What Can Regional Manufacturing Surveys Tell Us?—Lessons from the Tenth District

By William R. Keeton and Michael Verba

The Federal Reserve Bank of Kansas City conducts a monthly survey of over 100 manufacturers across the Tenth District. Other Federal Reserve Banks conduct similar surveys of manufacturers within their districts, as do a number of regional associations of purchasing managers. These regional surveys do not receive as much attention as the national survey of manufacturers by the Institute of Supply Management. However, the regional surveys receive much more attention than they did only a few years ago, thanks to the unending search by reporters and business analysts for timely information about the economy.

The increased attention paid to regional manufacturing surveys makes it important to know what kind of information these surveys provide. These surveys differ from other data sources by collecting only qualitative information, such as the direction of change in activity. The surveys could be useful either because they tell us something about regional manufacturing conditions, or because they signal something about manufacturing conditions in the nation as a whole. Another issue

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is whether the main contribution of the surveys is timely information about current conditions or accurate forecasts of future conditions. Finally, in deciding whether the surveys are worth the time and effort of conducting them, it is important to know whether they add any information beyond that contained in other publicly available data on the manufacturing sector—data such as industrial production and manufacturing employment.

This article addresses these issues by examining the information content of the Kansas City Fed Manufacturing Survey. The article concludes that the main value of the survey is providing information about current and future manufacturing conditions in the district, especially on variables such as production, orders, and capital spending for which no independent data exist at the regional level. The article also points out that while the Kansas City Fed survey provides little *direct* information about national manufacturing conditions, it can be a useful source of *indirect* information about such conditions. In particular, the results from the Kansas City Fed survey can be combined with similar information from other regions to obtain a more complete picture of national manufacturing conditions than is available from other published data.

The article begins with a brief description of the Kansas City Fed Manufacturing Survey. The second section presents an overview of qualitative business surveys, focusing on their advantages and disadvantages relative to quantitative data. The third section summarizes previous studies of the information content of U.S. manufacturing surveys, including both the national ISM survey and the regional surveys conducted by other Federal Reserve banks. The fourth section presents evidence on the information content of the Kansas City Fed survey, while the fifth section discusses the implications of that evidence.

I. THE KANSAS CITY FED MANUFACTURING SURVEY

The Kansas City Fed Manufacturing Survey is one of several surveys of regional manufacturing activity in the United States. All of these surveys are modeled after a national manufacturing survey conducted since the 1930s by the Institute of Supply Management (ISM).[1] The Kansas City Fed survey was begun in October 1994 to monitor manu-

facturing activity in the seven-state area covered by the Tenth Federal Reserve District (Colorado, Kansas, Nebraska, Oklahoma, Wyoming, western Missouri, and northern New Mexico). For the first seven years of its existence, the survey was conducted four times a year, in the first month of each quarter (January, April, July, and October). Since July 2001, the survey has been conducted on a monthly basis.[2]

The survey sample consists of approximately 150 manufacturing plants across the district. Of these plants, about 110 respond to the survey each month. The firms in the sample are chosen to be representative of the district manufacturing sector in terms of industries, geographic location, and firm size. Since firms drop out for various reasons, the sample is updated once a year to ensure that it remains of adequate size and continues to be representative of the district manufacturing sector.

Respondents are asked a total of 13 questions about their plants. Eleven of the questions are about changes in various measures of manufacturing activity, such as production, new orders, employment, capital spending, and inventories. The other two questions concern changes in prices. For most of the questions, respondents are asked to report changes over three time frames—the change from the previous month, the change from a year ago, and the expected change over the next six months.[3] As in most business surveys, respondents are allowed only three choices in their answers—increased, decreased, or unchanged. Respondents are not asked to make any adjustment for seasonal fluctuations.

The Kansas City Fed survey is sent to respondents relatively late in the month, which means the information is more current than in other manufacturing surveys but not available quite as soon. The survey is sent to respondents on the last Monday of the month. Responses are due on the Wednesday of the following week, and results are released to the public on the second Monday of the next month.[4]

II. AN OVERVIEW OF QUALITATIVE BUSINESS SURVEYS

The Kansas City Fed Manufacturing Survey belongs to a long tradition of qualitative surveys of business activity, sometimes referred to as "business tendency" surveys. The use of these surveys has expanded greatly in the last several decades, increasing from only a handful of surveys in three countries in 1950 to 185 surveys in 56 countries in 1995 (Zimmerman). This section describes the key features of qualitative business surveys and then discusses the advantages and disadvantages of such surveys as sources of information about economic activity.

Key features of qualitative surveys

Qualitative business surveys have three important features in common. First, they are conducted on a regular basis, usually monthly or quarterly. Second, they are based on relatively small samples of firms. Third, the surveys ask a standard set of questions each month, requiring respondents to choose among a limited number of categories such as increased, decreased, or unchanged.

The results of qualitative surveys are to be distinguished from quantitative data, which refer to estimates of economic aggregates such as production, employment, and capital spending. Like qualitative surveys, most quantitative data are derived from samples of firms and are collected on a regular basis. However, the samples tend to be much larger, and firms are required to report actual numbers instead of choosing among a limited number of categories.

The responses to questions on qualitative business surveys are typically summarized by diffusion indexes. A diffusion index is a measure of the net percentage of firms reporting an increase in activity over a specified time span. In most cases, including the Kansas City Fed survey, a diffusion index is expressed as a balance statistic—the percentage of entities or units reporting an increase minus the percentage reporting a decrease. In a few cases, however, the index is computed as 50 plus one-half the balance statistic, so that a value of 50 corresponds to no net

change.[5] The nationally based ISM manufacturing survey is the best-known example of a survey that reports diffusion indexes in this second form.

Informational advantages of qualitative surveys

One of the biggest advantages of qualitative surveys is that they tend to be timelier than most quantitative data. For example, the advance report on real GDP is not usually released until a month after the end of the quarter and is usually revised substantially in subsequent quarters. In contrast, qualitative business survey results are usually available within days or weeks of the completion of the survey. The greater timeliness of qualitative surveys is due partly to the fact that they are based on smaller samples, reducing the amount of time required to process the results. In addition, questions asking for qualitative responses rather than actual numbers tend to be easier for respondents to answer, reducing the amount of time it takes to complete the survey.

