MONEY AND INTEREST RATES AS PREDICTORS OF REGIONAL ECONOMIC ACTIVITY

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Abstract–This paper revisits the issue of monetary influences on regional economies. It explores linkages between national financial variables and economic activity in the Detroit MSA and the state of South Carolina, regions with very different industrial structures. Tests on the information-content of money and interest rates and evaluation of contributions to forecasting regional employment reveal that interest rates outperform monetary aggregates over several business cycles. Detroit is more sensitive to interest rates than South Carolina, but the latter is far from immune to changing national monetary conditions. The spread between rates on commercial paper and treasury bills outperforms monetary aggregates as a predictor of short-run changes in the regional economies. This result is in line with findings for the nation.

Because financial indicators provide sources of information about short-run changes in economic activity, analysts regularly follow stock prices intent on finding early clues about the direction the economy might take. Forecasters examine financial factors in explaining short-run swings in the economy: monetary aggregates signal impending changes in the economy, and restrictive monetary policies may contribute to slowdowns as well as to outright recessions. In fact, advance signals from monetary indicators such as M2 indicate that money leads production and income. This behavior is often interpreted thus: "Money causes income."

Stock and Watson (1989), Friedman and Kuttner (1992), and Bernanke and Blinder (1992) address this issue and report that a variety of money and interest-rate variables contain information about the future direction of the national economy. Their results suggest–strongly in several cases–that short-term interest rates and measures of spreads in interest rates contribute significantly to predicting future movements in real macroeconomic variables.

This paper revisits the issue of monetary influences on regional economies. If financial processes contain information about the future direction of the national economy, then how do they perform in a regional setting? Is there a difference in regional responsiveness to changes in national financial indicators? The paper addresses these questions by exploring linkages between financial variables and cyclical behavior in two very different regions: the Detroit MSA and the state of South Carolina. Specifically, what is the contribution of money and interest rates to explaining changes in employment in regions with very different industrial structures?

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Section I reviews issues surrounding the predictive power of money and interest rates at the national and regional levels and outlines a post-Keynesian perspective from a model offered by Dow (1987). Section II discusses the industrial structures of the Detroit MSA and the state of South Carolina. Section III presents a series of statistical tests for the 1972-1992 period, during which four national recessions occurred. Section IV evaluates regional forecasting performance for a set of national financial variables. Section V summarizes the findings, assesses the predictive power of money and interest rates, and indicates why certain national financial variables may affect some regions differently.

I. MONEY AND INTEREST RATES

Koch and Rasche (1988) reported that real M2 possesses a high degree of economic significance compared to other components of the index of leading indicators published by the U.S. Department of Commerce. Kozlowski (1991) demonstrated that M2 also enhanced the predictive power of regional indexes of leading indicators. Whatever role monetary processes play, the money stock, measured by M2, is an economically significant leading indicator that appears to predict changes in production, employment, and inflation. It displays long lead-times, especially at business cycle peaks. Declines in M2 seem to capture early symptoms of short-run changes in aggregate economic activity.

In a national and regional setting, therefore, money matters. That is far from conclusive, however. Impulses may be transmitted through changes in the supply of or demand for money, changes in credit conditions, or movements in short-term interest rates. Moreover, impacts on the real economy vary over time, across sectors, and presumably among regions.

Economists search for significant indicators. Nevertheless, with respect to monetary impulses, research results vary; and, in some cases, they are contradictory. Note the following conclusions:

> Over the last two years, the rates of growth of M2 and nominal GDP have corresponded fairly closely. It appears that the behavior of M2 will continue to offer useful information about the public's nominal expenditure and output. (Hetzel 1992)

> But one should also admit the possibility that in a deregulated financial environment no monetary aggregate may be reliably enough related to policy goals to become the pre-eminent information variable. (Higgins 1992)

Research pointing to asymmetric behavior at peaks and troughs in the business cycle challenges the role of money in forecasting (Morgan 1993). A statement by Federal Reserve Chairman Alan Greenspan reflects this concern.

