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ABSTRACT

This paper examines the cyclical dynamics of per capita personal income for the major U.S. regions during the 1953:3-95:2 period. The analysis reveals considerable differences in the volatility of regional cycles. Controlling for differences in volatility, we find a great deal of comovement in the cyclical response of four regions (New England, Southeast, Southwest, and Far West), which we call the core region, and the nation. We also find a great deal of comovement between the Mideast and Plains regions, but these regions are only weakly correlated with national movements. The cyclical response of the Great Lakes region is markedly different from that of the other regions and the nation. Possible sources underlying differences in regional cycles are explored, such as the share of a region's income accounted for by manufacturing, defense spending as a proportion of a region's income, oil price shocks, and the stance of monetary policy. Somewhat surprisingly, we find that the share of manufacturing in a region seems to account for little of the variation in regional cycles.

I. Introduction

The United States is made up of diverse regions that, although linked, may respond differently to changing economic circumstances. Some regions may react more strongly than others to nationwide forces, such as changes in monetary and fiscal policies, changes in relative prices, and technological innovations. For example, Carlino and DeFina (1998) showed that regions respond quite differently to unexpected changes in monetary policy. There is evidence that changes in the relative price of energy affect energy-producing states differently from energy-consuming states. Recent cutbacks in defense spending and downsizing in financial industries have been noted as the main reasons for continuing weakness in much of the northeastern part of the country.

Differences in a region's industrial structure may also contribute to differences in regional business-cycle behavior. Since regions have different mixes of industries, they experience different shocks to output, resulting in region-specific business cycles. For example, the Great Lakes region contains a much larger share of the cyclically sensitive manufactured durables sector, while the share of manufactured durables in the Southwest region is much smaller.

Despite long-standing interest in and concern about this issue, there is little empirical evidence on whether and to what extent regional business cycles differ. In this paper we investigate cyclical dynamics at the regional level using recently developed time series techniques that decompose regional per capita income into trend and cyclical components.

We look for common trends and common cycles in real per capita personal income for the major regions of the United States using quarterly data for the 1953:3-95:2 period. There are five main findings of this research. First, the level of real per capita incomes for the regions are cointegrated.

Second, our analysis reveals considerable differences in the volatility of regional cycles. The cyclical component in the most volatile region (Southeast) is more than seven times as great as in the least volatile region (Great Lakes). Per capita income in the Southeast and Southwest regions tends to be substantially more volatile than the national average. Per capita income in the Mideast, Plains, and Far West regions tends to be less volatile than the national average.

Third, controlling for differences in volatility, we find a great deal of comovement in the cyclical response of four regions (New England, Southeast, Southwest, and Far West), which we refer to as the core region, and the nation. We also find a great deal of comovement between the Mideast and Plains regions, although cyclical movements in these regions are not highly correlated with cyclical movements in the core region and the nation. Interestingly, the cyclical response of the Great Lakes region is strongly negatively correlated with that of the nation.

Fourth, we find that trend innovations are relatively more important than cyclical innovations in explaining the total variation in regional per capita incomes. This finding highlights an important feature of our methodology. The technique we use allows for variability in <u>both</u> trend and cycle components of regional per capita incomes. This is significant because a deterministic trend model could attribute too much importance to transitory fluctuations.

Finally, we explore some possible sources underlying the differences in regional cycles, such as the share of a region's income accounted for by manufacturing; defense spending as a proportion of a region's income; oil price shocks; and the stance of monetary policy. Somewhat surprisingly, we find that the share of manufacturing in a region seems to account for little of the variation in regional cycles.

II. Literature Review

Studies on regional business-cycle theory and measurement date from the early work of McLaughlin (1930), Vining (1949), Borts (1960) and Syron (1978). Recently, interest in regional fluctuations has been renewed, and the authors of new studies have employed systems methods of estimation--vector autoregression (VAR) techniques. Recent papers by Sherwood-Call (1988), Cromwell (1992), and Carlino and DeFina (1995) have focused on differential regional growth instead of differences in regional business cycles.[1] One exception is a recent paper by Quah (1996). Quah looks at comovement among aggregate and regional disaggregated data by modeling the dynamics as a cross-sectional distribution. While Quah's work is related to ours, his goal is to consider how leading regions contribute to national cycles, whereas ours is a comparison of cycles among regions.

III. The Empirical Model

Our study uses quarterly data on real per capita personal income (logs) by major BEA region for the 1953:3 to 1995:2 period. One issue is how to deflate nominal regional incomes, since regional price deflators do not exist. Consumer price indexes (CPIs) do exist for many of the metropolitan areas in the various regions. These metropolitan-area CPIs were grouped by region and weighted by their relative importance to form regional CPIs. One problem is that Denver is the only metropolitan area in the Rocky Mountain region where a CPI was calculated, and this index is available only for 1964-86. Given the absence of a deflator that covers our entire sample period, we elected to drop the Rocky Mountain region from our analysis. This is not a major concern, since the Rocky Mountain region accounts for only 3 percent of national income and population. This leaves seven regions in the analysis that follows.[2] Cointegration tests revealed that the seven regional price indexes share a single cointegrating relationship. We also found a high degree of correlation among the regional inflation measures (correlation coefficients in general around .75).