Some analysts argue that qualitative surveys can sometimes provide more accurate information about current changes in economic activity than quantitative data. According to one view, respondents are more likely to give correct answers if they are only asked to choose among a small number of categories than if they are asked for a specific number. Some analysts also argue that reliance on qualitative responses reduces the amount of "noise" in the results. These analysts point out that the diffusion indexes reported by business surveys give the same weight to firms reporting large changes in activity as to firms reporting small changes. As a result, the indexes may be more insulated than quantitative data from idiosyncratic shocks that affect only a few industries or firms (Kennedy).

Business survey indexes may also serve as good leading indicators because they measure the breadth of change in economic activity, and not just the total change in activity. According to this view, increases in economic activity tend to become *less* widespread among firms or industries shortly before a peak in economic activity. Conversely, increases in activity tend to become *more* widespread before a trough in economic activity. As a result, diffusion indexes such as those reported

by business surveys tend to lead business cycle peaks and troughs, turning downward before peaks and turning upward before troughs (Moore 1954, 1955).

Finally, unlike quantitative data, qualitative business surveys can provide direct information about firms' expectations and plans for the future (Britton and others). Some business surveys not only ask respondents about their recent experience, but also ask them about their expectations for future production and sales, their capital spending and hiring plans, and their outlook for general business conditions. As noted earlier, the Kansas City Fed manufacturing survey is one example of a survey that asks such forward-looking questions.[6]

Informational disadvantages of qualitative surveys

While qualitative business surveys have important advantages as sources of information about economic activity, they may also have drawbacks. Some analysts, for example, have suggested that qualitative responses may be more subjective than quantitative responses. According to this view, respondents will put less effort into their answers or be more prone to engage in wishful thinking if required to choose among categories such as up, down, or unchanged than if required to report an actual number (Tamm, Harris). A related criticism is that an implausibly large number of respondents to qualitative surveys typically choose the option "unchanged."[7] Some of these respondents may actually mean "don't know." Others may choose the answer "unchanged" when they really mean the perceived change falls below some threshold. To allow for such behavior by respondents, economists have devised sophisticated alternatives to the diffusion index for aggregating the responses of firms.[8] However, these alternative measures usually require strong assumptions that may not be met in practice (for example, the threshold below which no change is reported is the same for all firms and does not vary over time).

Some critics also claim that qualitative business surveys are less accurate than quantitative data because the samples are smaller and less representative of the entire population of firms. For example, the ISM survey is based on a sample of roughly 400 manufacturing firms, representing less than 1 percent of all such firms. In contrast, the monthly

employment data reported by the Bureau of Labor Statistics are based on a sample of 400,000 worksites representing one-third of total employment. While the organizations conducting business surveys usually try to choose representative samples, critics claim they pay less attention to the issue than the government agencies that produce quantitative data (Tamm).[9]

Another criticism of qualitative business surveys is that the equal weighting of firms with large and small changes in activity can cause survey diffusion indices to misrepresent the total change in activity. Consider, for example, two possible cases. In the first, activity increases at a majority of firms but by only a small amount at each firm. In the second case, activity increases at a minority of firms but by a very large amount at each firm. The diffusion index will be smaller in the second case, even though the change in aggregate activity may be substantially larger.[10]

Finally, some business cycle economists question the value of business survey indexes as leading indicators of future activity. These economists acknowledge that diffusion indexes tend to lead business cycle turning points. However, they argue that the indexes do not do any better job of signaling such turning points than the rate of change of the corresponding economic aggregate—for example, the rate of change of production in the case of a production diffusion index, or the rate of change of employment in the case of an employment diffusion index (Broida, Alexander, Stickler).

III. PREVIOUS EMPIRICAL STUDIES OF MANUFACTURING SURVEYS

As the previous section makes clear, qualitative business surveys have both advantages and disadvantages as sources of information about the economy. In this situation, the best way to determine if manufacturing surveys can provide useful information to policymakers, investors, and business people is to see how well these surveys have explained or predicted manufacturing activity in the past. Empirical studies in the United States that have taken this approach fall into two categories—studies of the ISM manufacturing survey, and studies of regional manufacturing surveys.

Studies of the ISM manufacturing survey

The ISM manufacturing survey has been conducted in one form or another since the late 1930s, making it the oldest business tendency survey in the world. The survey currently reports diffusion indexes for the monthly changes in 9 different manufacturing variables. Since 1982, the ISM has also published a composite index called the Purchasing Managers Index (PMI). This index is calculated as a weighted average of five component indexes—production, new orders, employment, inventories, and vendor deliveries.[11]

Early studies of the information content of the ISM survey by business economists generally found that the survey had limited value in predicting future manufacturing activity but was quite useful in explaining current activity. A number of studies in the 1970s and 1980s examined the performance of ISM diffusion indexes as leading indicators. These studies considered whether the ISM indexes tended to lead business cycle turning points or peaks and troughs in the growth of manufacturing activity and real GDP. Other studies examined the statistical relationship between ISM indexes and changes in manufacturing activity or real GDP over long periods of time. On the whole, the studies found that the ISM indexes did not do a particularly good job of predicting business cycle turning points, future changes in real GDP, or future changes in industrial production.[12] However, the studies also found a strong contemporaneous correlation between the ISM indexes on the one hand and changes in real GDP or manufacturing activity on the other hand. The latter finding suggested that even if the ISM indexes could not serve as leading indicators, they could still provide valuable advance information about economic aggregates such as real GDP and industrial production that were released with a longer lag.

One deficiency of these early studies was that they failed to consider whether the ISM survey provided *additional* information about real GDP or manufacturing activity beyond that contained in other data. Three studies by Federal Reserve economists during the last decade helped remedy this deficiency (Harris, Rogers, Koenig). These studies estimated regression equations for growth in an economic aggregate such as GDP or industrial production, using as explanatory variables a contemporaneous ISM index and values of other economic variables

available at the same time as the ISM index. Two of the studies also improved upon previous research by using real-time data in the empirical analysis—that is, data that would have been available at the time the forecasts were actually made (Rogers, Koenig). All three studies concluded that the ISM survey indexes provided information about current growth in economic aggregates beyond that contained in other data, although in some cases the amount of additional information was small.

Studies of regional manufacturing surveys

Several other Federal Reserve banks besides Kansas City conduct manufacturing surveys for their districts—the Philadelphia Fed, the New York Fed, and the Richmond Fed.[13] In addition, some local purchasing managers associations, such as the one in Chicago, conduct surveys similar to the ISM survey. Unfortunately, there have been far fewer empirical studies of the predictive performance of these surveys than of the ISM survey. One reason is that the regional surveys have not been in existence as long as the ISM survey. Another reason is that there is much less independent data on regional manufacturing activity than on national manufacturing activity, making it harder to evaluate the information content of the regional surveys.

