More typically, evidence has been collected about the effects of monetary policy actions on nominal income in particular regions.⁵ Results from these studies suggest that monetary policy has substantially different impacts in different regions.

⁵See the studies by William Toal; Charles Garrison and Hui Chang; John Beare; Vijay Mathur and Sheldon Stein; and Charles Garrison and John Kort.

However, this research contains a notable shortcoming. Existing studies measure the impact of monetary policy region by region without accounting for feedback effects among regions (i.e., monetary policy can directly affect the New England region, but because New England trades with the Mideast region, monetary policy indirectly affects the Mideast region and vice versa).

In an earlier study, we documented the importance of feedback effects among U.S. regions using a statistical technique known as vector autoregression (VAR).⁶ Our VAR included eight equations, one for real income growth in each region. For each equation, a region's real income growth depended on past values of its own and the other regions' real income growth.

By considering the system as a whole, rather than one equation at a time, the model allowed us to trace the effects of a change in a particular region's real income growth on real income growth in all other regions. For example, if income growth in New England rises, income growth in all other regions will be affected, since developments in New England will eventually affect other regions. Moreover, after the initial effect, continuing feedback effects on all other regions will occur, with the subsequent effects becoming smaller and smaller.

In a follow-up to that study, we used a VAR to estimate both the direct effects of *changes in monetary policy* on real personal income growth at the regional level and the spillover effects on income growth among regions.⁷ The variables

⁶See Gerald Carlino and Robert DeFina (1995a). A VAR is a widely used modeling technique for gathering evidence on business-cycle dynamics. VARs typically rely on a small number of variables expressed as past values of the dependent variable and past values of the other variables in the model. See Theodore Crone's article for a discussion of VARs as applied to regional analysis.

⁷See Gerald Carlino and Robert DeFina (1995b).

in our model included real personal income growth in each of the eight major regions defined by the Bureau of Economic Analysis (see *Appendix A* for a breakdown of the regions), the change in the relative price of energy (to account for the effects of oil price shocks), and the change in the federal funds rate (as a measure of changes in monetary policy). The study employed quarterly data for the period 1958-92.

A typical way to summarize the impacts of policy on personal income growth, and one that captures all interregional dynamics, is the cumulative impulse response. The cumulative impulse response shows how the level of real personal income in a region changes over time because of a monetary policy surprise. Monetary policy surprises are measured by unanticipated changes in the federal funds rate.⁸ For example, in fall 1994, Fed actions raised the federal funds rate 0.75 percentage point. Shortly before that time, forecasters were publicly predicting an increase of 0.25 percentage point. Thus, the additional 0.50 percentage point was a policy surprise or innovation.

The figure on page 23 shows the estimated cumulative response in real personal income for each region resulting from an unexpected

increase of one percentage point in the federal funds rate. The cumulative response of U.S. aggregate real personal income (a weighted average of the regional responses) is included as a benchmark for comparison. An unexpected increase in the fed funds rate lowers real income in all regions relative to what it would have been otherwise.

We found that an unexpected one-percentage-point increase in the federal funds rate reduces real *growth* temporarily and, thus, leaves the *level* of real personal income below what it otherwise would have been for about two years. The model treats tightening and easing of the fed funds rate symmetrically, so that an unexpected cut in the funds rate temporarily raises real personal income relative to what it would have been otherwise. Since there are both unanticipated increases and decreases in the federal funds rate over time, we should not conclude that monetary policy lowers real personal income on average.

Interestingly, not all regions respond by the same magnitude. Several regions generally respond to monetary policy surprises with a magnitude and timing similar to those of the national economy. Specifically, the responses of income in five regions (New England, Midwest, Plains, Southeast, and Far West), called core regions, mirror the national response. In those regions, income ultimately falls about 1 percent (compared with what it would have been) subsequent to the one-percentage-point increase in the federal funds rate.⁹ The core regions accounted for 68 percent of aggregate 1980 gross state product (GSP) in the United States and for 70 percent of total U.S. population.

