ESSAYS ON ISSUES

THE FEDERAL RESERVE BANK OF CHICAGO

DECEMBER 2011
NUMBER 293

Chicago Fed Letter

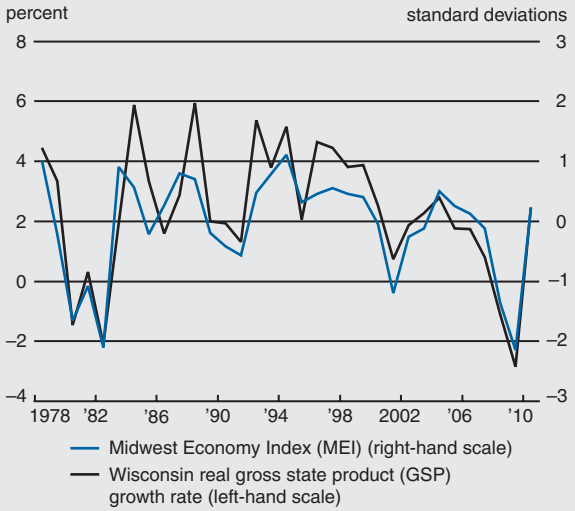
Predicting gross state product growth with the Chicago Fed's Midwest Economy Index

by Scott Brave, senior business economist, and Norman Wang, associate economist

This article explains how the Federal Reserve Bank of Chicago's Midwest Economy Index (MEI) can be used to produce quarterly estimates of the annual gross state product (GSP) growth of each state in the Seventh Federal Reserve District.

The U.S. Bureau of Economic Analysis (BEA) produces measures of gross state product, which are the state-level counterparts to the nation's gross domestic product (GDP). Unlike the GDP data that are updated on a quarterly basis by the BEA, the GSP data are available only annually.[1] In this *Chicago Fed Letter*, we describe a framework for producing quarterly estimates of GSP growth for the five states of the Seventh Federal Reserve District. To do so, we exploit the historical correlation between GSP growth in each of the five states and the Chicago Fed's Midwest Economy Index.

1. MEI and Wisconsin real GSP growth rate, 1979–2010



NOTES: The Wisconsin real GSP growth rate is calculated by the U.S. Bureau of Economic Analysis on an annual basis. The MEI is expressed as an annual average by taking the average of the March, June, September, and December values for each year.

SOURCE: Authors' calculations based on data from Haver Analytics.

The MEI and GSP

Earlier this year, the Chicago Fed unveiled a new index measuring growth in nonfarm business activity in the five Seventh District states called the Midwest Economy Index.[2] The index is a weighted average of 134 state and regional indicators of four broad sectors of the Midwest economy: 1) manufacturing, 2) construction and mining, 3) services, and 4) consumer spending. The weight each indicator receives is constructed such that greater influence in the index is given to those indicators that have historically been better able to explain broader fluctuations in the Midwest economy.

MEI values correspond to deviations of growth in Midwest economic activity around its historical trend, or long-run average. Values above zero indicate growth above its historical trend, and values below zero indicate growth below trend. Over long periods, growth in Midwest economic activity around its trend has tended to track similar deviations in national economic activity. However, over shorter periods this has not always been the case, particularly around the beginnings and ends of recessions. To highlight such differences, we construct two separate index values: an absolute value and a relative value.

The MEI (absolute value) captures both national and regional factors driving Midwest economic growth, while the relative MEI (relative value) provides a picture of the Midwest's economic conditions relative to the nation's. A positive value of the relative MEI indicates that regional growth is further above its trend than would typically be suggested based on the current deviation of national growth from its trend, while a negative value indicates the opposite.

2. Regression coefficients for real GSP growth

	Illinois	Indiana	Iowa	Michigan	Wisconsin
Constant	–0.2	0.5	–0.2	–0.4	0.8
GDP growth	0.8**	0.4*	0.6	0.3	0.5**
MEI	0.2	1.0**	0.1	1.3**	0.7*
Relative MEI	0.6**	0.4	0.7	–0.1	0.3
Lagged GSP growth	–0.1	–0.2**	0.0	–0.4**	0.0
Personal income growth	0.1	0.6**	0.5**	1.0**	0.2
Root mean squared error (RSME)	0.7	1.1	2.1	1.5	0.8
Number of observations	32	32	32	32	32

* Significant at the 5% level.

** Significant at the 1% level.

Notes: The sample period extends from 1979 through 2010 on an annual basis. Gross domestic product (GDP), gross state product (GSP), and personal income are expressed in constant price, or "real," terms. Constant denotes the estimated regression intercept. The regression coefficients describe the marginal impact on real GSP growth in percentage terms from a one unit change in each variable. The Midwest Economy Index (MEI) and relative MEI are in standard deviation units, while the others are in percent. Robust standard errors, clustered by year, are reported.

Source: Authors' calculations based on data from Haver Analytics.