> The historical relationships between money and income, and between money and the price level have largely broken down, depriving the aggregates of much of their usefulness as guides to policy. At least for the time being, M2 has been downgraded as a reliable indicator of financial conditions in the economy, and no single variable has yet been identified to take its place. (July 20, 1993)

Stock and Watson (1989) found the spread between rates on commercial paper and treasury bills to be a good predictor of national macroeconomic variables. Friedman and Kuttner (1992) demonstrated that information from an interest-rate spread remained significant across sample periods for the 1960s, 1970s, and 1980s; it dominated money-stock variables in anticipating changes in the economy. Bernanke and Blinder (1992) concluded that the federal funds rate is a good indicator of monetary policy and a reliable predictor of real macroeconomic variables such as personal income, industrial production, employment, housing starts, and durable-goods orders. They argue that monetary policy works in part by affecting bank assets (loans) and then real variables.

Two explanations suggest why an interest rate spread predicts so well. Cook and Lawler (1983) point out that the difference between a risky return, commercial paper, and a safe return of the same maturity, treasury bills, is a measure of perceived default risk. Before 1978 rising rates on money market securities led to disintermediation that increased the demand for treasury bills, lowered their rates, and pushed up the spread between money market rates and T-bill rates. They argue and demonstrate that after 1978, default risk, taxes, and the relative supply of treasury bills explain the behavior of this spread. A rise in the spread may foreshadow changes in real economic activity if it reflects information about investors' expectations on the chances of recession. Specifically, if they anticipate a recession in the near term, then perceived risk of private securities rises and the spread increases.

Bernanke (1990) offers a second explanation based on imperfect substitution between treasury bills and commercial paper. In short, the spread responds to

monetary policy whenever the federal funds rate is used as an intermediate target by the Federal Reserve. Increases in the federal funds rate, a rise in commercial paper rates, and an upswing in the spread accompany restrictive monetary policy. A spread between rates on commercial paper and T-bills may be a good predictor, therefore, because it reflects monetary policy, the state of financial markets, and expected default risks.

Short-term interest rates do move in a cyclic manner–rising during expansions, falling during recessions–but with a lag. They are lagging indicators in a traditional business cycle sense. In an inverse fashion, however, rising rates during an expansion phase may contain seeds of information from financial markets. Figure 1 shows the federal funds rate and the spread between the six-month rate on commercial paper and T-bills. Long, inverse leads exist that may link movements of short-term rates to real economic activity. The spread behaves relatively well in this respect.

Dow (1987) offered a static post-Keynesian model for examining differences in regions with respect to money. It focuses on liquidity preference, default risk, and investor confidence in the economies of different regions. Adapting the model for national monetary impulses and a region's reactions captures financial dynamics.

(1)	M_r	=	mB	M_r	=	regional money supply.
(2)	m	=	$\omega(x, I_o, F_r)$	m	=	bank multiplier.
(3)	B	=	$\xi(C_{d,r}, H_r, P_r)$	B	=	monetary base.

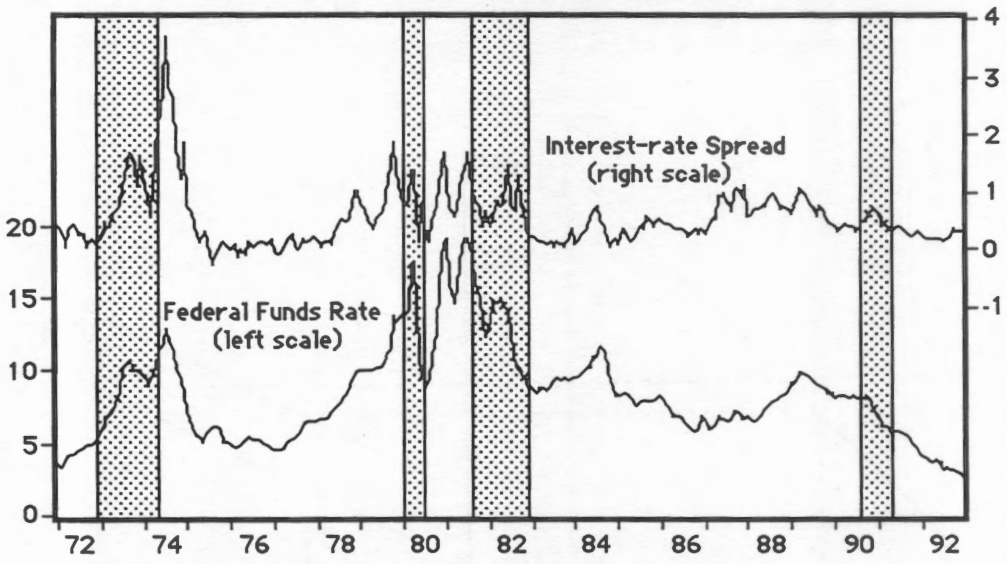
Substituting (2) and (3) into (1) yields

