

What's Happening in Manufacturing: “Survey Says...”

*Michael E. Trebing**

Financial journalists and market participants have focused a great deal of attention in recent years on the *Business Outlook Survey* (BOS) conducted by the Philadelphia Fed. The survey results are reported by the major financial wire services immediately after their release. This monthly survey seeks information from manufacturers in the Third Federal Reserve District about current conditions at their plants and their expectations for the future. The survey has been conducted monthly since 1968 and offers a valuable source of information in tracking developments in the District's manufacturing sector.

How useful is the survey in providing new information on the broader economy? Clearly, market participants see value in the survey results. Statistical analysis offers evidence that the survey provides information on short-term changes in the regional and national manufacturing sectors.

A SURVEY ABOUT THE DIRECTION OF BUSINESS ACTIVITY

The *Business Outlook Survey* asks participants to indicate the direction of change in overall business activity and in various measures of activity at their plants: employment, working hours, new and unfilled orders, shipments, inventories, delivery times, prices paid, and prices received. They are asked to indicate whether each measure has increased, decreased, or re-

*Mike Trebing is an economic analyst in the Research Department of the Philadelphia Fed.

mained the same since the previous month and whether they expect the measure to increase, decrease, or remain unchanged during the coming six months.¹ The section about expectations also includes a question about capital spending plans (see *Description of the Business Outlook Survey*). Surveys about the direction of change like the BOS have distinct advantages over traditional ways of measuring economic activity.

Advantages. One advantage of qualitative surveys is the nonintrusive nature of the questions. Since the survey asks only for information about the direction of change and not for specific numbers, firms may be more willing to participate. Firms do not have to reveal confidential information regarding sales. Moreover, results are

¹Such qualitative surveys are common in Europe, where they are generally referred to as “tendency surveys.” The Centre for International Research on Economic Tendency Surveys (CIRET) in Munich, Germany, has cataloged more than 100 institutions in 43 countries that conduct such business-cycle surveys.

Description of the Business Outlook Survey

The Philadelphia Fed’s *Business Outlook Survey* was started in 1968 and has remained essentially unchanged since that time. The survey questionnaire is a “box check” variety (see the *Business Outlook Survey Questionnaire* to the right). Respondents indicate whether the value of each economic indicator (except capital expenditures) has increased, decreased, or stayed the same over the past month. They are also asked about their expectations for each indicator over the next six months. No quantitative information (dollar amounts or volume) is requested for any of the variables, although participants can voluntarily submit comments about economic conditions or special factors relevant to their business. All the questions refer specifically to a firm’s own activity except the first one on general business activity. The response to the first question is not necessarily based solely on information from the firm, but the high correlation of aggregate responses to this question with the responses to the question on shipments indicates that a firm’s answer to the first question is primarily based on its own activity.^a

Each month, about 250 large manufacturing firms located in the Third Federal Reserve District receive the survey.^b Only those that have 100 or more employees are asked to participate in the survey, and participation is voluntary. The survey is sent to the same individual each month, typically the chief executive or a designated officer. The voluntary reporting panel has changed over time, and the group of participating firms is periodically replenished as firms drop out or a need arises to make the panel more representative of the industrial mix of the region.

Surveys are mailed to the participating firms near the end of each month, and the Fed asks that responses be returned by the end of the first full week of the following month. The period for collecting responses, therefore, does not coincide with the data collection period for most official statistics. In fact, the *Business Outlook Survey*’s collection period spans two calendar months. For example, the survey for July 1997 was mailed in late June with a return deadline of July 5, although survey forms are normally accepted after the return date. Therefore, most responses were based on activity through the first week of July. In recent years, between 100 and 125 firms have responded each month. For example, in July 1997, 114 respondents returned questionnaires. As shown in Table 1, data for the *Business Outlook Survey* are published ahead of comparable official data on the manufacturing sector.

Results of the survey are always published at 10:00 a.m. E.T. on the third Thursday of the month. Results are available immediately to market participants via the major national and international news wire services. The monthly release along with aggregate historical data series is also available on the Bank’s Internet site at ‘<http://www.phil.frb.org>’.

^aThe correlation coefficient between the diffusion indexes for current activity and shipments is 0.85.

^bThe Third Federal Reserve District comprises the state of Delaware, the southern half of New Jersey, and the eastern two-thirds of Pennsylvania.

BUSINESS

OUTLOOK

Federal Reserve Bank
of Philadelphia

Survey

July 1997

CONFIDENTIAL: Individual replies will not be published or quoted.