3. Variance decomposition of real GSP growth

	Illinois	Indiana	Iowa	Michigan	Wisconsin
	(- - - - - - - - - - - - - - - *percent* - - - - - - - - - - - - - -)				
National factors	67	10	19	2	53
Regional factors	28	22	15	11	39
State-specific factors	5	68	66	87	8

Notes: National factors denote real gross domestic product growth. Regional factors are the Midwest Economy Index (MEI) and relative MEI. State-specific factors comprise lagged real gross state product (GSP) growth and contemporaneous real personal income growth.

Source: Authors' calculations based on data from Haver Analytics.

The MEI and GSP measure growth in economic activity in complementary fashions, although their methods of accounting for it differ. Consider figure 1, which plots the MEI against the annual growth rate of gross state product for Wisconsin. The correlation coefficient between the two, at 0.87, is quite high. Among the Seventh District states, Wisconsin has the highest correlation coefficient between the MEI and GSP, although it is followed closely by Indiana, at 0.86; Illinois, at 0.84; and Michigan, at 0.83. In contrast, for Iowa the correlation coefficient drops to 0.60.

That said, the MEI and relative MEI provide a picture of the Seventh District's state economies that is timelier than the BEA's GSP data. In what follows, we show that the two indexes can be used to form real-time inferences on GSP growth for each Seventh District state; and in doing so, we gain a sense of how important regional growth factors summarized in the MEI and relative MEI have historically been in explaining economic growth for the Seventh District states relative to national and state-specific growth factors.

Predicting GSP growth

We construct a statistical model—more specifically, we estimate a simple linear regression—to explain the annual growth in GSP for each Seventh District state.[3] The model succinctly summarizes the historical relationships between national, regional, and state-specific factors driving each Seventh District state's GSP growth since 1979. We use GDP growth to capture the importance of national growth factors to GSP growth in our model. To capture regional influences on GSP growth in our model, we rely on the MEI and relative MEI. Finally, to account for state-specific growth factors' impact on GSP growth in our model, we use the one-year lag of GSP growth and the contemporaneous growth rate in personal income of each state.

The GSP growth for each Seventh District state tends to vary over time around a historical trend, but the rate at which it converges to that trend depends on national and regional growth factors. We include lagged GSP growth in the regression to capture this "conditional mean reversion." In addition, the MEI and relative MEI only measure activity in the *nonfarm business* sector; therefore, including personal income is necessary to fully capture economic activity, since it forms a considerable part of each state's GSP. The MEI, however, does help capture the impact of regional growth trends on each state's GSP, and the relative MEI does help explain GSP growth above that predicted by GDP growth and the MEI.

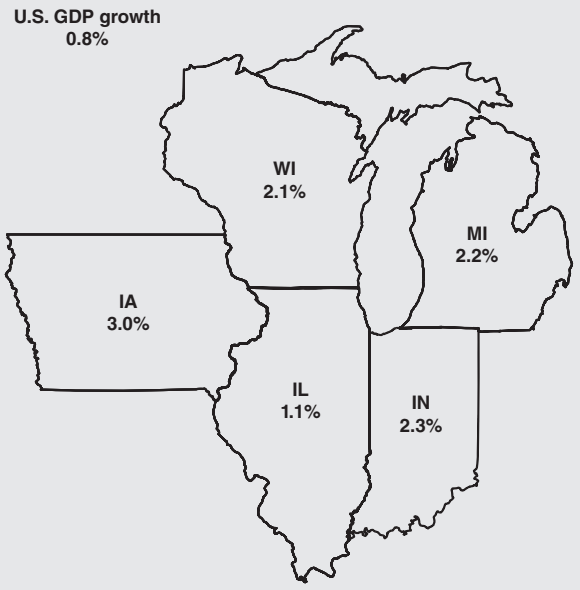
National, regional, and state-specific growth factors

Figure 2 displays the regression coefficients estimated using our model for each of the five Seventh District states over the period 1979–2010.[4] A 1% increase in GDP growth leads to about a 0.5% increase in GSP growth across the Seventh District states, with the effect slightly higher for Illinois and Iowa and slightly lower for Indiana and Michigan (figure 2, second row). The magnitude of these coefficients point to the fact that holding regional and state-specific growth factors constant, there is considerable co-movement (tendency to move in parallel) between the Seventh District and national economies, although the correlation is not one for one.

In contrast, Michigan's and Indiana's GSP growth varies one for one or better with the MEI (figure 2, third row), so that holding fixed state-specific and national growth factors, the performance of both state economies has historically been tightly connected with that of the other Seventh District states. Only Wisconsin also demonstrates a statistically significant correlation with the MEI. The relative MEI has a statistically significant impact on GSP growth only for Illinois (fourth row). This suggests that holding fixed national and state-specific growth factors, Illinois's economy has historically been most affected by regional growth trends during periods where large differences in regional and national growth occurred.