Not surprisingly, we found that real per capita income growth varied widely across regions, ranging from a low of less than1 percent in the Great Lakes region to a high of about 6.6 percent in the Southeast region. The simple correlations of growth in regional real per capita incomes are reported in Table 1, along with the sample standard deviations (final column). The standard deviation of real per capita income growth varied widely across regions. Real per capita income growth variance in the most volatile region (Plains) is 78 percent greater than in the least volatile region (Mideast).

Our analysis of the regional data proceeds by examining whether the series are cointegrated, the presence of cointegrating relationships indicating that the series share stochastic trends. Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests were used to check for stationarity in the level and growth rate of regional real per capita incomes. We find that the unit root null cannot be rejected for the level of regional real per capita income using either test, although stationarity is achieved by first differencing. Thus, the levels of the series appear to be I(1) while first differences are I(0).

The likelihood-based cointegration tests of Johansen (1988, 1991) and Johansen and Juselius (1990) were used to test for cointegration under the restriction of a single lag in the vector error correction model (VECM) representation of a system with seven variables. This lag length was chosen based on Akaike and Schwarz information criteria. A constant term was included in the VECM to account for the possibility of a deterministic trend in the series.

The values in each column of Table 2 pertain to the null hypothesis that the number of cointegrating vectors is $r \leq k$, against the alternative hypothesis that $r > k$. The results in Table 2 indicate that there is, at most, one cointegrating relationship and hence six common trends among the seven regions using the λ_{max} statistic. The trace statistic results indicate that there are, at most, two cointegrating vectors. To avoid the risk of falsely rejecting the null, we opted for identifying the rank of the cointegration space as two, consistent with the trace statistic results and suggesting that the seven BEA regions share five stochastic trends. The presence of common long-run trends in the regional data could arise from factors such as national economic policy or perhaps common productivity shocks.[3]

The regional income series appear to have common trends, but do they have common cycles? We examined this possibility using the common features framework described in Engle and Kozicki (1993) and Vahid and Engle (1993). Let y_t denote an n-vector of I(1) variables whose first difference is autoregressive. The elements of Δy_t are said to have a serial correlation common feature if there exists a linear combination β of them such that $E_{t-1} (\beta \Delta y_t) = 0$. Vahid and Engle (1993) show that if a set of I(1) variables share a serial correlation common feature, the levels of the variables share a common cycle in their Beveridge-Nelson decompositions. Engle and Kozicki (1993) use the common features framework to examine international business cycles, interpreting serial correlation common features as common business cycles.

We tested for the presence of serial correlation common features in the regional income series using the canonical correlation-based tests described in Vahid and Engle (1997). The test examines canonical correlations between Δy_t and its relevant history, determined as the dependent variables in the VECM representation of the system. The canonical correlations that are insignificantly different from zero represent linear combinations of Δy_t that are uncorrelated with the past infomation set and thus give the number of independent cofeature vectors. The results of the tests are given in Table 3. The test statistic is based on the scalar components model framework of Tiao and Tsay (1989). Ordering the squared canonical correlations (λ_i) from low to high, the null hypothesis for the tests is that the first j correlations are zero but the (j+1)th is nonzero. The tests are consistent with a finding that the system is characterized by four canonical correlations that are insignificantly different from zero, suggesting the system has four independent cofeature vectors.

We conclude then that the seven regions do share common, synchronous cycles. To further analyze the cyclical behavior of the series, we need to decompose the regional incomes into trend and cycle components. Under certain circumstances, described in Vahid and Engle (1993), there is a unique decomposition of a vector time series into trend and cycle components using the cointegration and cofeature bases. Essentially, the sum of the number of the cofeatures, of which we have four, and the number of cointegrating vectors, of which we have two, must equal the number of variables in the system. Since this condition does not hold for our data, we must impose identification assumptions to decompose the series.

We decompose the regional income series into permanent (P) and transitory (T) components following the method of Gonzalo and Granger (1995). Their decomposition is defined as follows. If X_t is a difference stationary sequence, then a P-T decomposition for X_t is a pair of stochastic processes P_t and T_t such that: (1) P_t is difference stationary and T_t is covariance stationary, (2) $var(\Delta P_t)$ and $var(T_t) > 0$, (3) $X_t = P_t + T_t$ and (4) the only shocks that affect the long-run forecast of X_t are those coming from an innovation to the permanent component of the series. Under these restrictions, we can decompose X_t, an I(1) vector sequence, as $X_t = Af_t + T_t$ where f_t is a set of I(1) variables of smaller dimension than X_t and A is a coefficient matrix. See Gonzalo and Granger

(1995) for details. Thus, the permanent component of each series is driven by the common factor vector f_t .