Name of Firm	Respondent
Title	Date

We would like your opinion of business conditions. Please complete this questionnaire by checking the appropriate box and return it by the 5th of the month. If it is more convenient to fax the survey, send it to (215) 574-4364.

Indicator	July vs. June			Six Months from Now vs. July		
	Decrease	No Change	Increase	Decrease	No Change	Increase
General Business Conditions What is your evaluation of the level of general business activity?						
Company Business Indicators						
New Orders						
Shipments						
Unfilled Orders						
Delivery Time						
Inventories						
Prices Paid						
Prices Received						
Number of Employees						
Average Employee Workweek						
Capital Expenditures						

Please comment on any special factors that may be affecting your business. Use reverse side if necessary.



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Ten Independence Mall, Philadelphia, PA 19106-1574, (215) 574-6448

BUSINESS

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Federal Reserve Bank
of Philadelphia

Survey

July 1998

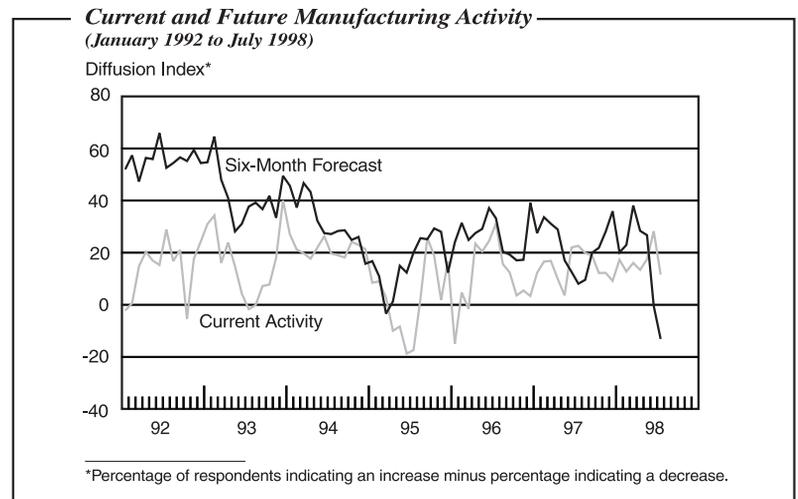
Regional manufacturing activity is reportedly expanding at a slower pace this month. Most of the survey's current indicators of economic performance declined from their relatively high readings of the previous month. Upward price pressures are notably absent this month. The manufacturers' responses indicate that overall weaker performance is expected over the rest of the year.

Indicators Fall to Their Lowest Readings This Year

The current general activity index declined from 28.2 in June to 11.6 this month, the lowest level since December (see Chart). Nearly 29 percent of the manufacturers report increases in activity this month, compared with nearly 40 percent the previous month. Slowing is also evident in firms' responses regarding shipments and new orders this month. Although the percentage of firms reporting increases in shipments and new orders is greater than the percentage reporting decreases, the diffusion indexes for both dropped to their lowest readings this year. The current shipments index declined from 27.4 to 7.2. The current new orders index fell from 22.6 to 7.5.

The percentage of firms reporting increases in employment (18 percent) edged out the percentage reporting declines (14 percent). The current employment index fell from 7.9 to 4.5. The average workweek index, however, declined markedly from 11.8 to -2.1.

Despite regional manufacturing's slower rate of growth, responses



regarding unfilled orders and delivery times changed little. The percentage of firms reporting increases in unfilled orders (26 percent) is greater than the percentage reporting decreases (19 percent). The current unfilled orders index increased from 6.8 to 7.5. More firms reported longer delivery times (19 percent) than reported shorter ones (10 percent). The delivery time index, which remained positive for the third consecutive month, increased from 2.3 in June to 8.2.

Price Indexes Fall to Relative Lows

Pressures on input prices moderated notably this month, according to the region's manufacturers. For the first time since February 1996, the percentage of firms indicating declining input prices (12 percent)

was larger than the percentage indicating increases (9 percent). The current prices paid index fell from 6.1 to -2.1.

Prices of final manufactured goods are reported steady by 69 percent of firms. For the first time since March, the percentage of firms reporting declining prices for goods (18 percent) is greater than the percentage reporting rising prices (12 percent). The current prices received index fell from 1.1 in June to -5.8.