$$(4) \quad M_r = \omega(x, I_o, F_r)\, \xi(C_{d,r}, H_r, P_r),$$

where x is the reserve ratio; I_o is the propensity of financial institutions to invest outside the region; F_r is the propensity of the nonbank public to spend in the region; $C_{d,r}$ is the region's demand for credit; H_r represents liabilities of the monetary authority; and P_r is the exogenous component of a region's balance of payments. In short, the supply of money to a region is a multi-dimensional phenomenon.

Liquidity preference plays a key role. For this model, $\partial\omega/\partial I_o < o$, which means that an increase in investment outside a region lowers its supply of funds; depository institutions may seek this channel when their liquidity preference rises. Nationwide, an increase in liquidity preference results in a decline in the willingness to extend credit. In a regional setting, there is a preference for national over

FIGURE 1
Nominal Interest Rates (%)



Note: Shaded areas are national recessions.

local assets. This is likely to occur before and during an economic contraction (recession), which, in a dynamic sense, reflects leading behavior.

Channels of transmission through liquidity preference, confidence, credit, and a national market are shown in (5) and (6).

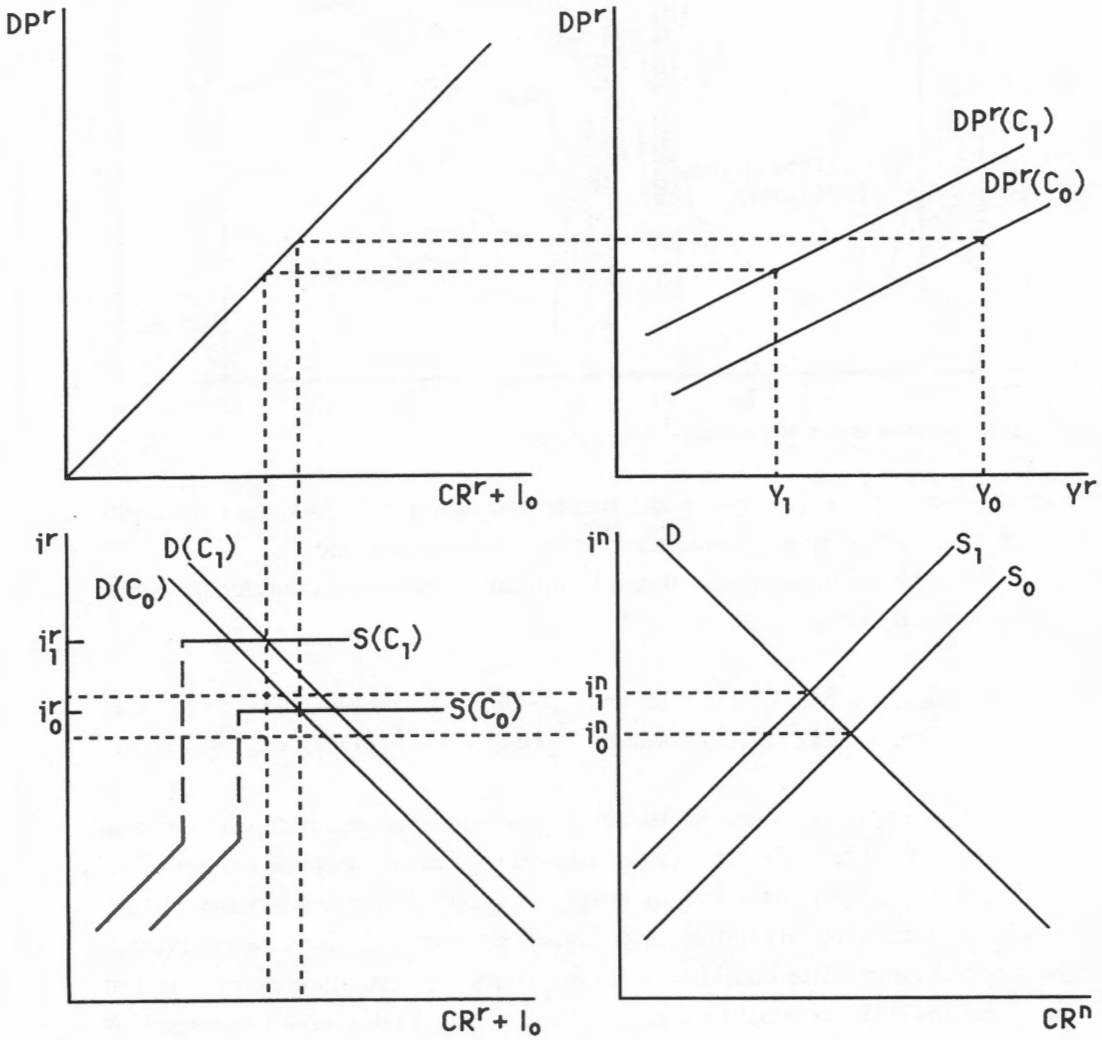
$$(5)\quad S_{CR} = S(i^r, C^r, i^n);\quad \text{where}\quad \partial S/\partial i^r = 0;\quad \partial S/\partial C^r > 0;\ \partial S/\partial i^n < 0.$$