The few studies that have been done suggest that regional manufacturing surveys provide at least some information about regional manufacturing activity. In a study of the Philadelphia Fed survey, Trebing found that the month-over-month employment index was positively correlated with month-over-month growth in manufacturing employment in the Third Federal Reserve District. Lacy obtained similar results for the Richmond Fed survey, finding the month-over-month employment index in that survey to be highly correlated with the monthly change in Fifth District manufacturing employment.[14] On the negative side, both Lacy and Trebing found no relationship between the survey workweek index and the change in the average manufacturing workweek in the region. Furthermore, neither study examined whether the survey employment indexes provided any information about current employment growth in the region beyond that contained in data on past employment growth.

The studies suggest that regional manufacturing surveys also contain some information about national manufacturing activity, but not any more than the broader-based ISM survey. Levy and Kretzmer found that the Philadelphia Fed index and Chicago Purchasing Managers indexes were highly correlated with year-over-year changes in U.S. industrial production. However, both indexes did a worse job of explaining month-over-month and year-over-year changes in industrial production than the ISM index. In his study of the Richmond Fed survey, Lacy found that the survey indexes were highly correlated with measures of national manufacturing activity such as employment, shipments, and orders. In each case, however, the relationship was not as strong as that between the ISM index and the measure of national activity. Finally, Trebing found that the Philadelphia Fed survey indexes helped explain measures of national manufacturing activity, such as manufacturing employment and industrial production, even when past values of those measures were included in the regression equation. Trebing did not compare the Philadelphia Fed indexes to the ISM indexes. However, a more recent study by Schiller and Trebing found that the Philadelphia Fed survey performed just as well as the ISM survey in explaining current production and employment.[15]

IV. INFORMATION CONTENT OF THE KANSAS CITY FED SURVEY

What kind of information has the Kansas Fed manufacturing survey provided about manufacturing activity since its inception in 1994? As noted above, previous studies of regional manufacturing surveys found that the survey indexes move closely with measures of national manufacturing activity but do not provide more information than in the ISM survey. The appendix shows that the same results hold for the Kansas City Fed survey. As a result, this section focuses instead on what the Kansas City Fed survey has to say about district manufacturing activity. Two distinct types of information are considered. The first type is information about *current* manufacturing activity—information that is either not available at all from other sources or becomes available from other sources only with a lag. The second type is information about *future* manufacturing activity.

Information about current manufacturing activity in the district

As in other studies of the information content of business surveys, the basic approach is to compare the Kansas City Fed survey indexes to independent measures of district manufacturing activity. Unfortunately, the only manufacturing data available at the state level at a higher frequency than once a year are the monthly statewide employment data reported by the Bureau of Labor Statistics (BLS). The Census Bureau does report data on production and shipments at the state level, but these data are reported only once a year in the Annual Survey of Manufactures. Thus, to compare the Kansas City Fed survey with an independent measure of manufacturing activity, it is necessary to focus on the survey's employment indexes.

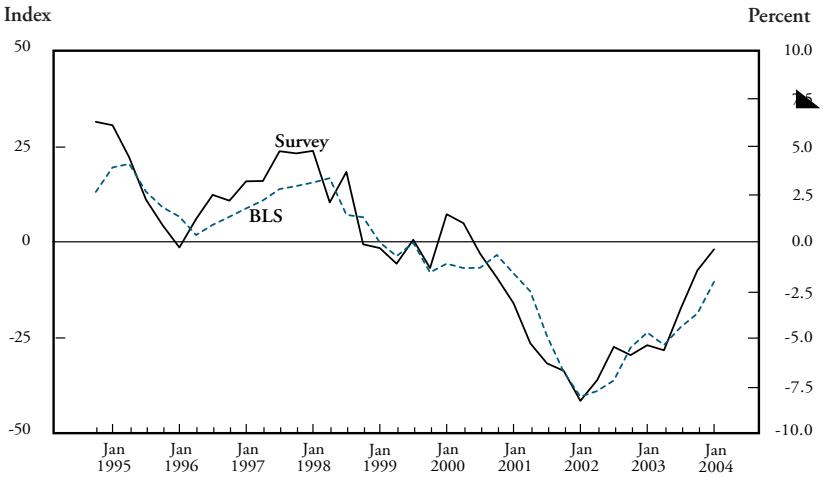
To obtain a sufficiently long time series to evaluate the information content of the Kansas City Fed survey, results from the old quarterly survey were spliced together with results from the more recent monthly survey. This yielded a sample of 38 observations, consisting of 27 observations from the quarterly survey (the January, April, July, and October indexes for the period from 1994:Q4 to 2001:Q2) and 11 observations from the monthly survey (the January, April, July, and October indexes for the period from July 2001 to January 2004). The fact that the Kansas City Fed survey has been in existence only ten years makes it somewhat harder to obtain precise statistical results than in studies of older surveys such as the ISM survey and the Philadelphia Fed survey. Fortunately, however, the sample period is still long enough to include both a major expansion and a steep downturn, lending some generality to the results.[16]

One problem with comparing the employment indexes to employment growth is that the geographic area covered by the employment data does not coincide exactly with the area covered by the Kansas City Fed survey. Specifically, the survey covers the Tenth Federal Reserve District only, while the employment data include portions of southern New Mexico and eastern Missouri that lie outside the district. The inclusion of southern New Mexico in employment data is unlikely to distort the results, but the inclusion of eastern Missouri could have a significant effect due to the large amount of manufacturing activity in St. Louis. Unfortunately, there is no easy way of resolving this problem

Chart 1

YEAR-OVER-YEAR EMPLOYMENT GROWTH

Survey vs. BLS



Source: Federal Reserve Bank of Kansas City and Bureau of Labor Statistics

because the county-level employment data that would be required to construct a district-only employment measure are reported only on an annual basis.[17]

What kind of information do the data suggest the Kansas City Fed survey can provide about current manufacturing activity? Consider first the year-over-year employment index. This index is very closely related to year-over-year growth in district manufacturing employment. The contemporaneous correlation coefficient between this index and year-over-year employment growth is 0.94, which is not only very large but highly significant in the statistical sense (Table 1).[18] Indeed, the only time the year-over-year employment index gave a false signal on the direction of change in employment was in the first half of 2000, when the survey index rose above zero but year-over-year employment growth remained negative (Chart 1).