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Forecasts Fall Precipitously in Past Few Months

A notable decline in expectations was in evidence in the previous survey and again this month. The future activity diffusion index fell from -0.5 in June to -13.1, its lowest reading since 1990 and the fourth consecutive month of decline (see Chart). Although 44 percent of respondents expect no change in activity from current levels, the percentage expecting declines (32 percent) is greater than the percentage expecting increases (19 percent). A similar pattern is in evidence regarding firms' expectations about future new orders and shipments. Firms anticipate that declines in orders

will be accompanied by declines in unfilled orders and shorter delivery times. On balance, inventories are expected to decline from current levels.

For the second consecutive month, the percentage of firms expecting declines in employment (26 percent) is greater than the percentage expecting increases (19 percent). The future employment index also fell from -2.9 to -7.4, its lowest reading since January 1996. Declines in average work hours are also consistent with declines in other broad forecast indicators. The future index for average employee workweek declined from -10.5 to -23.5.

Summary

Although last month's survey reported robust growth in regional manufacturing, *Business Outlook Survey* indicators this month suggest only slight improvements in overall business. Slowing of growth is evident in responses regarding new orders, shipments, and average work hours. More firms reported declines in input and output prices this month than reported increases. Sharp declines in the six-month forecast indicators over the past few months suggest weaker conditions are expected through the end of the year.

BUSINESS OUTLOOK SURVEY

Summary of Returns

July 1998	July vs. June				Six Months from Now vs. July			
	Decrease	No Change	Increase	Diffusion Index	Decrease	No Change	Increase	Diffusion Index
What is your evaluation of the level of general business activity?	17.0	54.5	28.6	11.6	32.0	44.3	18.9	-13.1
Company Business Indicators								
New Orders	24.8	42.9	32.3	7.5	35.9	34.0	28.8	-7.1
Shipments	18.0	56.9	25.2	7.2	35.6	38.1	22.4	-13.2
Unfilled Orders	18.8	54.9	26.3	7.5	41.0	45.4	9.7	-31.3
Delivery Time	10.3	70.0	18.6	8.2	30.4	59.1	6.7	-23.8
Inventories	26.9	57.3	15.7	-11.2	35.3	43.1	20.8	-14.6
Prices Paid	11.5	79.1	9.4	-2.1	5.4	59.8	33.4	28.1
Prices Received	17.7	69.3	11.9	-5.8	18.9	55.2	25.5	6.5
Number of Employees	13.9	67.7	18.4	4.5	26.1	55.3	18.6	-7.4
Average Employee Workweek	22.0	58.1	19.9	-2.1	35.7	50.5	12.2	-23.5
Capital Expenditures	—	—	—	—	14.1	43.1	22.6	8.5

Notes: (1) Items may not add up to 100 percent because of omission by respondents.

(2) All data seasonally adjusted.

(3) Diffusion indexes represent the percentage of respondents indicating an increase minus the percentage indicating a decrease.

TABLE 1
The Timing of Surveys and Publication Dates

The table below depicts the publication dates for the July 1997 reference month and the corresponding publication date for selected U.S. and regional manufacturing data. The collection period for the *Business Outlook Survey* spans two months. For example, the July 1997 report reflected only one week in the month of July, but it was available in advance of the comparable official statistics for the manufacturing sector for that month.

	Reference Month	Publication Date
<i>Business Outlook Survey</i>	July	July 17
Regional Data		
U.S. Department of Labor Bureau of Labor Statistics Manufacturing Employment	July	August 26
Average Workweek in Manufacturing	July	August 26
National Data		
U.S. Department of Labor Bureau of Labor Statistics Manufacturing Employment	July	August 1
Average Workweek in Manufacturing	July	August 1
Producer Prices	July	August 13
U.S. Department of Commerce Bureau of the Census New Orders, Shipments, and Unfilled Orders	July	September 4
Board of Governors, Federal Reserve System Industrial Production	July	August 14
National Association of Purchasing Managers Backlog of Orders and Supplier Deliveries	July	August 1

published only in the aggregate, so information about individual companies is not disclosed.

Qualitative surveys also take less time to fill out than quantitative surveys because there is no need to collect exact numbers. Busy executives are more likely to respond to a survey whose time requirements are minimal. Moreover, because qualitative surveys can be filled

out more quickly, they are returned more quickly, so the data can be processed in a more timely fashion.

Qualitative surveys also enjoy a cost advantage over quantitative surveys. A major cost in processing any survey involves entering data into computer systems, editing the data for validity and quality, and obtaining missing re-

ports. Qualitative surveys require fewer costly processing steps, and data are simpler to enter and edit.