$$(6)\quad D_{CR} = D(i^r, C^r, i^n);\quad \text{where}\quad \partial D/\partial i^r < 0;\quad \partial D/\partial C^r < 0;\ \partial D/\partial i^n > 0.$$

These supply and demand functions for credit in a region depend on local confidence, C^r. They interact with the national market to determine a regional interest rate i^r. Such behavior, in turn, affects a region's output and income. For example, tighter monetary policy and higher short-term interest rates increase default risks and lower confidence in local assets. Regional interest rates reflect this, and the difference between regional and national rates, $(i^r - i^n)$, increases. A drop in income occurs, $\Delta Y^r < 0$. Regional cyclical change may follow a traditional multiplier-accelerator process. This approach brings monetary shifts directly into traditional demand-side regional macroeconomics.

Figure 2, adapted from Dow (1987), illustrates how shifts in national monetary conditions (southeast quadrant) transmit changes to a region (northeast quadrant).[1] CR^n and CR^r represent quantities of national and regional credit, respectively; and DP^r is total deposits in a region. Moving clockwise from the na-

FIGURE 2
National Credit, Shifts in Confidence, and Regional Economic Activity



tional market, a decline in supply nationwide, accompanied by a higher short-term interest rate, leads to a drop in local confidence (C_0 to C_1), a decrease in local supply [$S(C_0)$ to $S(C_1)$], and possibly an increase in local demand for working capital as the local business conditions weaken [$D(C_0)$ to $D(C_1)$].

In a dynamic sense, changing national money conditions cause an increase in liquidity preference, represented by a shift away from local assets and a backward shift in DP^r (northeast quadrant). From this perspective, the interest-rate differential between the nation and the region reflects default risk. Thus, a decline in available funds, that is, $\Delta CR^n < 0$ and $\Delta i^n > 0$, results in $\Delta Y^r < 0$. Predictions are straightforward; but dynamic responses may vary across regions, and over time, not only because of differences in industrial structures (interest-sensitive activities) but also through changes in liquidity preference and shifts in confidence.

A change in the national market works its way through regional channels and affects real economic activity. National changes may be noticeable in either the stock of money, short-term interest rates, or both, depending on shifts in the supply of or demand for credit.

II. SAMPLE REGIONS

Money and interest rates are tested against employment in two regions: the Detroit MSA and South Carolina. Detroit is a heavily industrialized region that specializes in the manufacture of automobiles and related parts and equipment. Manufacturing accounted for about one-quarter of total employment during the 1980s, down from about a one-third share in the 1970s. Nevertheless, production of durable goods accounted for approximately 85 percent of total manufacturing employment during the 1980s. This mature, industrialized area produces big-ticket items that are the major export products from the region. Employment in Detroit is expected to be sensitive to changes in money and credit conditions nationwide.

South Carolina also depends on manufacturing, which accounted for approximately 30 percent of the state's employment during the 1980s. In contrast to Detroit, this state's manufacturing is concentrated in production of nondurable goods. The latter accounted for about 70 percent of manufacturing and nearly 25 percent of total employment. Only about 10 percent of the state's employment during the 1980s was related to production of durable goods.