A. Trend-Cycle Decompositions The percent change in the actual levels of per capita incomes for the seven BEA regions and the U.S. for the past eight recessions is reported in the top panel of Table 4. The table also reports the trend components in the middle panel and the cycle components in the bottom panel for each recession.[4] The table shows, for example, that the 5.6 percent decline in real per capita income in the Great Lakes region during the 1957-58 recession consists of a 4.3 percent drop in the trend term and a 1.3 percent decline in the cyclical component.

The 1973-75 recession and the 1980 recession are of interest for several reasons. First, these were the most severe recessions of the postwar period.[5] Declines in real per capita income were, in general, larger in these two recessions than in other postwar recessions. At the national level, real per capita income fell almost 6 percent during the 1973-75 recession, compared with the 3.5 percent drop in the 1957-58 recession, the prior largest downturn of the postwar period. Second, Table 4 shows that the effects of the 1973-75 and 1980 recessions led to declines in trend growth for all regions. That is, real per capita personal incomes at the regional level never returned to the earlier growth path following the 1973-75 and 1980 recessions.

Notice that in some downturns, such as the 1960-61 recession, the trend components generally rose, which served to lessen the magnitude of the negative cyclical movement in real per capita incomes. Declines in trend growth during recessions are, however, important to understanding the nature of total declines in the New England, Mideast, and Plains regions. In these regions, the cyclical component is negative in only two of the past eight recessions. The trend component, on the other hand, is negative in all but one downturn in the New England and Plains regions and negative in every recession in the Mideast region. In the Plains region, the trend component was negative in six of the past eight recessions. Similarly, the trend component declined in the Great Lakes and Far West regions in all but the 1960-61 recession. Prior to the 1973-75 recession, the trend component generally increased during recessions, mitigating cyclical declines in *total* real per capita income in the Southeast and Southwest regions. However, during the 1973-75, 1980, and 1981-82 recessions, the Southeast and Southwest regions also experienced trend declines in trend growth. Thus, our findings for the U.S. regions are in accord with the Nelson and Plosser view that business cycles are not entirely temporary events.

We now turn our attention to the cyclical components of regional incomes. While it is difficult to make comparisons across the various regions, standard deviations are a convenient way to summarize the volatility across regions. The last column of Table 5 reports the standard deviation of the regional cyclical components for our entire sample period. The data reveal considerable cross-regional differences in cyclical volatility. The cyclical component in the most volatile region (Southeast) is more than seven times as great as in the least volatile region (Great Lakes). The cyclical component in the New England, Southeast, Southwest, and Far West regions tends to be more volatile than the national average. Per capita income in the Mideast, Great Lakes, and Plains regions tends to be less volatile than the national average.

In spite of the differences in amplitude of regional cycles, we find a high degree of correlation of the cycle components for many regions. Table 5 reports the simple correlation coefficients among the regional and national cyclical components. Four of the eight regions (New England, Southeast, Southwest, and Far West) have correlation coefficients among themselves that in every instance are greater than .90. Moreover, the cyclical components in these four regions are highly correlated with the national cyclical component. The correlation coefficient is at least .97 between any of these regions and the nation.

There is also a strong correlation between the Mideast and Plains regions (correlation coefficient of .99). These regions share a much weaker correlation with national cycles. The data also reveal a negative correlation between the Great Lakes region and the nation as well as with New England, Mideast, and Plains regions.

To standardize the regional cyclical components, we divided each series by their respective standard deviations. This should approximately control for differences in amplitude of the cycles and help clarify the common timing and duration of regional cycles. Figure 1 presents the standardized cyclical component of the regions in three graphs. All graphs include the NBER recession bars for reference.[6] The standardized cyclical component for the nation has been included in each graph. The graph in the northwest quadrant shows the four regions found to have highly correlated cycles. We refer to this grouping as the core region. Not surprisingly, this grouping consists of the same four regions (New England, Southeast, Southwest, and Far West) that were found to share high correlation coefficients. While some differences in the amplitude of the regions that make up the core region remain, these regions appear to be similar with respect to turning points and the duration of their cycles.

The graph in the northeast quadrant presents the standardized cyclical component for the Mideast and Plains regions. There is a considerably lower correlation between these regions and the nation. The graph in the southwest quadrant shows the standardized cyclical component for the Great Lakes region. Cycles in this region are often the mirror image of national cycles.