Interpreting Qualitative Surveys. By their nature, qualitative surveys provide less precise information than quantitative ones. A response that new orders rose 2.1 percent this month is much more informative than one that merely states that orders rose. The less precise nature of a qualitative survey is manifested in the large percentage of BOS respondents each month who indicate "no change" for many of the variables. It is unlikely that all these respondents have experienced absolutely no change. For some, a change may be so small that it is insignificant for their operation. Others may not know the direction of change in each variable, and a "no change" response may reflect a reasonable state of uncertainty.

Even though the information is less precise, is there any evidence that responses to qualitative surveys are systematically biased? In the case of the *Business Outlook Survey*, a large percentage of responses come from chief executives, financial officers, or other individuals in a position to know.² Occasionally, the accuracy of individual responses has been verified through telephone conversations with respondents. Many firms decide not to participate in the BOS, and sometimes a firm may decide not to respond to a particular question. When participants do answer the questions, however, there is little reason to suspect that they systematically bias their confidential responses.³

²This constitutes an important difference between the BOS and other frequently cited national surveys, which focus on specific professional groups, for example, the National Association of Purchasing Management, which distributes surveys to purchasing management professionals; or the APICS survey, which polls manufacturing production and inventory control professionals.

³In his 1991 study, John Carlson of the Cleveland Fed also argues that there is "no reason to dismiss evidence from surveys on the assumption that people are systematic li-

COMPARING THE SURVEY'S RESULTS WITH OTHER REGIONAL AND NATIONAL DATA

The main goal of the BOS is to obtain meaningful information about the pace of growth in the District's manufacturing sector. To put the individual survey responses into a form useful for tracking business conditions, the Philadelphia Fed constructs a diffusion index to summarize each indicator. The diffusion index is calculated for each indicator in the *Business Outlook Survey* by subtracting the percentage of respondents indicating a decrease from the percentage indicating an increase. Each index has a maximum value of 100 and a minimum value of -100. For example, if 100 percent of the respondents indicate increases in new orders compared with the previous month, the diffusion index for current new orders would be 100. Similarly, if 100 percent reported declines in new orders this month, the index would have a value of -100. None of the indexes is likely to take on such extreme values. In practice, a large percentage of firms will report no change for many variables, and the diffusion index is determined by those reporting increases and decreases. If 60 percent of firms report "no change," 30 percent report "increase," and 10 percent report "decrease," the diffusion index would equal 20 (30 - 10).

To derive meaningful information about activity in the manufacturing sector from the BOS diffusion index, we need to account for unintentional seasonal bias in responses. For example, a manufacturer of chocolate candy would naturally have higher shipments during certain months because of holiday consumption. But it may not be clear to the manufacturer how to report this seasonal change. Prior

ars." He advocates more frequent use of surveys by economists but cautions: "Designers of surveys and users of the results should think carefully about whether the respondents might have any systematic tendencies to give false or misleading answers."

to 1985, respondents to the BOS were asked not to report changes that were only seasonal. Despite this request, the aggregate data displayed significant seasonal patterns, most noticeably a consistent pattern of a business slowdown during the summer months and at year-end.⁴ More recently, individual respondents have not been asked to adjust for any seasonal pattern, and the Philadelphia Fed seasonally adjusts the percentages for increase, decrease, and no change for each BOS index.⁵

Like a statistical average, the diffusion index is an incomplete summary measure. For example, consider two situations that result in identical diffusion indexes but portray two very different distributions of responses. If 50 percent of respondents indicate increases in new orders this month and 50 percent report declines, the overall diffusion index is zero. The index would also be zero when only 5 percent of firms report increases, 5 percent report declines, and 90 percent report no change. In these two situations, the zero diffusion index characterizes quite different distributions of responses.⁶ Consequently, the publication of re-

⁴The historical data suggest seasonal components have diminished over time but are nonetheless very important. The traditional reasons for such seasonal slowdowns may have become less important. For example, summer closings for capital equipment maintenance, summer vacations, and inventory valuation are less prevalent.

⁵We use an additive seasonal adjustment procedure in which separate seasonal factors are calculated for the aggregate increase, decrease, and no change proportions. The additive procedure accommodates zero percentages (for example, no respondents indicating price reductions in a given month). Minor adjustments are made to the seasonal calculations to prevent the situation where the seasonally adjusted individual percentages might take on negative values.

⁶This is similar to using the statistical mean or average to describe data. Although the mean is a good summary measure of the central tendency of a distribution, the standard deviation is the statistic that helps to describe the degree of dispersion of the data.

sults includes the distribution of responses as well as the diffusion index (see Summary of Returns on July 1998 BOS).