Other regions (Great Lakes, Southwest, and Rocky Mountain), called noncore regions, show

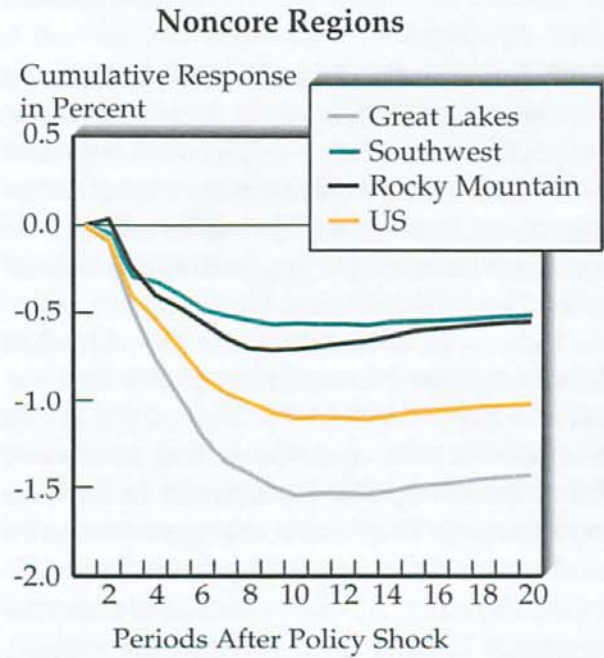
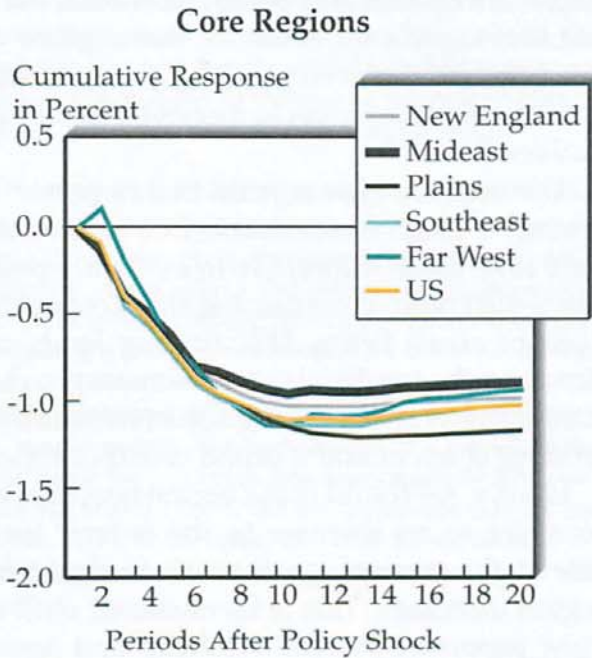
⁸The model includes an equation that predicts changes in the federal funds rate on the basis of a year's worth of past data for each of the following variables: the change in the federal funds rate; real personal income growth in each of the eight major regions; and the change in the relative price of energy. Unexpected changes in the federal funds rate are measured by taking the difference between the actual and predicted change. Unexpected changes in the federal funds rate are used to proxy monetary policy surprises in the policy simulations that follow. The analysis assumes that unexpected changes in the federal funds rate arise only from policy surprises. Some economists believe that only unanticipated changes in monetary policy affect real economic variables. See Shaghil Ahmed's article for a fuller discussion of the distinction between unanticipated and anticipated monetary policy and its effect on real activity.

⁹The terminology "core regions" is taken from Tamim Bayoumi and Barry Eichengreen, who use it in a related, but somewhat different, way.

Response of Real Personal Income to a One-Percentage-Point Unexpected Increase in the Fed Funds Rate*

Some Region's Responses Mirror the Nation's...

...Other Region's Responses Do Not



*Graphs show the percent difference in real regional personal incomes from what they would have been without the unanticipated increase in the fed funds rate.

magnitudes of monetary policy effects quite different from the magnitudes for the national economy. The noncore regions accounted for 32 percent of total 1980 GSP in the United States and for 30 percent of U.S. population. Personal income in the Great Lakes region showed the largest response to an unexpected increase of one percentage point in the fed funds rate, dropping about half again as much as income in the core regions. The Great Lakes region accounts for 18 percent of total GSP. In two other regions (Rocky Mountain and Southwest), personal income is much less responsive to an unanticipated one-percentage-point increase in the fed funds rate than income in the core regions, falling about half as much. Together these two regions account for 14

percent of aggregate GSP and 12 percent of the U.S. population. The Rocky Mountain region is the smallest, accounting for only 3 percent of aggregate GSP and only 3 percent of the nation's population.¹⁰

After eight to nine quarters, real personal income begins to recover in most regions. Although the forecasted level of real regional personal income appears to remain below the

¹⁰In a more formal statistical test, the cumulative responses for the five regions that make up the core are found to be insignificantly different from the national cumulative response at the 5-, 10-, 15-, and 20-quarter horizons. In contrast, the cumulative responses of the noncore regions are generally found to differ significantly from the cumulative response of the nation.

level that would have existed in the absence of the unanticipated increase in the fed funds rate, we cannot conclude that the level of regional personal income will remain permanently lower.¹¹

WHAT CAUSES THESE DIFFERENTIAL RESPONSES?