B. Variance Decomposition of Regional Per Capita Income Innovations The relative importance of transitory and permanent shocks for the total variation of regional per capita income is investigated via a variance decomposition. The decompositions are based on bivariate VARs of the log first differences of the permanent and transitory components. Each VAR contains three lags of each variable (based on the Schwarz information criterion) and a constant term. The findings of the trend/cycle decomposition are reported in Table 6 for selected horizons (h) between 1 and 16 quarters. The trend/cycle decomposition reported in Table 6 are based on seven separate variance decompositions (one for each region). In Table 6, each cell contains two numbers: the top number represents the relative importance of the shock in that category when the cyclical shocks come first in the orthogonalization procedure, while the number in parentheses represents the same measure when the trend component is ordered first. Engle and Issler (1995), and others, suggest putting trend innovations first in the orthogonalization procedure, since in real business cycle models innovations in productivity cause both trend and cycle movements.

When the trend component is ordered first in the decomposition, the greatest contribution to the h-step ahead forecast variance comes from the trend component for the New England, Mideast, Great Lakes, and Plains regions. In this ordering, the cyclical component matters most for the Southeast, Southwest, and the Far West. Alternatively, when the cyclical component is ordered first in the decomposition, the greatest contribution to the h-step ahead forecast variance comes from the trend component for all regions with the exception of the Far West region. By and large, these results suggest that the trend component makes the greatest contribution to regional income forecast variances.

IV. What Causes These Differential Responses?

In this section we look at the effects of a number of variables commonly thought to affect regional cycles and trend growth. Differing industrial structures is perhaps the most often cited reason to account for regional differences in both business cycle responses and trend growth. At the national level, Lilien (1982), Long and Plosser (1987), and Horvath and Verbrugge (1995), among others, find that a significant part of aggregate fluctuations is due to sectoral shocks. The combination of regional differences in industrial structure and the different cyclical responses of various industries could make some regions more vulnerable to cyclical swings than others. Browne (1978) found that industry mix was an important factor responsible for regional differences in cyclical behavior during the period 1958-76. More recently, however, Clark (1998) found that differences in regional employment fluctuations are not related to differences in regional industrial structure. We use the percent of a region's total output accounted for by manufacturing to measure the importance of industry mix for regional cycles and trend growth.

While industry mix is one factor that may be responsible for regional differences in cyclical behavior, other factors are likely to play a role as well. Carlino and DeFina (1998) found that monetary policy has differential effects on regional per capita incomes. The interest rate channel associated with monetary policy may interact with industry mix differences and cause different regional responses to Fed tightening and easing of policy. While this channel for monetary policy would be captured by our industry mix variable, other possibilities include differing cyclical responses due to credit channel influences. Regional differences in the proportion of large and small borrowers, and the sources of credit available to each, could also lead to different regional responses to monetary policy. We use the Boschen and Mills (1995), hereafter BM, "narrative measure" that ranks monetary policy on a numerical scale from -2 (large emphasis on inflation control) to +2 (large emphasis on promoting real growth).[7]

Researchers have argued that spatial variations in defense spending may be an important source of regional differences in income growth [Mehay and Solnick (1990), and Hooker and Knetter (1997)] and employment cycles [Davis, Loungani, and Mahidhara (1997)]. For our seven regions, average military spending in the postwar period ran from a high of $13.3 billion in both the New England and Far West regions to a low of $3.8 billion in the Plains region.[8] We include the percent of a region's income accounted for by military spending as an explanatory variable in the model that follows. Finally, the relative price of oil is included in our empirical model as a proxy for supply shocks.

To see what relationship exists among oil price shocks, innovations in monetary policy, shocks to defense spending, manufacturing share, and regional economic activity, the *estimated* trend and cycle components were regressed on lagged variables according to the model:

$$\Delta y_{i,t} = \alpha_o + \sum_{j=1}^{3} \beta_j \Delta oil_{t-j} + \sum_{j=1}^{3} \delta_j BM_{t-j} + \sum_{j=1}^{3} \phi_j \Delta mfg_{i,t-j}$$
$$+ \sum_{j=1}^{3} \eta_j \Delta pmilt_{i,t-j} + \sum_{j=1}^{3} \upsilon_j \Delta y_{i,t-j} + \varepsilon_{i,t}$$

Where: y = either the estimated cyclical or estimated trend variable;

oil = implicit price deflator for fuels and related products relative to the PPI ;

BM = Boschen and Mills narrative index of monetary policy;

mfg = the proportion of a region's total income accounted for by its manufacturing industry;

pmilt = defense spending as a proportion of a region's total income;

ε = random error term;

Δ = first difference of variable; and i indexes region, and t indexes time

Three lags of each variable are included to account for lagged adjustment, and three lags of the dependent variable are included as regressors to control for serial correlation. With the exception of the BM index, first differencing is required to make the variables stationary. We used the Huber/White heteroskedasticity-consistent estimator of the variance-covariance matrix in the regressions that follow. The sample period is 1953:2 to 1992:4, providing 154 observations in each regression. The findings are reported in Table 7.