More important than the correlation between the survey index and employment growth is whether the index is a good *conditional* indicator of employment growth. In other words, can the survey index provide any information about current employment growth beyond that contained in past values of employment growth? To answer this question,

Table 1

RELATIONSHIP BETWEEN SURVEY INDEXES AND CURRENT EMPLOYMENT GROWTH

BLS employment measure	Kansas City Fed survey index	Correlation coefficient	Regression of BLS measure on current survey index and lagged BLS measure	
			Coefficient on survey index	Change in adjusted R-square from including survey index
Year-over-year growth	Year-over-year diffusion index	.94**	.055** (5.63)	.017
Month-over-month growth (SA)	Month-over-month diffusion index (SA)	.72**	.037** (5.01)	.223

Notes: Numbers in parentheses are t-statistics. T-statistics and significance levels were computed using the GMM procedures recommended by Newey and West (for regression coefficients) and Ogaki (for correlation coefficients).

* Significant at 5 percent level.

** Significant at 1 percent level.

SA = Seasonally adjusted

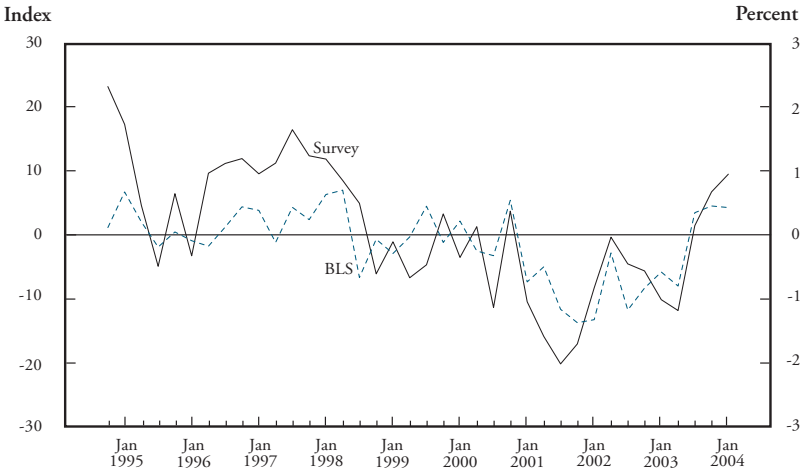
the current year-over-year survey index was included in a regression of current year-over-year employment growth against lagged year-over-year employment growth—specifically, year-over-year employment growth in each of the last six months.[19] The estimated coefficient on the survey index turned out to be positive and statistically significant at the 1 percent level, suggesting that the year-over-year index does provide some additional information about year-over-year employment growth (last two columns of Table 1). However, the additional information contained in the year-over-year employment index is small. In particular, including the index in the regression equation increases the adjusted R-square only slightly, by less than 0.02.[20]

The month-over-month employment index is not as highly correlated with employment growth as the year-over-year index but performs much better as a conditional indicator. The correlation coefficient between the month-over-month employment index and month-over-month employment growth is 0.72, which is highly significant in the statistical sense (Table 1 and Chart 2). The correlation with employment growth is about 0.2 lower than for the year-over-year survey index. As shown by the last column, however, the month-over-month index adds considerably more information than the year-over-year

Chart 2

MONTH-OVER-MONTH EMPLOYMENT GROWTH

Survey vs. BLS



Source: Federal Reserve Bank of Kansas City and Bureau of Labor Statistics

index to data on past employment growth. When the month-over-month employment index is included in a regression of current month-over-month employment growth against lagged employment growth, the estimated coefficient on the survey index is positive and statistically significant at the 1 percent level. Moreover, including the survey index in the regression increases the explanatory power substantially, boosting the adjusted R-square by 0.223.[21]

Information about future manufacturing activity in the district

Does the Kansas City Fed survey also help predict future manufacturing activity in the district? Consider first the year-over-year and month-over-month employment indexes. These indexes are not explicitly forward-looking. Because they are diffusion indexes, however, they could still provide more information about future employment growth than is contained in current and past employment growth. Two possible reasons were suggested in the previous section. First, diffusion indexes measure the *breadth* of change in activity rather than the aggregate change, making them good leading indicators in the view of some econ-

Table 2

RELATIONSHIP BETWEEN SURVEY INDEXES AND FUTURE EMPLOYMENT GROWTH

Future BLS employment measure	Kansas City Fed survey index	Regression of future BLS measure on current and lagged values of survey index and BLS measure	
		Does survey index help predict BLS measure?	Change in adjusted R-square from including survey index
Year-over-year growth in six months	Year-over-year diffusion index	Yes	.063
Month-over-month growth in one month (SA)	Month-over-month diffusion index (SA)	Yes	.404

Notes: For both regressions, the joint hypothesis that the coefficients on current and lagged values of the survey index are equal to zero can be rejected at the 1 percent level. Significance levels were computed using the GMM procedures recommended by Newey and West.

SA= Seasonally adjusted

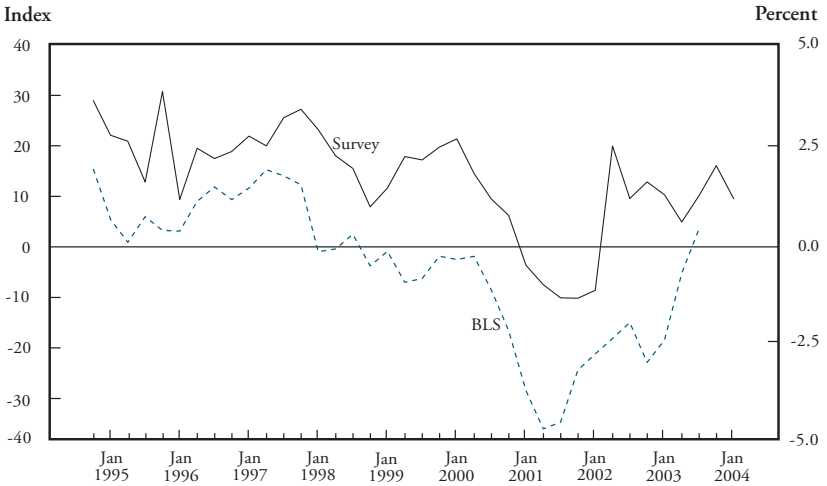
omists. Second, diffusion indexes tend to be unaffected by large, idiosyncratic changes in activity at a few firms, which may make them more reliable measures of underlying trends than most economic aggregates.