Although the diffusion index does not completely describe the distribution of responses, it has always dropped below zero during recessions, then moved above zero during the recovery phase of a business cycle (Figure). Through recessions and expansions, the index has been highly correlated with rates of change in corresponding quantitative measures.

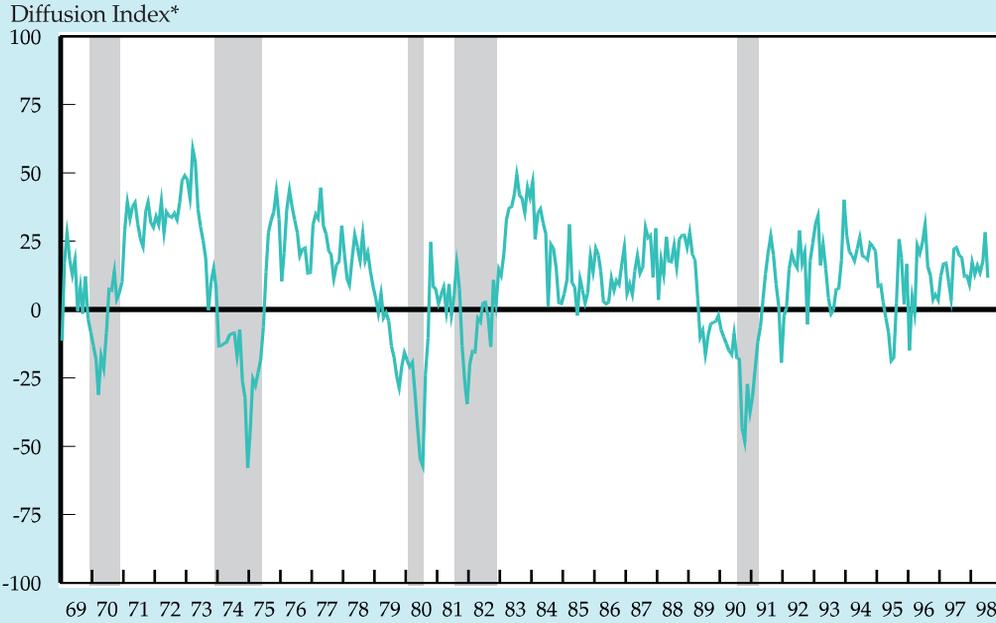
One major benefit of the *Business Outlook Survey* is that it is available before comparable quantitative measures. One criterion for evaluating the importance of the survey's information to market participants and policymakers is its ability to predict the quantitative measures. In other words, the ultimate test of the BOS diffusion indexes as measures of manufacturing activity is how well the indexes correspond to changes in the manufacturing statistics from quantitative surveys. At the regional level, only two government statistics are comparable to indexes from the BOS: manufacturing employment and average work hours.⁷ The correlation between the BOS diffusion index on the number of employees and the monthly changes in employment is reasonably high. But the BOS diffusion index on the average workweek is not significantly correlated with changes in the average workweek in the region.⁸

Even though the BOS is a regional survey, the indexes also reflect conditions in the national manufacturing sector. The BOS diffusion

⁷The Bureau of the Census also computes annual estimates of value-added for each industry at the state level based on the *Census of Manufactures* and the *Annual Survey of Manufactures*. But these data are available only on an annual basis and are published with a considerable lag.

⁸The correlation coefficient between the BOS's current average workweek index and changes in regional employment, however, is 0.48 and is significant at the 1 percent level.

FIGURE
Business Outlook Survey
Current Activity (January 1969 - July 1998)



*Index represents percentage of respondents indicating an increase minus percentage indicating a decrease.

Note: Shaded areas denote official recessions as defined by the National Bureau of Economic Research.

indexes are positively and (with one exception) significantly correlated with changes in the corresponding national series.⁹

Several factors may explain the positive cor-

⁹Correlation coefficients between BOS diffusion indexes and monthly changes in comparable U.S. manufacturing indicators range from a high of 0.58 for the monthly change in U.S. manufacturing employment to a low of 0.04 for the monthly change in the U.S. manufacturing workweek. All of the correlation coefficients are statistically significant at the 1 percent level with the exception of the one for average workweek. Table 2 provides more details from the perspective of regression analysis.

relations with national data. First, the manufacturers who respond each month represent relatively large establishments (most have more than 250 employees), and their markets are national. Second, many of the manufacturers have plants operating in other parts of the country, and growth in the Third District reflects growth for the national organization. Moreover, goods produced by some of the firms in the survey represent inputs for other firms that operate in national markets.