Table 7 reports two sets of findings for each region, the response of the region's cycle and the response of a region's trend growth to the various shocks. Each cell reports the sum of the coefficients of that variable. Changes in the relative price of oil had the expected negative and significant impact on the cyclical component for three regions (New England, Mideast, and Plains), while it had a negative and significant impact on the Far West region's trend growth. The strongest negative impact on cyclical components occurs in the New England and Mideast regions. There was a positive and significant impact on the Great Lakes region's cyclical component and on the New England region's trend component. Surprisingly, changes in the relative price of oil had no significant impact on either the cycle or trend components in the Southwest region.

We found that positive shocks to the BM index, which indicates an expansionary monetary policy stance, had a negative impact on the cyclical component in all regions but the Great Lakes, for which it was both positive and significant. It was negative and significant for three regions. While the results for the cyclical components are unexpected, the trend component regressions have the anticipated result that expansionary monetary policy has a positive and significant impact on trend growth in all seven regions. We find that monetary policy had a relatively large effect on trend growth in the New England and Southeast regions, while having the least effect on the Southwest region. Our findings are consistent with the view that monetary policy slows growth when it is above trend and stimulates growth when it is below trend.

Similar to Clark (1998), we find no evidence that regional volatility is tied to industry mix. The coefficient on the percent manufacturing variable has the expected positive sign in three cases but none is significant. The only significant coefficient is on the Far West region's trend component. Positive shocks to the Far West region's manufacturing sector have had an overall positive effect on the region's trend growth.

Finally, we find that positive shocks to defense spending tend to boost growth. The coefficient on the percent military variable has a positive and significant sign in the cycle regressions for the New England, Southwest, and Far West regions. As indicated above, military spending in the postwar period was well above average in the New England and Far West regions. Our finding also suggest that recent cutbacks in military spending had a negative impact on trend growth in the Far West region. Hooker and Knetter (1997) also find that changes in military spending had a a sizable impact on those states with a large exposure to the military sector and a modest impact on most other states.

V. Conclusion

The national economy is a composite of diverse regional sub-economies. Similarly, national business cycles are amalgams of regional cycles. When we consider only national aggregates, such as GDP, national income, employment, and industrial production, a large amount of detail about regional cycles is lost. This loss of regional detail may be unimportant if the divergence of regional cycles from national cycles is small. However, we find evidence of considerable divergence of regional business cycles from national cycles. Large differences in business cycles across regions can make it difficult for national policymakers to bring about satisfactory outcomes in all parts of the country. Attempts at stimulating the economy during national recessions, for example, may lead to tight labor markets in some regions while others lag behind.

Our analysis reveals considerable differences in the volatility of regional cycles. The cyclical component in the most volatile region (Southeast) is more than seven times as great as in the least volatile region (Great Lakes). Controlling for differences in volatility, we find a great deal of comovement in the cyclical response of four regions (New England, Southeast, Southwest, and Far West) and the nation, which we refer to as the core region. We also find a great deal of comovement between the Mideast and Plains regions, but these regions are only weakly correlated with national movements. Finally, the cyclical response of the Great Lakes region is strongly negatively correlated with that of the nation.

We also investigated possible sources of the observed differences in regional business cycles. While it is oftened claimed that cyclical differences in regional per capita incomes result largely from differences in regional industrial structure, we find little evidence to support this claim. In a study that is closely related to ours, Engle and Issler (1995) look at the degree of trend and cyclical comovement in U.S. sectoral output during the postwar period. They find very different behavior for trends, but they find quite similar cyclical behavior among the one-digit industries. Juxtaposing our findings with those of Engle and Issler (1995) suggests that the divergent regional cycles that we report are due to more than just differences in industry mix across regions.

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Table 1: Simple Correlations of Real Regional Per Capita Personal Income Growth, 1953:3-95:2

	US	NE	ME	GL	PL	SE	SW	StDev*
NE	0.75							0.0116
ME	0.77	0.70						0.0104
GL	0.84	0.55	0.66					0.0124
PL	0.64	0.23	0.33	0.55				0.0185
SE	0.84	0.59	0.57	0.69	0.47			0.0113
SW	0.76	0.49	0.50	0.53	0.45	0.70		0.0114
FW	0.75	0.55	0.52	0.52	0.26	0.59	0.44	0.0122

NE = New England, ME = Mideast, GL = Great Lakes, PL = Plains, SE = Southeast, SW = Southwest,and FW = Far West

*Standard Deviation

Table 2: Cointegrating Results, No Trend				
Test Statistic		Critical Value at 95%		Null Hyp.
λ_{max}	Trace	λ_{max}	Trace	
5.43	5.43	3.76	3.76	$r \leq 6$
8.16*	13.59*	19.07	15.41	$r \leq 5$
13.51*	27.10*	20.97	29.68	$r \leq 4$
17.74*	44.84*	27.07	47.21	$r \leq 3$
23.43*	68.26*	33.46	68.52	$r \leq 2$
26.00*	94.24	39.37	94.15	$r \leq 1$
48.81	143.05	45.28	124.29	$r \leq 0$

*denotes significance at the 5% level.