To determine if the year-over-year and month-over-month employment indexes had any predictive power, future measures of employment growth were regressed on two sets of variables—current and lagged values of the survey index, and current and lagged values of employment growth. For the year-over-year index, the measure of future employment growth was year-over-year growth six months from now; for the month-over-month index, the measure was month-over-month growth in the next month.[22] The survey index is considered to help predict the measure of future employment growth if the estimated coefficients on current and lagged values of the survey index are jointly different from zero in the statistical sense.[23] The additional information provided by the survey index can be represented by the increase in explanatory power from including current and lagged values of the survey index in the regression—that is, by the increase in the adjusted R-square of the regression.

Chart 3

SIX-MONTH-AHEAD EMPLOYMENT GROWTH

Survey vs. BLS



Source: Federal Reserve Bank of Kansas City and Bureau of Labor Statistics

Table 3

RELATIONSHIP BETWEEN SIX-MONTH-AHEAD INDEX AND SIX-MONTH-AHEAD EMPLOYMENT GROWTH

BLS employment measure	Kansas City Fed survey index	Correlation coefficient	Regression of BLS measure on survey index and current and lagged BLS measure	
			Coefficient on survey index	Change in adjusted R-square from including survey index
Six-month-ahead growth (SA)	Six-month-ahead diffusion index (SA)	.80**	.075* (2.01)	.065

Notes: Number in parentheses is the t-statistic. T-statistics and significance levels were computed using the GMM procedures recommended by Newey and West (for regression coefficients) and Ogaki (for correlation coefficients)

* Significant at 5 percent level.
** Significant at 1 percent level.
SA = seasonally adjusted.

The results indicate that both the year-over-year and month-over-month survey indexes help predict future employment growth. In both cases, the estimated coefficients on the current and lagged survey index are significantly different from zero at the 1 percent level (Table 2).[24] As in the regressions used to explain current employment growth, however, the month-over-month index adds substantially more information than the year-over-year index. Specifically, including the year-over-year index in the regression increases the adjusted R-square by 0.063, while including the month-over-month index raises the adjusted R-square by 0.233.

Consider next the six-month-ahead index. Because this index is forward-looking, it should also contain information about future employment growth. In particular, if respondents can predict employment growth at their own firms, and if the survey sample is representative of the district manufacturing sector, then the six-month-ahead index should be closely related to actual six-month-ahead growth in district manufacturing employment. This turns out to be the case—the two series track each other closely, and the correlation coefficient between them is high and statistically significant (Chart 3 and Table 3).[25]

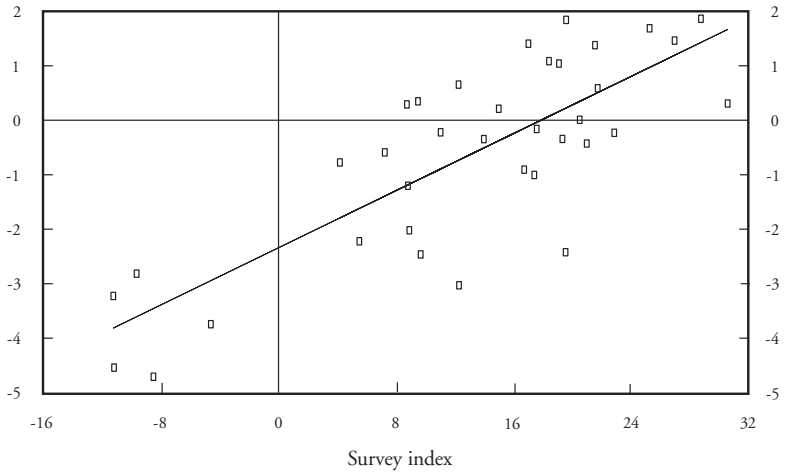
The six-month-ahead employment index also proves to be a useful conditional indicator of future employment growth. The last two columns of Table 3 show the results of regressing six-month-ahead employment growth against the six-month-ahead employment index and lagged values of six-month employment growth. The estimated coefficient on the six-month-ahead index is positive and significant in the statistical sense. Furthermore, including the survey index in the regression increases the explanatory power moderately, raising the adjusted R-square by 0.065.[26]

While respondents' forecasts contain some information about future employment growth, the forecasts have shown a distinct upward bias. In particular, Chart 3 shows that it is not unusual for survey respondents to predict positive employment growth over the next six months, but for actual employment growth over that period to turn out negative. From October 1998 to October 2000, for example, the survey's six-month-ahead employment index was positive, while actual employment growth over the same horizon was

Chart 4

SIX-MONTH-AHEAD EMPLOYMENT GROWTH

Percent change in employment



Source: Federal Reserve Bank of Kansas City and Bureau of Labor Statistics

negative. The same discrepancy also occurred from April 2002 to April 2003, as the six-month-ahead index rose above zero but actual job growth remained negative.

Chart 4 suggests a simple way of correcting for respondents' excessive optimism about future employment growth. This chart plots the six-month-ahead employment index, measured on the horizontal axis, against the actual six-month-ahead change in employment, measured on the vertical axis. The solid trend line is estimated from a simple regression of the employment change on the survey index. The observations are clustered fairly closely around the trend line, indicating a strong positive correlation between the six-month-ahead survey index and the actual change in employment. However, the trend line also has a large horizontal intercept of 18, indicating that the actual change in employment tends to be negative even when the survey index is zero. One way to adjust for the systematic optimism of survey respondents is to simply subtract this intercept from the six-month-ahead index. If the adjusted index is positive, past experience would suggest employment will increase.

Table 4

CORRELATION BETWEEN YEAR-OVER-YEAR INDEX AND AVERAGE SIX-MONTH-AHEAD INDEX

Kansas City Fed survey index	Correlation coefficient
Employment	.81**
Backlog of orders	.69**
Prices for finished goods	.69**
Production	.67**
Capital expenditures	.62**
New orders	.61**
New orders for exports	.61**
Shipments	.57**
Materials inventories	.52**
Prices for raw materials	.40*
Finished goods inventories	.36
Average workweek	.33*
Supplier delivery time	.13

Notes: The average six-month-ahead index is the average of the six-month-ahead index from six months ago and the six-month-ahead index from 12 months ago. Significance levels were computed using the GMM procedures recommended by Ogaki.