We identified three ways in which monetary policy could have differential regional effects: regional differences in the mix of interest-sensitive industries, in banks' ability to adjust their balance sheets, and in the mix of large and small borrowers. How important are these factors in accounting for the different regional responses to monetary policy innovations?

To answer the question, we analyzed whether cross-regional differences in the size of real income responses are systematically related to variables capturing these three factors (see *Appendix B*). Having so few observations makes it difficult to sort out the various ways in which monetary policy affects the economy of regions, but our findings are suggestive.

The interest sensitivity of a region's industries is likely to rise with the percent of a region's total gross state product accounted for by construction or manufacturing. Studies have shown that consumer spending on housing and manufactured goods, especially durable goods, tends to be interest sensitive.¹² Spending on services, in contrast, tends to vary little with interest rates. Our analysis

indicates that manufacturing-intensive regions are more responsive to changes in monetary policy than the more industrially diverse regions. This finding suggests that differences in interest-rate sensitivities are one reason for different regional responses. However, we do not find significant evidence that regions dependent on the construction industry have greater responsiveness to monetary policy initiatives.¹³

The analysis also reveals that regions containing a large concentration of small firms tend to be more responsive to monetary policy shifts than regions containing small concentrations of small firms. This finding lends credence to the credit view of monetary policy, although we cannot distinguish between a bank lending channel and a broad credit channel.¹⁴

Finally, we found that a region becomes less sensitive to an increase in the federal funds rate as the percentage of small banks in that region increases. This is inconsistent with the view espoused by Anil Kashyap and Jeremy Stein.¹⁵ One possibility for the inconsistency is

¹³While the finding that monetary policy has larger effects in manufacturing-intensive regions is consistent with a greater interest-rate sensitivity in these areas, it is also consistent with other explanations. For example, contracts fixed in nominal terms are thought to be one avenue by which monetary policy affects economic activity. To the extent that manufacturing firms make greater use of nominal contracts than other firms, it becomes difficult to sort out the true source of the greater policy impact.

¹⁴Earlier we found that while the Rocky Mountain and Southwest regions have high shares of small firms they are less sensitive to changes in monetary policy. The Great Lakes region has a relatively low share of small firms and is most sensitive to changes in monetary policy. The results presented in *Appendix B* suggest, however, that once we take other factors into account (manufacturing and construction shares and percent of loans made by small banks), the regional concentration of small firms appears to have the anticipated positive effect.

¹⁵If small banks largely make loans to small firms, this relationship would be captured by the small firm variable.

¹¹We found that changes in the fed funds rate have statistically insignificant long-run effects on the level of each region's real income. This finding is consistent with the widely held theoretical view that monetary policy actions have no lasting impact on real variables, such as real income and output.

¹²See Paul Bennett's 1990 article for a survey of relevant studies.

that a bank's asset size may be a poor indicator of its ability to adjust its balance sheet to monetary policy actions.¹⁶

There is a moderate correlation between the small firm variable and the small bank variable used in the analysis described in Appendix B (a simple correlation of .64). This correlation could explain the lack of a positive response of the bank size variable to changes in monetary policy. It does not, however, account for the negative effect.