To determine how well a BOS diffusion index can predict changes in the corresponding national or regional data, we used the common

statistical technique of regression analysis. We show the results of 12 simple models in which the current month's diffusion index alone is used to predict the change in the corresponding regional or national data (Table 2). The BOS indexes are most successful at forecasting industrial production, regional and national manufacturing employment, and producer prices.¹⁰ The indexes are less successful at predicting changes in more volatile monthly series, such as new orders and inventories, but the BOS indexes still have significant relationships with these series. Only in the case of the average workweek does the BOS index not have a statistically significant relationship to the change in the corresponding official data.

For example, consider the results in regard to the relationship between the current general activity index and the monthly change in the U.S. manufacturing component of the industrial production index (second row of Table 2). According to the regression results, each one-point increase in the BOS is consistent with a 0.02 percentage point rise in the monthly change of the U.S. manufacturing index. For example, a BOS reading of 10 suggests a monthly percent increase in manufacturing production of 0.2 percent (10×0.02 , the estimated coefficient from the regression shown in the second row). A diffusion index of zero, in this case, also corresponds to essentially no change in the manufacturing index as suggested by the theory underlying the index's construction (see Appendix).

The regression results in Table 2 also allow us to calculate a break-even point, a value for the diffusion index that is consistent with no change in the official statistic. These break-even points range from -36.3 for inventories to 14.8 for producer prices. The break-even points for industrial production and employment,

however, are close to zero, as would be suggested by the analytic model described in the Appendix. For all the BOS indexes, only values above the break-even point suggest an increase in the corresponding official series for the current month, and only values below the break-even point suggest a decline in the official series.

BUT DOES THE SURVEY CONTAIN ANY NEW INFORMATION?

The correlations and regression results suggest that most of the BOS indexes track corresponding official statistics reasonably well and exhibit distinct cyclical behavior. This information is potentially valuable because the BOS collection periods overlap the collection periods of the official series and the BOS is published prior to the official series.¹¹ But do the indexes actually give us any useful information ahead of other measurements of the manufacturing sector?

We can assess the value of the information in the BOS in at least three different ways. First, does the diffusion index alone help predict the change in the official series? The simple regression results indicate this is true for all but one of the BOS indexes (Table 2). Second, we can apply a more stringent criterion. Does the addition of the index from the BOS help us predict this month's change in the official series better than we could with just the past changes in the official series? And, finally, if we also use other relevant information available when the BOS is published, will we improve our predictions further still by incorporating the BOS in-

¹⁰The results presented here are generally consistent with those found in Bell and Crone (1986).

¹¹For example, preliminary estimates of U.S. industrial production for a given month are available in the second or third week of the following month. Because the BOS collection period cuts across two months, the current month's BOS (which is always released on the third Thursday of the month) contains some information that would correspond to the yet-to-be-published industrial production statistics.

TABLE 2
Simple Regression Results Using U.S. and Regional Economic Measures Against Their Counterpart BOS Diffusion Indexes
(1969:01 to 1997:06)

Dependent Variable: (percent change in measure)	Corresponding Explanatory Variable (BOS diffusion index)	Constant	Diffusion Index Coefficients (t statistics)	R²	Break-even Point*
National Data					
U.S. Industrial Production Index	current activity	0.0011 (0.026)	0.0203 (11.33)	.27	-0.05
U.S. Industrial Production Index: Manufacturing Component	current activity	.0008 (.018)	0.0235 (11.82)	.29	-0.03
Manufacturing Shipments	current shipments	0.174 (1.48)	0.0233 (4.09)	.05	-7.5
Manufacturing New Orders	current new orders	0.353 (2.73)	0.017 (2.69)	.02	-20.7
Manufacturing Employment	current employment	0.003 (0.14)	0.023 (13.11)	.34	-0.1
Manufacturing Workweek	current workweek	0.038 (0.42)	0.0096 (1.14)	.004	-4.0
Unfilled Orders	current unfilled orders	0.621 (0.054)	0.026 (7.47)	.14	-23.9
Inventories	current inventories	0.581 (10.0)	0.016 (4.09)	.05	-36.3
Producer Prices (Finished Goods)	current prices received	0.145 (4.37)	0.0176 (10.59)	.25	-8.2
Producer Prices (Intermediate Goods)	current prices paid	-0.311 (-6.18)	0.021 (16.52)	.45	14.8
Regional Data					
District Manufacturing Employment	current employment	-0.14 (-0.59)	0.01 (6.33)	.26	14.0
Average manufacturing workweek in the District	current workweek	0.03 (0.42)	0.01 (1.14)	.01	-3.0

*The break-even point is defined as the level of the diffusion index consistent with no change in the underlying official statistic according to the regression model. It is equivalent to the negative of the ratio of the estimated intercept and slope coefficient.

dex? Using all three methods, we tested the value of the general activity index in predicting changes in the U.S. manufacturing index for the years 1969 to 1997.