*Significant at 5 percent level
** Significant at 1 percent level

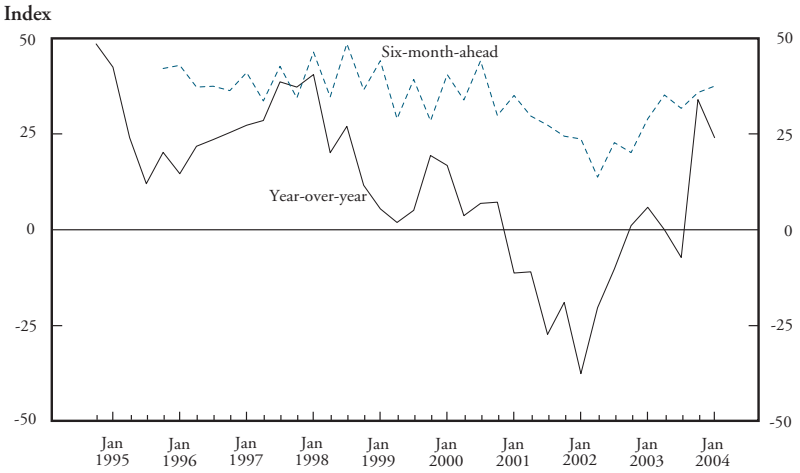
A final test of whether the six-month-ahead index is a good predictor of future activity is to see if survey respondents can forecast activity at their own firms. The better respondents are at predicting activity at their own firms, the more information the survey's forward-looking indexes should provide about future manufacturing activity in the district.

To get a rough idea how good respondents were at predicting their own activity, the year-over-year survey index was compared to the average of the two six-month-ahead survey indexes covering the same time period.[27] Because no independent measure of manufacturing activity was required, these comparisons could be made for all measures of manufacturing activity covered by the survey—for example, for production, orders, and capital spending, in addition to employment. To

Chart 5

SURVEY PRODUCTION INDEXES

Year-over-year vs. average six-month-ahead

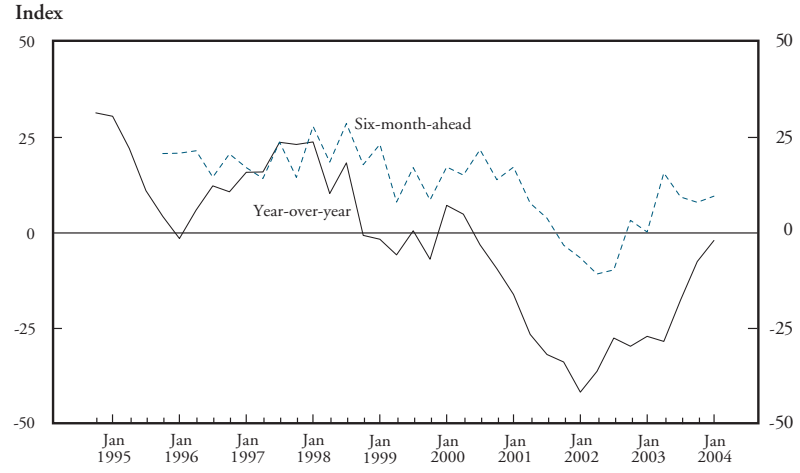


Source: Federal Reserve Bank of Kansas City

Chart 6

SURVEY EMPLOYMENT INDEXES

Year-over-year vs. average six-month-ahead



Source: Federal Reserve Bank of Kansas City

evaluate the accuracy of such forecasts, Table 4 reports the correlation coefficient between the year-over-year index for each variable and the average of six-month-ahead indexes covering the same time period (the six-month-ahead index for six months ago and the six-month-ahead index for 12 months ago). For purposes of illustration, Charts 5 and 6 plot the year-over-year index and the average six-month-ahead index for two of the variables—production and employment.

Overall, the results suggest that respondents do a reasonably good job of predicting activity at their own firms but display the same optimistic bias noted earlier. Except for supplier deliveries and finished good inventories, the correlation coefficients in Table 4 are all positive and statistically significant. Consistent with this finding, the average six-month-ahead indexes for production and employment in Charts 5 and 6 tend to move in the same direction as the year-over-year indexes, especially in the latter half of the sample period. As before, though, the data suggest that respondents systematically overpredict the rate of growth. Specifically, Charts 5 and 6 show that the average six-month-ahead index has been consistently higher than the year-over-year index. Although not shown in the table or charts, the same optimistic bias exists for most of the other variables in the survey.[28]

V. IMPLICATIONS OF EMPIRICAL RESULTS

In the case of the Kansas City Fed survey, the advantages of qualitative business surveys appear to outweigh the disadvantages, making the survey a valuable source of information about district manufacturing activity. Both the year-over-year index and the month-over-month index help explain current employment growth, even after taking into account past employment growth. This result implies that the survey can provide advance information about current employment growth during the interval between the release of the survey results and the release of the employment data. In 2003, final results from the Kansas City Fed survey were available internally an average of 21 days before the release of the statewide data on manufacturing employment, with the lead time ranging from a low of nine days to a high of 43 days

(Table A2 in the appendix). Receiving information on district manufacturing employment several weeks early can be of some value to policymakers, especially during turning points in the business cycle.

A more important implication of the close relationship between the employment indexes and district manufacturing employment is that it provides some assurance that other survey indexes contain useful information about district manufacturing activity. As noted earlier, there are many important manufacturing variables for which no independent data exist at the district level, including production, new orders, inventories, and capital spending. If these variables all moved in lockstep with manufacturing employment, there would be no need to obtain information about them—policymakers and business economists could make do with the employment data alone. However, productivity shifts often cause production and employment to move in different directions, and inventories and capital spending need not move in lockstep with either production or employment. By providing reliable information about these variables, the survey can fill an important gap and produce a clearer picture of the current state of district manufacturing.

The results also suggest that the survey indexes can play a useful role forecasting future manufacturing activity in the district. The month-over-month and year-over-year employment indexes both help predict next month's employment growth, consistent with the view that diffusion indexes have leading indicator properties. The six-month-ahead employment index also improves on forecasts of six-month-ahead employment growth based solely on data on current and past employment growth. Unfortunately, lack of independent data makes it harder to determine how much information about future manufacturing activity is provided by the other six-month-ahead indexes—for example, those for production, new orders, and capital spending. However, the fact that these other six-month-ahead indexes are closely correlated with the year-over-year indexes for the same time periods suggests that they, too, could be very useful for forecasting district manufacturing activity.

