FRBSF Weekly Letter

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Investment Plans as Forecasts

The opening season of each new year sees an overwhelming number of economic forecasts. These economic forecasts differ not only by the individuals or institutions making them but also by the methodologies used. Some forecasts are primarily judgemental, others are based mainly on survey information, and still others employ econometric modeling techniques.

Important examples of the use of survey information in forecasting are the surveys of planned capital spending by business compiled by both the Commerce Department's Bureau of Economic Analysis (BEA) and the McGraw-Hill Publishing Company. The fall surveys recently released by BEA and McGraw-Hill indicate an increase of 0.2 percent and a decline of 3.1 percent, respectively, in real capital spending (nominal spending adjusted for anticipated changes in the prices of capital goods) from 1986 to 1987. Weak capital spending, in turn, is a key element in the moderate economic growth that most forecasters picture for 1987.

But just how useful is such survey information on capital spending compared to other available forecasts? This *Letter* examines whether the BEA and McGraw-Hill surveys provide very much useful information by comparing their forecasts with those from a standard econometric model.

Surveys vs. an econometric model

The BEA takes surveys of capital spending plans four times a year, while McGraw-Hill conducts its surveys every spring and fall. We will focus on the fall surveys, which give the outlook for a full year ahead. Respondents are asked how much their companies will spend on plant and equipment in the year ahead and also how much they expect the prices they pay for plant and equipment to rise. (Recently, BEA substituted an extrapolation of price increases in the previous year for the answer to the latter question.) By subtracting the expected percentage change in prices from the anticipated percentage increase in nominal spending, the surveys arrive at the percentage increase in real (or adjusted for prices) spending anticipated by the respondents.

Economic forecasters are generally most interested in the outlook for nonresidential fixed investment as measured by the national income accounts, which is not quite the same concept as the spending on plant and equipment used in the surveys. For example, investment in the farm sector is included in nonresidential fixed investment but not in the plant and equipment series. Also, the nonresidential fixed investment series reflects the value of new construction put in place and shipments of equipment whereas the plant and equipment series reflects expenditures, which on balance tend to come later. Nevertheless, the value of nonresidential fixed investment is within 2 percent of total plant and equipment expenditures, and the two generally tend to move quite closely together.

The econometric model that we use to forecast nonresidential fixed investment follows the neoclassical approach elaborated by Professors Robert Hall and Dale Jorgenson. In neoclassical theory, capital is viewed as a substitute for other factors of production. Firms in neoclassical theory therefore respond to the relative prices of capital goods (their prices relative to that of other factors of production) in making their decisions to invest in plant and equipment. The relative prices of capital goods, in turn, depend importantly upon real (or inflation-adjusted) interest rates, taxes, and physical rates of depreciation. The higher the relative prices of capital goods, the lower will be the amount of capital per unit of output that firms will desire to hold, and the greater will be the amount of other factors, such as labor, that they will wish to employ.

Firms adjust to the difference between their desired and actual capital stocks gradually. As a result, the amount of new planned investment,

equal to the amount of capital appropriations, is some fraction of the difference between the desired and actual capital stock plus the amount of investment for replacing existing stock. Actual spending or gross investment then occurs as a lagged amount of planned investment distributed over time. Empirically, there is about a two-quarter lag between the investment decision and appropriations, followed by a 7-quarter distributed lag between appropriations and expenditures.

Investment plans for the years 1967 through 1985, as indicated by the fall surveys conducted by BEA and McGraw-Hill, were compared with forecasts of nonresidential fixed investment generated by this standard econometric model. Forecasts with the econometric model were made outside the data sample used to estimate the model, with the estimate being updated each year. However, the forecasts were based on actually realized data for final sales, taxes, and interest rates within the year being forecast. Thus, they assume more information than would be available with certainty at the time of a forecast.

In actuality, not very much more information was assumed because of the long lags in the investment process. The assumptions with respect to the values of the above variables within the forecasting period actually made very little difference. Only 20 percent of the change in nonresidential investment was determined by the values of final sales, taxes, and real interest rates within the year being forecast, with the remaining 80 percent determined by already available information.

Accuracy of the forecasts

The accuracy of alternative forecasts of the rate of change in real nonresidential fixed investment is measured by the root mean squared error of the forecast, which is calculated simply as the square root of the average of the squared errors. For an unbiased forecast (in which the errors tend to cancel out over time), we can expect that 70 percent of the time the true value of the change in nonresidential fixed investment will fall within an interval around the forecast equal to plus or minus the root mean squared error, and 95 percent of the time it will fall within an interval equal to plus or minus twice the root mean squared error.

As a benchmark of minimum acceptable accuracy, we use a "naive" forecast of no change in the percentage rate of expansion in investment from one year to the next. The naive forecast has errors that tend to cancel out over time, as indicated by an average error of only −0.4 percentage points. But its root mean squared error is 9.6 percentage points. This means that the naive forecast of no change in the rate of expansion of investment is correct within plus or minus 9.6 percentage points 70 percent of the time, and plus or minus 19.2 percentage points 95 percent of the time.

Errors from the naive forecast are so large that they make the forecast virtually useless, but fortunately the errors from alternative forecasts are much smaller. The errors in forecasts made from the BEA and McGraw-Hill surveys are very similar to one another. Although the average error is slightly positive in both, statistical tests reveal that it is not large enough in either case to be significantly different from zero. In other words, it is possible that errors from both surveys would cancel out in a larger sample. Most importantly, the root mean squared error of a forecast from either survey is about 3.5 percentage points less than that for the naive forecast. In addition, statistical tests reveal that this improvement over the naive forecast is not simply attributable to chance.