Both regions experienced positive growth in employment during the 1970s and 1980s, but the rate of growth for South Carolina was nearly three times that of Detroit. The Detroit MSA exhibited a much higher degree of cyclical volatility, however. For the entire period, amplitudes of contractions in employment averaged about -9.2 percent for Detroit, compared to -3.1 percent for South Carolina. During the 1980s, contractions in Detroit averaged -9.5 percent compared to -1.9 percent for South Carolina.

Besides differences in industrial structures, Detroit and South Carolina were selected because monthly indexes of leading indicators are available for both regions covering the entire 1972-1992 period. These short-run forecasting devices provide early signals of cyclical change from models composed of a set of important, and mostly regional, leading indicators. The Detroit index includes the average workweek in manufacturing, initial claims for unemployment insurance, new residential building permits, consumer installment loans at Detroit banks, the index of consumer sentiment, and U.S. dealers' day's supply of new cars. The index for South Carolina includes eight series: the average workweek in manufacturing, initial claims for unemployment insurance, nonfarm job openings unfilled, the unemployment rate, the ratio of average weeks claimed to insured employment, unemployment insurance benefits, new residential building permits, and new business incorporations. It is expected that national monetary indicators will contribute information about cyclical behavior beyond that generated by past levels of employment itself and past values of regional processes summarized in the indexes of leading indicators.

III. EMPIRICAL TESTS

Cross-correlations for regional employment with monetary aggregates, the federal funds rate (FF), and the spread between the rates on six-month commercial paper and six-month treasury bills (SPD) show varying degrees of association at different lag lengths.[2] Table 1 presents correlations for lag lengths of six, twelve, and eighteen months. Interest-rate variables display stronger negative associations with employment in Detroit than in South Carolina. Also, associations between Detroit's employment and interest rates get stronger at longer lag lengths. Traditional regional macroeconomics predicts these results: interest rates have a greater influence on a region heavily dependent on production of durable goods. Note also that monetary aggregates are significantly associated with regional employment, more strongly in South Carolina than in Detroit. Significant trends explain the latter result to some extent.

Bivariate measures support expectations about links between money, interest rates, and regional activity. Moreover, cross-correlations for FF and SPD exceeded those of some regional variables regarded as key leading indicators. For example, cross-correlations for Detroit's employment with FF and SPD were stronger at longer lag lengths than those of the average work week of manufacturing workers, initial claims for unemployment insurance, and the index of consumer sentiment used in that region's index of leading indicators.

TABLE 1
Cross-Correlations: Employment and Financial Indicators
(Sample period: 1972:1-1992:12

	Detroit				
Lags	M1	M2	MB	FF	SPD
6	.702	.681	.682	-.347	-.186
12	.652	.642	.628	-.423	-.264
18	.621	.620	.595	-.455	-.313

	South Carolina				
Lags	M1	M2	MB	FF	SPD
6	.901	.910	.902	-.032	-.107
12	.831	.850	.828	-.025	-.108
18	.767	.792	.760	-.020	-.106

Note: MB is the monetary base; FF is the federal funds rate; SPD is the spread between the commercial paper rate and T-bill rate of six-month maturity.

While these results point in the right direction, they fail to distinguish between the monetary-aggregate and the interest-rate variables. If financial processes transmit impulses to regions in a nonuniform manner, do they include information about future movements in employment beyond that already contained in regional variables themselves? If they do, then forecasters should be able to exploit this information to improve predictions.

Regressions of the form specified in (7) provide a benchmark model for testing monetary and interest-rate variables in a regional setting.

$$(7)\quad E_t = \alpha + \sum_{i=1}^{12}\beta_i E_{t-i} + \sum_{i=1}^{12}\chi_i ILI_{t-i} + \sum_{i=1}^{12}\delta_i M_{t-i} + \sum_{i=1}^{12}\psi_i R_{t-i} + \sum_{i=1}^{12}\lambda_i P_{t-i} + u_t$$

E represents regional employment; ILI is the regional index of leading indicators; M includes current dollar values of national monetary aggregates: M1, M2, or the monetary base; R includes the federal funds rate or the spread between six-month commercial paper rate and treasury bill rate; P is the consumer price index; and u is a disturbance term.[3] E, ILI, M, and P are natural-log levels; and all monthly data, except interest rates, are seasonally adjusted. Lag length (i) is one to twelve months.[4]