Finally, the results of this section suggest that the Kansas City Fed survey can help assess manufacturing activity in the nation as a whole. As shown in the appendix, the Kansas City Fed survey adds little direct information about national manufacturing activity beyond that contained in the ISM survey and national data such as industrial

production. However, information from the Kansas City Fed survey can still be combined with similar information from other districts to obtain a more accurate picture of the national manufacturing sector. This approach is used in the Federal Reserve's Beige Book, which summarizes the national economy based on reports from the 12 district economies. Having accurate information about economic activity in each region allows policymakers to evaluate the breadth of change in activity across regions, just as survey diffusion indexes provide information about the breadth of change across firms. Such information can help determine whether an upturn or downturn in national economic data reflects a true turning point in economic activity or a temporary blip.[29]

VI. CONCLUSIONS

Regional manufacturing surveys have been attracting increasing attention from the financial press and business economists, partly because they are among the first releases of the month. To learn what these surveys can tell us about the economy, this article has examined the information provided by the Kansas City Fed Manufacturing Survey since its beginning in 1994. The Kansas City Fed survey indexes provide little direct information about *national* manufacturing activity beyond that contained in the broader-based ISM survey. However, the Kansas City Fed's employment indexes do provide substantial information about current and future growth in *district* manufacturing employment. These findings suggest that the Kansas City Fed survey may be a valuable source of information about the district manufacturing sector, especially for variables such as production, orders, and capital spending for which no independent data exist at the regional level. Finally, while the Kansas City Fed survey may not provide much direct information about national manufacturing activity, the findings of this article such that regional surveys can still play a key role in assessing the state of the national manufacturing sector. In particular, information from regional manufacturing surveys can be used to determine the breadth of change in national manufacturing activity across regions, providing a valuable supplement to national data on manufacturing such as industrial production and the ISM survey.

APPENDIX

This appendix shows that the Kansas City Fed survey indexes move closely with measures of national manufacturing activity but provide only a small amount of information about these measures beyond that contained in the more broadly based ISM survey and past data. Two measures of national activity are considered: U.S. manufacturing employment and U.S. industrial production in manufacturing. As before, a sample of 38 observations on the Kansas City Fed survey was produced by combining monthly and quarterly surveys and using only the survey results for the first month of each quarter.

Table A1 shows that the Kansas City Fed month-over-month indexes for production and employment are highly correlated with the corresponding measures of national manufacturing activity. The correlation is 0.46 for month-over-month growth in industrial production, and 0.66 for month-over-month growth in employment. Both coefficients are also highly significant in the statistical sense.

The question remains whether the Kansas City Fed survey provides any information about national manufacturing activity beyond that contained in the broader-based ISM survey. The answer to this question is important because the Kansas City Fed survey has no significant timing advantage over the ISM survey. During 2003, for example, final results from the Kansas City Fed survey were available internally an average of four days *after* the release of the ISM survey, with the lag ranging from one to eight days (Table A2).[30]

To determine whether the Kansas City Fed survey had any value as a conditional indicator of national manufacturing activity, growth in each measure of manufacturing activity was regressed against the corresponding Kansas City Fed survey index, the corresponding ISM survey index, and past data on the measure.[31] The results are shown in the last three columns of Table A1. The fourth column shows the estimated coefficient on the Kansas City Fed survey index, while the fifth column shows the estimated coefficient on the ISM index. The last column shows how much the inclusion of the Kansas City Fed index increases the explanatory power of the regression, as measured by the change in the adjusted R-square.

Table A1

RELATIONSHIP BETWEEN KANSAS CITY FED SURVEY INDEXES AND MEASURES OF CURRENT NATIONAL MANUFACTURING ACTIVITY

Kansas City Fed survey index	Measure of national activity	Correlation coefficient	Regression of national measure on current Kansas City Fed index, current ISM index, and lagged national measures		
			Coefficient on Kansas City Fed index	Coefficient on ISM index	Change in adjusted R-square from including Kansas City Fed index
Month-over-month production index (SA)	Month-over-month growth in industrial prod. (SA)	.46**	.016* (2.12)	.018* (2.17)	.027
Month-over-month employment index (SA)	Month-over-month growth in mfg. employment (SA)	.66**	-.002 (.60)	.017** (3.18)	-.007

Note: Numbers in parentheses are t-statistics. T-statistics and significance levels were corrected for serial correlation using the GMM procedure recommended by Newey and West.

*Significant at 5 percent level

**Significant at 1 percent level

SA = seasonally adjusted

Table A2

NUMBER OF DAYS BETWEEN CLOSE OF KANSAS CITY FED SURVEY AND PUBLIC RELEASE OF OTHER DATA, 2003

Survey month	*Tenth District manufacturing employment*	*ISM survey*	*U.S. industrial production*	*U.S. manufacturing employment*
January	43	-2	9	2
February	41	-2	9	2
March	29	-8	6	-5
April	23	-6	8	-5
May	16	-2	13	2
June	9	-8	7	-6
July	13	-5	9	-5
August	16	-1	12	2
September	13	-7	8	-5
October	16	-2	9	2
November	16	-2	13	2
December	20	-5	9	2
Average	21	-4	9	-1

The results imply that the Kansas City Fed survey adds a small amount of information about current growth in U.S. industrial production and no information about current growth in U.S. manufacturing employment. The coefficient on the Kansas City Fed production index is statistically significant and about the same size as the coefficient on the ISM production index. However, including the Kansas City Fed survey index in a regression with the ISM index and past growth in U.S. industrial production increases the adjusted R-square only modestly, by 0.027. The coefficient on the Kansas City Fed employment index is indistinguishable from zero, and inclusion of the index in the regression equation actually lowers the adjusted R-square.

The finding that the Kansas City Fed survey adds only a small amount of direct information on national manufacturing activity to the ISM survey comes as little surprise. The Kansas City Fed survey is based on a much narrower geographic sample than the ISM survey, which covers the whole nation. Furthermore, while the district manufacturing sector is fairly representative of the national manufacturing sector, it still differs in important ways, such as having a higher concentration of food processors and a lower concentration of chemical manufacturers and primary metals producers.

ENDNOTES

[1]Before 2002, the ISM survey was known as the NAPM survey (National Association of Purchasing Managers). For convenience, we will refer to the survey as the ISM survey throughout the article.

[2]See Smith for an early overview of the survey and Wilkerson for a recent example of how the results are reported each month.

[3]For capital spending, which tends to be lumpy, respondents are asked about the year-over-year and six-month-ahead change but not the month-over-month change.

[4]In contrast, the Philadelphia Fed survey is released on the third Thursday of the survey month, and the ISM survey on the first business day following the survey month. These early release dates come at a cost, however—both surveys are based on responses received in the first half of the month, which means they cannot reflect developments in the second half of the month (Koenig).