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Table 3: Cofeatures Test			
Squared Canonical Correlations	χ^2 Statistic C(S)[a]	Degrees of Freedom[b]	Significance Level
0.577	167.23	63	0.0000
0.4642	99.99	48	0.0000
0.3879	59.703	35	0.0057
0.3406	32.639	29	0.1121
0.2356	12.167	15	0.6661
0.1178	2.691	8	0.9523
0.0473	0.371	3	0.9462

[a]The χ^2 Test is:

$$C(S) = -(T - h)\sum_{i=1}^{s}\log(1-\lambda_i)$$

[b]Degrees of freedom are given by s*(h*k+r+s)
where s = number of canonical correlations,
k = dimension of y(t)
r = number of cointegrating vectors
h = number of lags-1 in VECM

Table 4: PERCENT CHANGE IN PER CAPITA INCOME FOR THE POSTWAR RECESSIONS*

RECESSIONS	NE	ME	GL	PL	SE	SW	FW	US
ACTUAL INCOME								
3Q53-2Q54	-0.76	-1.60	-4.27	3.68	-2.20	0.82	-1.46	-1.68
3Q57-2Q58	-3.23	-3.83	-5.59	0.13	-1.28	-0.47	-4.11	-3.45
2Q60-1Q61	1.30	0.26	0.19	4.02	-0.20	-1.31	-5.45	-0.44
4Q69-4Q70	-0.66	-1.11	-2.80	-0.19	2.03	3.26	-1.79	-0.63
4Q73-1Q75	-4.55	-5.70	-6.74	-13.63	-5.69	-6.34	-3.68	-6.03
1Q80-3Q80	-4.48	-4.06	-9.29	-7.62	-6.84	-5.49	-6.81	-6.44
3Q81-4Q82	0.57	-0.02	-4.09	-1.34	-2.74	-0.61	-0.93	-1.49
3Q90-2Q91	-2.78	-1.53	-1.54	1.01	-0.12	-0.38	-1.57	-1.02
1Q80-4Q82	-0.43	-0.49	-4.63	-0.00	-2.06	1.68	1.53	-1.29
TREND COMPONENT								
3Q53-2Q54	-3.12	-3.86	-2.68	0.84	-2.47	0.92	-2.00	-2.38
3Q57-2Q58	-4.18	-5.55	-4.27	-2.10	0.50	0.94	-3.02	-3.35
2Q60-1Q61	5.07	-0.64	1.40	2.53	10.57	5.94	2.46	3.17
4Q69-4Q70	-0.95	-1.02	-2.92	-0.05	1.15	2.66	-2.45	-0.94
4Q73-1Q75	-3.41	-4.05	-7.97	-11.57	-6.85	-7.31	-4.32	-6.06
1Q80-3Q80	-4.62	-5.12	-8.45	-8.99	-4.78	-3.97	-5.39	-5.78
3Q81-4Q82	-0.97	-0.94	-3.50	-2.45	-4.20	-1.47	-2.17	-2.35
3Q90-2Q91	-3.58	-2.58	-0.76	-0.33	0.44	0.12	-1.31	-1.06
1Q80-4Q82	-1.67	-0.91	-3.90	-0.51	-4.02	0.51	-3.07	-2.22
CYCLICAL COMPONENT								
3Q53-2Q54	2.38	2.28	-1.60	2.84	0.27	-0.10	0.54	0.71
3Q57-2Q58	0.95	1.74	-1.33	2.24	-1.78	-1.40	-1.09	-0.10
2Q60-1Q61	-3.73	0.90	-1.21	1.48	-10.49	-7.14	-7.87	-3.58
4Q69-4Q70	0.29	-0.09	0.11	-0.15	0.88	0.60	0.66	0.31
4Q73-1Q75	-1.14	-1.66	1.25	-2.11	1.18	0.99	0.65	0.03
1Q80-3Q80	0.14	1.08	-0.88	1.43	-2.12	-1.55	-1.45	-0.68
3Q81-4Q82	1.54	0.92	-0.58	1.10	1.44	0.85	1.23	0.85
3Q90-2Q91	0.81	1.06	-0.78	1.34	-0.56	-0.50	-0.27	0.04
1Q80-4Q82	1.21	0.41	-0.20	0.45	1.82	1.17	1.45	0.90

*Trend and cyclical components may not sum to actual due to rounding errors.