The BEA and McGraw-Hill surveys therefore contain useful information on the outlook for nonresidential fixed investment. Nevertheless, the size of their forecast errors is still rather high. The BEA survey predicts the true value of the growth in nonresidential fixed investment within plus or minus 6.0 percentage points 70 percent of the time, and within plus or minus 12.0 percentage points 95 percent of the time; forecast errrors for the McGraw-Hill survey are slightly larger.

One might conceivably reduce these forecast errors by combining the two surveys. But we do not find that any combination of the BEA and McGraw-Hill surveys does, in fact, reduce the root mean squared error of the forecast to less than that using the BEA survey alone. Although the BEA survey appears to be slightly more accurate, the McGraw-Hill survey contains essentially the same information, so nothing is gained by combining the two.

As it turns out, the forecast errors generated by the econometric model are considerably lower than those from these two surveys. The econometric model's forecast errors average to nearly zero and give a root mean squared error of 3.3 percentage points — about half that for the surveys. Thus, the econometric model forecasts the actual rate of expansion in real nonresidential fixed investment within 3.3 percentage points 70 percent of the time, and within 6.6 percentage points 95 percent of the time.

Moreover, neither the BEA nor the McGraw-Hill survey, either singly or in combination, can be used together with the econometric forecast to produce significantly lower forecast errors. Thus, in recent years, forecasts from a standard econometric model of business fixed investment have been characterized by relatively low errors, and surveys of planned capital spending have not added any significant amount of information to those forecasts.

Forecasts for 1987

As mentioned earlier, the BEA survey forecasts a 0.2 percent improvement in real nonresidential fixed investment in 1987, while the McGraw-Hill survey indicates a 3.1 percent decline. Our analysis of the historical forecast errors indicates that each of these surveys contains useful information, and that nothing is gained by combining them. It also indicates, however, that an econometric model can do even better and that the smallest forecast errors would have been obtained simply by using an econometric model alone.

The econometric model gives a forecast of 4.9 percent real growth in nonresidential fixed investment for 1987 — a more optimistic forecast than that provided by the surveys. This forecast is based upon the growth rate of real GNP (about 3.0 percent), and hence final sales, and the path for interest rates (relatively constant) predicted by the sample of forecasters polled by the American Statistical Association and the National Bureau of Economic Research. The greatest source of the strength in the forecast comes from the lagged effects of recent declines in interest rates adjusted for inflation. However, the forecast is not very sensitive to the exact assumptions made about the course of interest rates and GNP during 1987.

Although our analysis suggests that the econometric forecast alone should be relied upon, there is at least one special factor this year about which the surveys may contain some useful information and which may not be captured by the standard neoclassical model. That factor is the 50 percent decline in the price of oil that occurred in 1986. The decline in the price of oil already appears to have depressed the structures component of nonresidential fixed investment substantially through its impact on the expected profitability of oil drilling, and it is likely to continue to hold down investment in structures into 1987.

To capture the effect of oil prices on business fixed investment, we re-estimated the neoclassical model to include the influence of the real price of oil on the desired amount of capital in structures. We find that a fall in the real price of oil has the expected negative effect on investment, and significantly so. Moreover, this modified neoclassical investment equation predicts only a 2.8 percent rate of growth in real nonresidential fixed investment from 1986 to 1987.

Taking into account the mild tendency of the surveys of planned investment to underestimate actual investment, this final econometric forecast is about the same as the BEA survey and somewhat more optimistic than the McGraw-Hill survey. However, the historical record indicates that the two surveys do not really add any significant information to that already contained in the econometric forecast. The most reliable forecast is the econometric one, and there is no evidence to suggest that forecast errors can be reduced any further by combining it with the others.

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BANKING DATA—TWELFTH FEDERAL RESERVE DISTRICT

(Dollar amounts in millions)

Selected Assets and Liabilities Large Commercial Banks	Amount Outstanding 1/21/87	Change from 1/14/87	Change from 1/22/86 Dollar	Change from 1/22/86 Percent[7]
Loans, Leases and Investments[1] [2]	206,791	56	4,310	2.1
Loans and Leases[1] [6]	186,011	– 15	3,134	1.7
Commercial and Industrial	54,930	– 53	1,964	3.7
Real estate	67,028	– 65	1,237	1.8
Loans to Individuals	38,811	– 250	– 1,538	– 3.8
Leases	5,472	– 95	– 243	– 4.2
U.S. Treasury and Agency Securities[2]	13,635	69	2,605	23.6
Other Securities[2]	7,146	3	– 1,429	– 16.6
Total Deposits	209,502	– 195	6,812	3.3
Demand Deposits	54,263	– 509	5,216	10.6
Demand Deposits Adjusted[3]	35,327	– 3,064	– 9,735	– 21.6
Other Transaction Balances[4]	19,317	– 483	4,322	28.8
Total Non-Transaction Balances[6]	135,922	798	– 2,727	– 1.9
Money Market Deposit Accounts—Total	47,270	621	1,491	3.2
Time Deposits in Amounts of $100,000 or more	32,521	253	– 6,227	– 16.0
Other Liabilities for Borrowed Money[5]	28,503	508	268	0.9

Two Week Averages of Daily Figures	Period ended 1/12/87	Period ended 12/29/86
Reserve Position, All Reporting Banks		
Excess Reserves (+)/Deficiency (–)	1	10,277
Borrowings	3	11
Net free reserves (+)/Net borrowed(–)	– 1	10,266

1 Includes loss reserves, unearned income, excludes interbank loans
2 Excludes trading account securities
3 Excludes U.S. government and depository institution deposits and cash items
4 ATS, NOW, Super NOW and savings accounts with telephone transfers
5 Includes borrowing via FRB, TT&L notes, Fed Funds, RPs and other sources
6 Includes items not shown separately
7 Annualized percent change