First, we ran a simple regression. This regression used the BOS activity index to forecast monthly changes in the U.S. manufacturing index (see the first row of numbers in Table 3). The BOS index explains about 29 percent of the variation in the monthly change in the U.S. index.¹²

A second, more demanding test for the value of the diffusion index is whether it adds any information not in the history of the manufacturing production index itself. This question can be addressed by including in the equation past monthly changes in the manufacturing production index to explain the current change. The past values of the manufacturing index explain less of the variation in the manufacturing index than the current diffusion index from the BOS (compare the first and second rows of Table 3).¹³ Moreover, if we add the BOS diffusion index to past values of the manufacturing index (row 3 of Table 3), we can account for 14 percentage points more of the monthly variation

in the manufacturing index than if we depend only on past values of the manufacturing index.¹⁴

Mark Rogers of the Atlanta Fed has sug-

TABLE 3
Testing for New Information in the
Business Outlook Survey
Dependent Variable: Monthly Change in U.S.
Manufacturing Production Index
(1969:01 to 1997:06)

Explanatory Variables:	Coefficient on Diffusion Index (t-statistic)*	R²
current BOS activity index	.0235 (11.82)	.29
12 lagged values of change in manufacturing index	–	.17
12 lagged values of change in manufacturing index plus BOS diffusion index	.0235 (8.13)	.31
12 lagged values of change in manufacturing index and lagged values of change in total manufacturing hours worked	–	.20
12 lagged values of change in manufacturing index, current and lagged values of change in total manufacturing hours worked, plus BOS diffusion index	.024 (7.43)	.32

¹²The R² statistic (0.29) reported in the second column of numbers in Table 3 can be interpreted as the proportion of the total variation in the dependent variable (monthly changes in the official statistic in this case) explained by the regression model. This is the same model reported in row two of Table 2.

¹³The difference between the R² for in-sample forecasts in the first row and the second row is 0.12. Also, the coefficient in the BOS diffusion index remains significant even after past values of monthly changes in industrial production are added (row 3).

*The t-statistic tests the hypothesis that the coefficient is significantly different from zero. In all the reported regressions, the diffusion index is significant at less than the 0.01 level, meaning there is less than a 1 percent probability that the diffusion index coefficient is equal to zero.

gested an even more rigorous test of the value of the information in the BOS diffusion index. Rogers showed that a relatively successful forecast of monthly changes in the manufacturing production index is possible using available employment and average workweek statistics along with past changes in industrial production. These employment and workweek data can contain additional important information on short-run changes in production. Our final test is based on a model that estimates changes in manufacturing production from past changes in manufacturing work hours (employment times average hours worked) and past changes in the manufacturing index itself. Adding the BOS index to this expanded model explains 12 percentage points more of the variation in

¹⁴A question arises regarding whether the BOS diffusion index is valuable because of the overlap in collection periods (the survey responses reflect the result of a period spanning the current and previous months) or the early publication of the survey results. That is, does the BOS diffusion index contain information that is forward-looking and backward-looking? Some information can be gleaned by including the lagged value of the change in manufacturing production as the dependent variable along with the current BOS diffusion index as the explanatory variable. The current diffusion index remains significant in this equation and the explanatory power of the model remains similarly high. Therefore, the BOS diffusion index appears to contain information about both the past and future, as one might expect from the collection period.

changes in the manufacturing production index (see the fourth and fifth rows of Table 3).¹⁵ Thus, the BOS diffusion index adds information to what is known from several variables at the time the index becomes available.

SUMMARY

The *Business Outlook Survey* has gained a reputation as a key cyclical indicator for both the regional and national manufacturing sectors. We applied rigorous methods to test the ability of the information in the BOS to forecast changes in national manufacturing output. The evidence suggests that the survey's indexes provide statistically significant information to market participants in forecasting movements in the manufacturing sector.