TABLE 5: Simple Correlations Among the Regional Cyclical Components and the Standard Deviation of a Region’s Cyclical Component,1953:3-95:2

	US	NE	ME	GL	PL	SE	SW	StDev*
US								0.0275
NE	0.99							0.0354
ME	0.50	0.63						0.0134
GL	-0.15	-0.30	-0.93					0.0091
PL	0.39	0.52	0.99	-0.97				0.0161
SE	0.98	0.93	0.31	0.06	0.19			0.0662
SW	0.97	0.92	0.28	0.10	0.15	0.99		0.0437
FW	0.98	0.95	0.35	0.02	0.22	0.99	0.99	0.0509

NE = New England, ME = Mideast, GL = Great Lakes, PL = Plains, SE = Southeast, SW = Southwest,and FW = Far West

*Standard Deviation

FIGURE 1: Standardized Cyclical Components
(Regional Cycle Divided by its Standard Deviation)

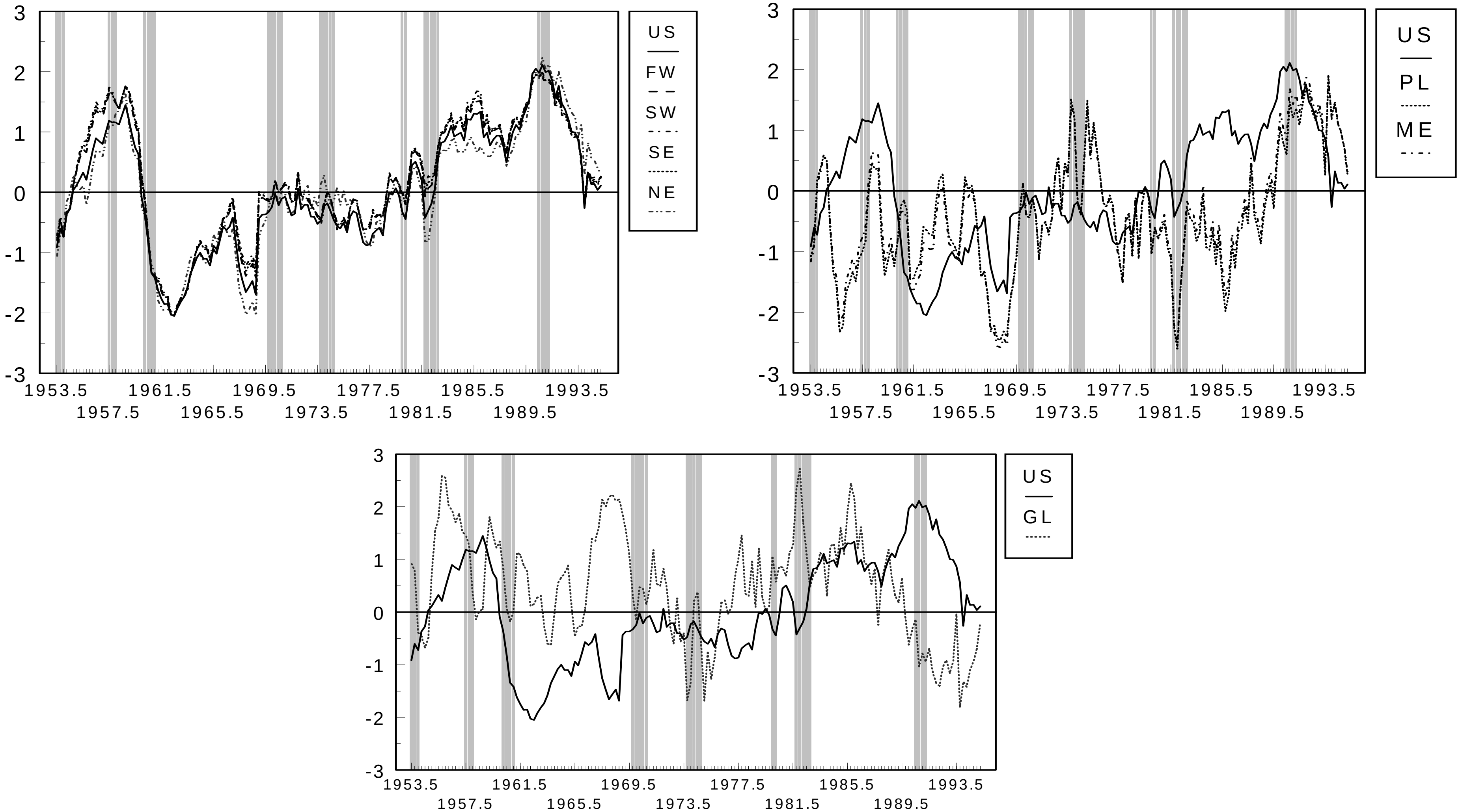

Table 6: Percent of the Variation of Per Capita Income Innovations Attributed to Trend and Cyclical Shocks at Horizon (h).