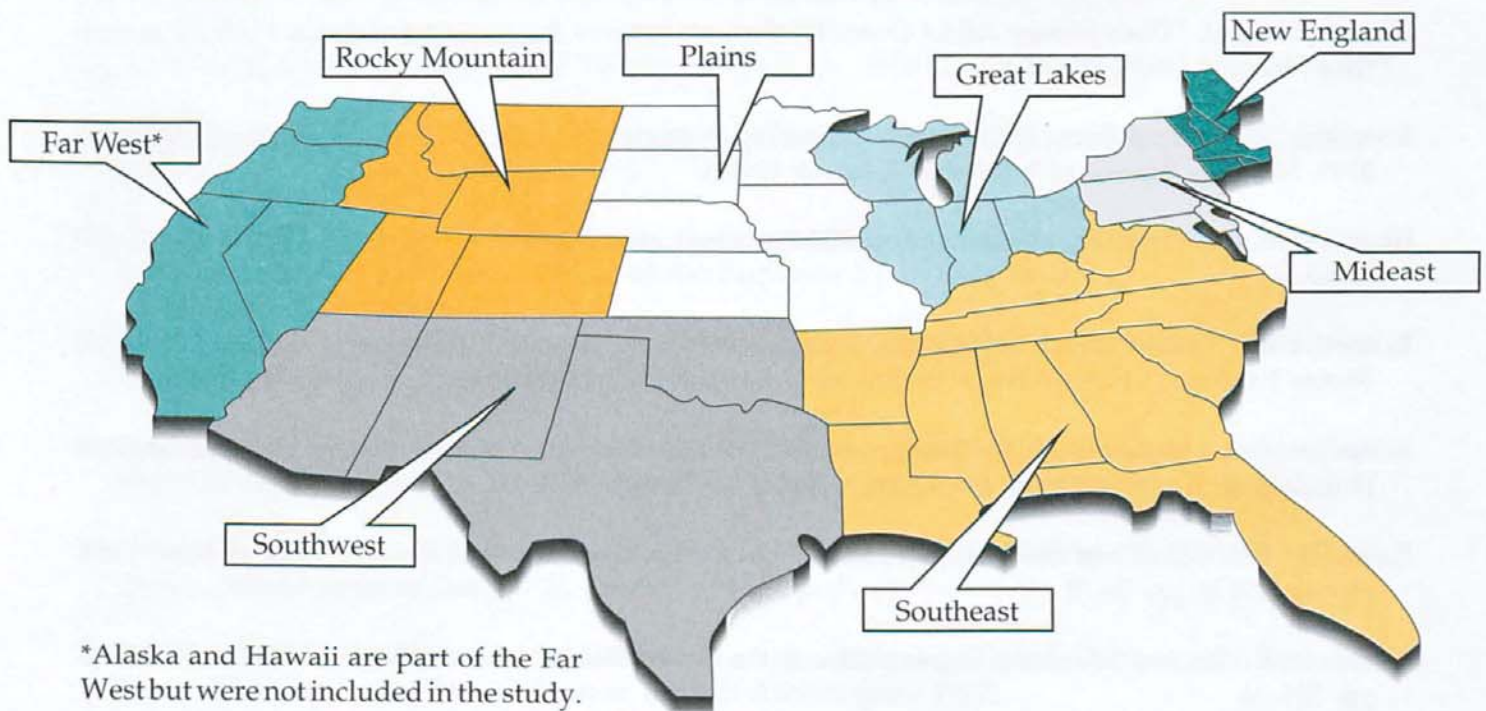
¹⁶Joe Peek and Eric Rosengren suggest that bank capital is a better indicator because better capitalized banks have more and cheaper alternative sources of funds available. In addition, Anil Kashyap and Jeremy Stein point out that regional differences in the types of loans being made might also matter, a factor not controlled for in our study. Another consideration is that the loans variable used in the regression is measured at the end of 1994, which is outside our sample period. We re-estimated the cross-regional model using the percent of total loans made by a region's banks that are at or below the 90th percentile as of the end of 1985. The results using the 1985 loans variable are essentially identical to the reported results using the 1994 variable.

CONCLUSION

Does monetary policy have differential regional effects? The answer is yes. Our research reveals two regions—the Southwest and Rocky Mountain—in which monetary policy has smaller effects on local economic activity than it has on the national economy and one region—the Great Lakes—in which it has a larger effect. The other five, or core, regions respond to monetary policy changes in ways that closely approximate the average response in the United States. The core regions accounted for more than 68 percent of aggregate personal income in the United States in 1980 and for 70 percent of the nation's population.

The existence of disparate responses underscores the complexity of conducting a national monetary policy for countries as large and diverse as the United States. We hope that information from studies such as this will allow regional data to better inform the national policy process.

APPENDIX A Breakdown of Regions



APPENDIX B

The absolute value of the estimated regional cumulative responses reported in the figure on page 23, denoted CR, can be used as dependent variables in a cross-regional regression equation to explain the differential regional responses to monetary policy shocks. An eight-quarter horizon was chosen for the cumulative response because this is generally when Fed policy has its maximum significant cumulative impact. The independent variables in the model are designed to account for the three reasons given to explain why regional responses to monetary policy innovations differ. Unfortunately, the small number of observations (eight regions) limits the number of different reasons that can be considered at the same time. A region's interest-rate sensitivity is measured by the percent of a region's GSP accounted for both by manufacturing (Mfg) and by construction (Con). Two variables are used to account for the regional credit views of monetary policy: the percent of a region's firms that are small (defined as the percent of a region's firms with fewer than 500 employees) (Firms) and the percent of a region's total loans accounted for by a region's banks that are at or below the 90th percentile nationally in assets and not a member of a bank holding company (Loans). The findings from the regression analysis are reported below and discussed in the article (t-statistics are given in parentheses):

$$CR_i = -2.5054 + 0.0856Mfg_i - 0.1649Con_i + 0.0426Firms_i - 0.0305Loans_i$$

(-1.42)
(4.22)
(-1.12)
(2.57)
(-3.02)

$$\bar{R}^2 = 0.8507$$

$$F = 10.97$$

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