A set of Granger-Causality tests addresses possible contributions of money or interest-rate variables in the presence of other variables. A reasonable hypothesis is that an employment change can be predicted from its own past

TABLE 2
Marginal Significance Levels for the Benchmark Model
(Sample period: 1972:1-1992:12

A. Excluding interest-rate variables

	Detroit		
	M1	M2	Monetary Base
Federal Funds Rate	.136	.203	.047
Interest-rate Spread	.005	.002	.005
	South Carolina		
Federal Funds Rate	.015	.177	.146
Interest-rate Spread	.007	.008	.004

B. Excluding monetary aggregates

	Detroit	
	Federal Funds Rate	Interest-rate Spread
M1	.744	.955
M2	.631	.661
Monetary Base	.377	.931
	South Carolina	
M1	.149	.726
M2	.261	.282
Monetary Base	.349	.261

values, the information contained in past values of the region's index of leading indicators, and past values of national financial indicators included in M and R. In assessing the federal funds rate, for example, estimates on employment from (7) include lags of regional employment, the regional index of leading indicators, and one of the three monetary aggregates. Tests on interest rates include a monetary aggregate and vice versa. Marginal probabilities in Table 2 come from the hypothesis that lags on a variable in M or R, either a monetary aggregate or an interest rate, can be excluded in predicting employment; in other words, δ_i or φ_i equal zero. Low probability values indicate significant contributions to predicting regional employment.

TABLE 3
Variance Decomposition for Predicted Employment in Detroit

Months ahead	Own Lags	ILI	M1	M2	MB	FF	SPD6	CPI
6	90.3	8.2	0.2			0.2		1.2
12	79.1	7.9	4.5			7.3		1.2
18	53.8	6.6	21.8			16.8		1.0
6	85.6	5.2		7.4		0.4		1.4
12	55.9	3.4		27.3		12.3		1.1
18	41.5	2.9		26.8		26.0		2.7
6	86.2	12.3			0.4	0.5		0.7
12	62.2	11.8			13.0	12.1		0.9
18	37.5	9.5			27.5	24.7		0.9
6	85.2	8.3	0.3				3.4	2.8
12	49.4	7.3	0.5				37.7	5.0
18	32.7	10.7	1.0				43.8	11.8
6	84.0	4.1		5.9			3.7	2.3
12	39.2	2.0		13.9			41.8	3.0
18	24.2	2.1		16.2			46.8	10.6
6	82.7	9.9			0.4		2.7	4.4
12	48.6	9.0			2.5		32.2	7.6
18	33.1	12.6			2.5		37.6	14.2

Note: Percentages are based on vector autoregressions with twelve monthly lags of each variable. The ordering of variables is the same as the columns. ILI is the index of leading indicators; MB is the monetary base; FF is the federal funds rate; SPD6 is the spread between rates on commercial paper and T-bills of 6-month maturity.

Table 2 reveals variation among the financial variables. Results on the federal funds rate are mixed, but the spread is highly significant in the presence of each monetary aggregate. None of the monetary aggregates makes a significant contribution to information about changes in employment in the presence of either interest rate variable. For the entire twenty-one year period, therefore, the interest-rate spread is a highly significant variable for the two regions, with Granger tests showing little difference between Detroit and South Carolina. These regional results for the spread variable conform to findings for the national economy presented by Stock and Watson (1989) and reinforced by Friedman and Kuttner (1992).

TABLE 4
Variance Decomposition for Predicted Employment in South Carolina

Months ahead	Own Lags	ILI	M1	M2	MB	FF	SPD6	CPI
6	77.5	17.8	2.8			1.4		0.4
12	61.5	30.4	5.2			1.5		1.4
18	56.3	31.2	7.1			1.6		3.8
6	87.9	8.3		2.5		1.2		0.1
12	63.7	12.3		22.9		0.8		0.3
18	52.1	10.4		36.2		1.0		0.3
6	86.4	12.5			0.4	0.6		0.1
12	70.2	21.4			2.2	6.0		0.2
18	64.2	19.6			5.5	10.1		0.7
6	83.4	11.7	0.3				4.4	0.2
12	45.4	17.0	0.1				36.7	0.7
18	37.0	15.7	0.2				46.1	1.1
6	88.8	5.1		1.9			3.8	0.4
12	46.0	7.1		8.2			37.0	1.6
18	35.8	6.2		15.0			40.9	2.2
6	83.9	9.7			0.2		6.0	0.2
12	49.0	15.3			0.3		35.1	0.3
18	43.1	15.3			0.3		41.1	0.2

Note: Percentages are based on vector autoregressions with twelve monthly lags of each variable. The ordering of variables is the same as the columns. ILI is the index of leading indicators; MB is the monetary base; FF is the federal funds rate; SPD6 is the spread between rates on commercial paper and T-bills of 6-month maturity.