	h = 1		h = 5		h = 9		h = 16	
	Cycle	Trend	Cycle	Trend	Cycle	Trend	Cycle	Trend
New England	0.01 (0.41)	0.99 (0.59)	0.04 (0.32)	0.96 (0.68)	0.05 (.30)	0.95 (0.70)	0.05 (0.03)	0.95 (0.70)
Mideast	0.01 (0.28)	0.99 (0.72)	0.07 (0.20)	0.93 (0.80)	0.08 (0.20)	0.92 (0.80)	0.08 (0.20)	0.92 (0.80)
Great Lakes	0.03 (0.17)	0.97 (0.83)	0.04 (0.19)	0.96 (0.81)	0.04 (0.19)	0.96 (0.81)	0.04 (0.19)	0.96 (0.81)
Plains	0.30 (0.21)	0.70 (0.79)	0.24 (0.17)	0.76 (0.83)	0.24 (0.17)	0.76 (0.83)	0.24 (0.17)	0.76 (0.83)
Southeast	0.04 (0.80)	0.96 (0.20)	0.04 (0.80)	0.96 (0.20)	0.04 (0.79)	0.96 (0.21)	0.04 (0.79)	0.96 (0.21)
Southwest	0.09 (0.62)	0.91 (0.38)	0.11 (0.65)	0.89 (0.35)	0.11 (0.64)	0.89 (0.36)	0.11 (0.64)	0.89 (0.36)
Far West	0.55 (0.88)	0.45 (0.11)	0.52 (0.86)	0.48 (0.14)	0.52 (0.86)	0.48 (0.14)	0.52 (0.86)	0.48 (0.14)

Table 7: Estimated Equations Explaining Variations in Trend and Cycle Components.

		OIL	BM	%MFG	%MILT
New England	Cycle	-0.1167**	-0.0035**	-0.6378	0.2444**
	Trend	0.0305**	0.0050**	0.8005	-0.2781
Mideast	Cycle	-0.0843**	-0.0017**	-0.3805	-0.0630
	Trend	-0.0116	0.0032**	-0.1615	1.036
Great Lakes	Cycle	0.063**	0.0010**	0.2015	0.0027
	Trend	-0.1472	0.0035**	0.3202	0.5318
Plains	Cycle	-0.1113**	-0.0022**	-0.7638	0.0658
	Trend	-0.0841	0.0030**	0.2971	-0.755
Southeast	Cycle	-0.0599	-0.0025	-0.2392	-0.5043
	Trend	0.0029	0.0049**	0.9264	0.3738
Southwest	Cycle	-0.0347	-0.0014	0.0251	0.1617**
	Trend	0.0489	0.0026*	-0.2211	0.0862
Far West	Cycle	-0.0732	-0.0023	0.1747	0.3942**
	Trend	-0.0738*	0.0030**	0.3311**	-0.4419**

*, ** denotes significant at the 10 and 5 percent levels respectively.

H_0: Coefficients are jointly zero

Endnotes

1. Some studies have focused more narrowly on specific metropolitan areas. Studies by Coulson (1993) and Coulson and Rushen (1995) use VAR models of the economies of the Philadelphia (Coulson) and Boston (Coulson and Rushen) metropolitan areas to quantify national, industry-specific, and local influences. A number of other recent papers have looked at regional labor market dynamics [Blanchard and Katz (1992) and Davis, Loungani and Mahidhara (1997)].

2. See Appendix A for definitions of the regions.

3. Our finding of five common trends may be related, for example, to regional specialization of production coupled with industry-specific innovations.

4. The trend and cycle components for the nation are weighted averages of trend and cycle estimates at the regional level. Each region's share of national real personal income is used as weights. The trend and cyclical components for the nation were also computed as unweighted averages of the regional trend and cyclical estimates. We found very little differences between the weighted and unweighted versions. We used the weighted average versions in this article.

5. Since it is debatable whether the 1980 and the 1981-82 recessions were one long recession, as opposed to two separate ones, we combined the 1980-82 period and report this as one recession at the bottom of each panel in Table 4.

6. The peaks and troughs of business cycles are dated by the National Bureau of Economic Research (NBER) by considering the comovement in many different economic indicators, such as gross domestic product, industrial production, personal income, sales, employment, and unemployment. By looking at changes in a variety of economic variables, the NBER minimizes the chance of reaching an erroneous conclusion based on mismeasurement. Unfortunately, many of these

indicators are not available on a monthly basis at the regional level. Therefore, it is not possible to date the peaks and troughs of business cycles at the regional level.

7. We elected to use the BM index instead of the fed funds rate for several reasons. First, observed changes in the funds rate may reflect forces other than the decisions of the monetary authority. Second, funds rate changes can have different interpretations depending on the operating procedure in place. Narrative approaches, such as the BM index, minimize these difficulties by attempting to identify monetary policy shocks by looking at evidence derived from the Federal Open Market Committee's policy directives. Another advantage of the BM index is that inflation expectation series, which are not available and must be estimated, are not required to generate real interest rates.

8. Defense expenditure consists of prime contracts awarded by the Department of Defense and by the National Aeronautics and Space Administration. We thank Prakash Loungani for providing these data.

APPENDIX A

DEFINITIONS OF REGIONS

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

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

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

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

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

Southwest
- Arizona
- New Mexico
- Oklahoma
- Texas

Far West
- California
- Nevada
- Oregon
- Washington