Michigan and Indiana also demonstrate significant conditional mean reversion based on the regression coefficients for their lagged GSP growth (figure 2, fifth row). Therefore, state-specific growth factors for these two Seventh District states are likely to be nontrivial in historically explaining their GSP growth. Furthermore, personal income growth is a significant predictor of GSP growth for Indiana, Iowa, and Michigan—and

4. 2011 forecasts for real GSP growth



NOTES: Forecasts are of the annual growth in real gross state product (GSP) for each Seventh District state (Illinois, Indiana, Iowa, Michigan, and Wisconsin) using annualized data through the second quarter of 2011. GDP growth indicates annualized real gross domestic product growth over the same period.

SOURCE: Authors' calculations based on data from Haver Analytics.

the only one for Iowa (sixth row). Thus, omitting state-specific growth factors from our model would likely have profound effects on our ability to predict GSP growth for a number of Seventh District states.

To get a sense of the relative importance of national, regional, and state-specific factors, we decomposed the variance in each state's GSP growth into that explained by each of these three types of factors (figure 3).[5] State-specific factors (last row) do indeed dominate in explaining Indiana's, Iowa's, and Michigan's GSP growth, while national factors (first row) dominate in explaining Illinois's and Wisconsin's. That said, regional growth factors (second row) vary in importance from 11% in Michigan to 39% in Wisconsin, and they account for 22% or more of the explained variance for three of the five Seventh District states. It is in this sense that including the MEI and the relative MEI proves to be nontrivial for predicting each Seventh District state's GSP growth.

Quarterly GSP growth projections

We can use the model described in this article to make projections of GSP growth on a quarterly basis, updating its predictions for annual GSP growth in the Seventh District states throughout the year on a schedule similar to that for GDP. Doing so will improve upon the timeliness and frequency with which GSP data are currently made available. In addition, doing so will help connect recent values of the MEI and relative MEI to an alternative method of describing Midwest and national economic growth. However, first we must assess the accuracy of our model's predictions.

The fit of our model is surprisingly good for Illinois and Wisconsin, with a typical prediction error (i.e., root mean squared error) of less than 1% (figure 2, seventh row). The fit for Indiana and Michigan is slightly worse, but with an average error of 1.5% or less. In contrast, Iowa has an average prediction error of 2.1%. Prediction errors of this magnitude represent between 0.3 and 0.6 historical standard deviations of the Seventh District states' GSP growth. Therefore, with the possible exception of Iowa, inferences on annual GSP growth based on the MEI and the other indicators we consider are likely to be reasonably reliable in real time.

Projections for annualized GSP growth through the first half of 2011 in each of the five Seventh District states are displayed in figure 4. The growth projections for all of the Seventh District states exceed national GDP growth over the same period. They also show some diversity, reflecting the results for regional and state-specific growth factors we reported earlier. For instance, Illinois's relative weakness stems from the recent weakness in national growth being only partly offset by the strength in the relative MEI in the first half of 2011. In contrast, strong regional and state-specific factors boost GSP growth in the other states.

Conclusion

The results from using our model suggest that the MEI can be reliably used to project GSP growth for the five states in the Seventh Federal Reserve District on a quarterly basis. The value in doing so is that it provides us with another way to make direct and timely comparisons between national and regional economic growth. We will make these estimates available in the future as part of the monthly release for the MEI; we will update them on a quarterly basis following the BEA's final release of GDP data for each quarter.

[1] Technically, the GSP data are available semiannually, as they are updated near the beginning and middle of each year. However, these updates are for the prior year, unlike the GDP releases, which are for the prior quarter.

[2] For more information on the MEI, go to www.chicagofed.org/mei. The Seventh District comprises all of Iowa but only the greater parts of Illinois, Indiana, Michigan, and Wisconsin. In contrast, because of the form in which state and regional data are available, the construction of the MEI entails the entire boundaries of all five states.

[3] The notation for our model is expressed as follows: $GSP_{it} = \alpha_i + \beta_i GDP_t + \gamma_i MEI_t + \delta_i RMEI_t + \rho_i GSP_{it-1} + \varphi_i I_{it} + \varepsilon_{it}$.

ISSN 0895-0164

Growth rates are approximated by log first differences for real gross state product (*GSP*), real gross domestic product (*GDP*), and real personal income (*I*) data. To construct annual averages of the Midwest Economy Index (*MEI*) and relative MEI (*RMEI*), we take the average of the March, June, September, and December values of each year to conform to the fact that each represents a three-month moving average.

[4] To allow for prediction errors to be correlated across states, we use a cluster-robust variance estimate to calculate standard errors of the predictions, where the clustering unit is the year of observation. This structure allows for arbitrary correlation between the prediction errors for each Seventh District state in each year.

[5] The regression constant was excluded for each state in this calculation.