[5]In this case, the index can also be calculated as 50 plus the percentage of respondents reporting an increase minus one-half the percentage of respondents reporting no change.

[6]Another advantage sometimes claimed for business surveys is that the results are usually not revised after the initial release. As noted by Tamm, however, the absence of revisions should not be considered an advantage if it results in less accurate data.

[7]For example, Harris reports that, during the period from January 1990 to January 1991, the percentage of "no change" responses in the ISM survey was 54 percent for production and 64 percent for employment, figures which he describes as "implausibly large." The percentage of "no change" responses is of similar magnitude in the Kansas City Fed manufacturing survey and in business surveys in other countries such as the UK (Cunningham).

[8]Theil was the first economist to address this issue. For more details on the different techniques, see the surveys by Pesaran and by Driver and Urga.

[9]One problem confronted by all surveys is that the sample can vary from month to month depending on which firms choose to respond. The government agencies that produce quantitative data typically control for such variations in sample, while business surveys generally do not (Harris).

[10]To cite another example of how diffusion indices might misrepresent aggregate changes, the employment indexes of the ISM and regional manufacturing surveys turned positive in early 2004 at the same time aggregate job growth in manufacturing remained negative. Some analysts suggested that this discrepancy was due to the fact that expanding firms were hiring fewer workers than contracting firms were laying off (Hilsenrath, Martin).

[11]The PMI was first proposed by Theodore Torda, an economist at the Department of Commerce.

[12]Klein and Moore found that the PMI tended to peak and trough several months before the business cycle turning points identified by the National Bureau of Economic Research, but a couple of months *after* the Department of Commerce's index of leading indicators. As Harris notes, the PMI has also given many false signals about turning points, reaching multiple local peaks during the course of an expansion. Finally, as Kaufman pointed out in a comprehensive

survey of the literature, most studies found no tendency for peaks and troughs in the PMI to occur before peaks and troughs in the growth of real GDP or industrial output.

[13]The Atlanta Fed also conducted a monthly manufacturing survey from 1992 to 2000.

[14]The correlation coefficients between the month-over-month employment index and month-over-month employment growth were 0.51 for the Philadelphia Fed survey and 0.64 for the Richmond Fed survey.

[15]One implication of this finding is that the Philadelphia Fed survey can provide useful information about national manufacturing activity during the two-week period after the Philadelphia Fed survey is released and before the ISM survey is released.

[16]For month-over-month comparisons, both the survey index and the BLS data were seasonally adjusted using X-12. The authors adjusted the BLS data themselves because the BLS quit seasonally adjusting manufacturing employment in each state when it switched from the SIC system of industrial classification to the NAIC system in early 2003.

[17]For 2001, these data show that 71 percent of manufacturing employment in Missouri was outside the Tenth District and that 27 percent of manufacturing employment in New Mexico was outside the Tenth District.

[18]Because the data display substantial serial correlation, test statistics were computed using the GMM methods recommended by Ogaki for correlation coefficients and by Newey and West (1987, 1994) for regression coefficients.

[19]In calculating lagged employment growth, revised BLS data were used instead of the real-time data available at the time the survey was released. This approach may bias the results against the survey, because it assumes the forecaster had more accurate data on past employment growth than was really the case. The authors also tried estimating the regression with additional lags of the survey index, but the coefficients on these lags were statistically insignificant.

[20]The R-square of a regression is a measure of its explanatory power and varies between zero and one. The adjusted R-square controls for the increase in explanatory power due solely to the increase in the number of independent variables. One reason the current survey index adds only a small amount of information to the lagged data is that there is significant overlap (10 out of 12 months) between the current month's year-over-year growth rate and the previous month's year-over-year growth rate.

[21]As a check on the results, the regression was also estimated using nonseasonally adjusted data from the period when the monthly survey was in effect and including all months (34 months from July 2001 to April 2004). The results were very similar to those for the longer sample period: the estimated coefficient on the month-over-month survey index was 0.038; the coefficient was significant at the 1 percent level, and including the survey index in the regression with lagged employment data increased the adjusted R-square by 0.20.

[22]More precisely, future employment growth for month t is measured by actual growth from month t-6 to month t+6 in the year-over-year case and by actual growth from month t to month t+1 in the month-over-month case.

[23] This test is sometimes referred to as an exclusion test. The lagged values of the survey index were for the first months of the previous two quarters, while the lagged values of employment growth were for each of the previous six months.

[24] Though not shown in the table, the regression results also suggest that the current value of the survey index is more useful than lagged values in predicting future employment growth.

[25] The employment growth line ends in July 2003 because at the time of writing, that was the last date for which six-month-ahead employment growth could be computed.

[26] Although not shown in the table, the six-month-ahead index has substantially more value as a conditional indicator when current employment data are unavailable. Specifically, when only lagged values of employment growth are included in the regression equation, the coefficient on the six-month-ahead index is significant at the 1 percent level rather than the 5 percent level, and including the six-month-ahead index in the regression raises the adjusted R-square rises by .183 instead of .065. As shown in Table A2 in the appendix, current employment data became available an average of three weeks after the survey data during 2003.

[27] For example, the year-over-year index from the October 1995 survey was compared to the average of the six-month-ahead index from the April 1995 survey and the six-month-ahead index from the October 1994 survey. As a check on the results, the six-month-ahead index was also compared to the average of the month-over-month indexes for the same time horizon, using nonseasonally adjusted data from the monthly survey (July 2001 onward). In most cases, the correlations were high and statistically significant.

[28] Specifically, when the year-over-year index is regressed on the average six-month-ahead index, the estimated constant term is negative and statistically significant in most cases. For example, the constant term is -47 for production, -37 for new orders, -25 for employment, and -13 for capital spending.

[29] Consistent with this view, a recent study of the Beige Book found that district economic reports contained substantial information about national economic activity (Balke and Petersen). The authors assigned numerical scores to the national Beige Book summary and each of the 12 district summaries. These scores were then included in regressions for current and next-quarter GDP growth along with national data such as industrial production, employment, and lagged GDP.

[30] In about half the survey months, a substantial majority of responses were received a few days before the ISM release, implying that the survey could have provided some advance indication to policymakers of what the ISM survey would say. However, this timing advantage seems too small to be of much benefit.

[31] This exercise could be performed only for the month-over-month survey indexes, because unlike the Kansas City Fed survey, the ISM survey does not ask respondents about the year-over-year change in activity. The ISM indexes were converted to balance statistics so that the coefficients on the indexes would be comparable to the coefficients on the Kansas City Fed indexes.

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