IV. EVALUATING FORECASTS

How do these monetary and interest-rate variables perform in forecasting employment? Tables 3 and 4 present the variance decomposition from vector autoregressions, with variables shown in columns and forecast-horizons given in rows. Each VAR is based on monthly data, again using twelve lags on each variable: employment, the regional index of leading indicators, three monetary aggregates, the federal funds rate, the interest-rate spread, and the consumer price index. Here, the impulse response function traces effects on future employment from innovations (shocks) coming from monetary or interest-rate variables. For these VAR results, ordering does count; the federal funds rate and the spread are at a disadvantage through placement after the monetary aggregates.

Taken together, the monetary aggregates and the federal funds rate account for more of the forecast variance in Detroit than in South Carolina. At a reasonable forecast-horizon of eighteen months, for example, M2 and FF account for 52.8 percent of the variance in Detroit's predicted employment, compared to only 37.2 percent for South Carolina. Note also that the federal funds rate contributes more to forecasts for Detroit than for South Carolina, especially twelve and eighteen months ahead. Percentages are somewhat larger for the federal funds rate combined with M2 for Detroit's employment, compared to South Carolina's employment. For M1 and the monetary base, however, the results from the variance decomposition of forecasts are virtually the same.

For the interest-rate spread there is no clear distinction between the two regions. In the presence of monetary aggregates, the spread is a major contributor, especially at longer horizons. This conforms to the Granger tests reported in Table 2.

V. CONCLUSIONS

Financial variables contributed information about changes in employment for the Detroit MSA and the state of South Carolina over a long period of time that included four national recessions. Regional results varied, however. Monetary conditions influenced Detroit more than South Carolina, a result in line with the traditional focus in regional economics on differences in industrial structures. Production of durable goods dominates in Detroit. A decline in aggregate demand caused by restrictive monetary changes contributes to declines in output (and employment) in that region's major export industries. Therefore, the evidence indicates that the Detroit MSA is more sensitive to interest rates than South Carolina; but the latter is far from immune to changing national monetary conditions.

Over several business cycles, interest rates did outperform monetary aggregates in a regional setting. This result is consistent with a well-known stylized fact that nominal interest rates are reasonably good predictors of real economic activity. The spread between the commercial paper rate and the T-bill rate is noteworthy because it outperformed monetary aggregates and the federal funds rate over the entire twenty-one years, a result in line with findings for the nation by several researchers.

The spread between rates on commercial paper and treasury bills, which measures default risk to some extent, reflects an avenue for monetary impacts as a proxy for shifts in liquidity preference and confidence in a region's economy. Detroit's well-recognized cyclical sensitivity may very well influence perceptions

and confidence about the future of the local economy as national monetary conditions tighten, and this is likely to affect local investment activities. This link, which provides another channel for national monetary impulses to affect regional economic activity that adds to changes in aggregate demand inherent in traditional regional macroeconomics, calls for more attention from regional analysts.

ENDNOTES

1. Dow (1987) starts with the southwest quadrant to illustrate regional differences in the financial sector. She leaves the national market unchanged. Figure 2 begins with a change in national conditions and traces a path through a region's financial sector to its aggregate economic activity in the northeast quadrant.

2. Six-month rates on commercial paper and treasury bills are used to maintain conformity with some of the national research cited. Rates of three-month maturity could be used, but there is really little difference between a spread of three or six months. The results remain the same.

3. The monthly consumer price index is added to equation (7) to capture impacts of real money and interest rates on real economic activity represented by employment.

4. Lag-length does vary somewhat between monetary and interest-rate variables and the two regions, and could be extended here. Nevertheless, there is little gain from lengthening lags beyond twelve months, even though the interest-rate variables do perform somewhat better at longer lags. That only makes the case stronger for interest rates as information variables and leading indicators. For consistency across the statistical tests lag length remained constant at twelve months.

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