Although the analysis has focused on the use of the survey's indexes in forecasting national economic statistics, the results for the limited data that are readily available on manufacturing at the regional level bolster the use of the survey as a regional indicator. Finally, the relatively low cost and timely availability of the survey results suggest that this kind of approach to obtaining economic information has been underused.

¹⁵Experimentation with different periods of sample estimation and an evaluation of out-of-sample forecast performance did not appreciably change these conclusions.

APPENDIX DIFFUSION INDEXES AND GROWTH RATES

Diffusion indexes can be useful indicators of the rate of change in economic variables.* To illustrate, suppose that at any given time, some firms in the manufacturing sector are experiencing growth in shipments, while others are experiencing declines. Also assume that firms are of equal size. If the distribution of firms experiencing growth and decline is the same as that shown in Figure A (a normal distribution), the average growth rate (\bar{X}_t) is greater than zero.

Now consider a random sample of firms from this distribution and their responses to a qualitative survey question about the direction of change in shipments from the previous month. For example, assume Figure A represents the true distribution of growth in shipments for all firms in a given reporting period. Few, if any, firms would have exactly no change in production. Assume, however, that for some “small” change the respondent would report no change. We refer to this small change as the “indifference interval.” The upper and lower bounds of the indifference interval (δ_a and δ_b in Figure A) are referred to as “reporting thresholds” or “just noticeable difference

FIGURE A
Distribution of Firms Experiencing Increases and Decreases in Shipments

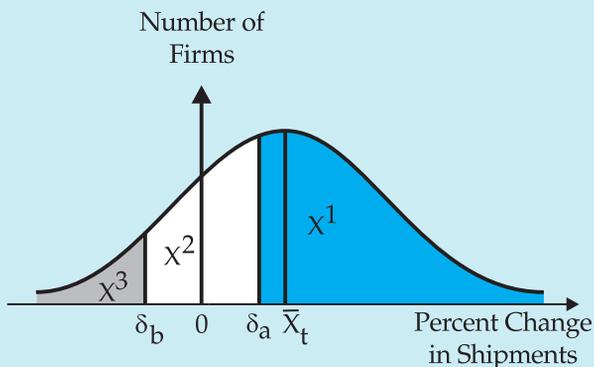
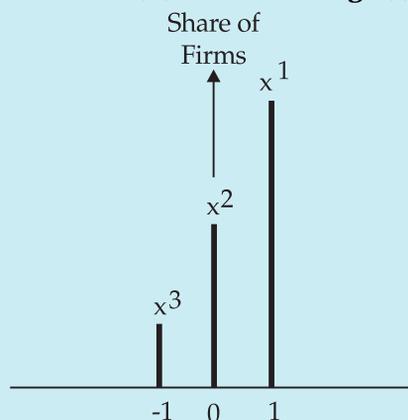


FIGURE B
Proportion of Firms Reporting Increases (+1), Decreases (-1), and No Change (0)



*M.H. Pesaran provides a comprehensive study of the problem of converting survey data into aggregate summary measures.

APPENDIX (continued)

parameters." While the reason for this "no change" or indifference interval may not be clearly understood, some possible explanations are that the respondents are not sure or changes in production are so small that levels are not much different from the previous month's numbers. The area to the right of δ_a would be associated with firms reporting an increase, and the area to the left of δ_b would be associated with those reporting decreases.

If individual responses for increase, no change, and decrease are coded as 1, 0, and -1, respectively, the distribution of the monthly reported change in shipments can be represented as a discrete distribution (Figure B). The height of the line segments (x_t^1 , x_t^2 , and x_t^3) corresponds to the proportion of firms in each category (increase, no change, and decrease), and the total length of the three segments must sum to one. A little arithmetic reveals that the mean of this distribution is $x_t^1 - x_t^3$, and if multiplied by 100, it is commonly referred to as the net change, balance, or diffusion index. This diffusion index will be positively correlated with the average change (\bar{X}_t) in shipments among manufacturing firms.

Now let's consider how one can relate the responses summarized in Figure B with the true distribution of change in Figure A. The percentage of firms reporting increase, no change, or decrease is represented by the three areas under the curve in Figure A corresponding to X^1 , X^2 , and X^3 , respectively. So long as the shape of the true distribution and the indifference interval do not change markedly from month to month, changes in the diffusion index will correlate with shifts in the corresponding distribution of individual firms. In other words, the value of the diffusion index would be positively correlated with the average change in shipments among manufacturing firms.

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